**Objective:** Low-grade serous ovarian carcinoma (LGSOC) commonly carries mutations in the MAP kinase pathway (KRAS, NRAS, BRAF). Penetrance of mutations in this pathway is reported to be approximately 50%. The role of other mutations in the pathogenesis of this disease is poorly understood. Our objective was to evaluate the penetrance of pathogenic mutations outside of this pathway in a racially diverse population.

**Method:** Utilizing an institutional tumor registry, patients with LGSOC seen by our practice between January 2, 2006, and June 11, 2018, were identified, and charts were reviewed. Commercial germline and somatic tumor profiling results were tabulated. $\chi^2$, Fisher exact, and Cox proportional hazards models were used for statistical analysis, with significance set at $P < 0.05$.

**Results:** Thirty-eight patients with LGSOC were identified. Eighteen (47.4%) had somatic tumor profiling completed. Thirteen (31.6%) had germline testing performed. Five patients (13.2%) had both germline and somatic testing. Median age at diagnosis was 43 years (range 23–68 years). Eight patients (21.1%) were black, 29 (76.3%) were white, and one was of unknown race. Seventeen patients (44.7%) identified as Hispanic. Median follow-up was 48.5 months (range 0–497 months). Median disease-free survival (DFS) to first recurrence was 22 months. Somatic profiling results are described in **Table 1**. KRAS was the most common mutation, followed by ERCC1 and TUBB3, each present in half of the patients. On germline testing 1 patient had a CHEK2 mutation, and 1 had a PALB2 mutation. No BRCA1 or BRCA2 mutations were seen in germline or somatic testing. Only age influenced DFS, with younger age being protective (HR = 0.29, 95% CI 0.10–0.82, $P = 0.01$). Smokers had fewer somatic KRAS mutations compared to never-smokers (14.3% vs 90.9%, $P = 0.002$).

**Conclusion:** Mutations outside of the MAP kinase pathway were at least as common as those within it. Further research into the effects of these genetic mutations in driving disease pathogenesis is warranted.

**Table 1:** Somatic molecular profiling characteristics of Low Grade Serous Ovarian Carcinomas

<table>
<thead>
<tr>
<th>Mutation</th>
<th>N=18</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>KRAS</td>
<td>11</td>
<td>61.1</td>
</tr>
<tr>
<td>ERCC1</td>
<td>9</td>
<td>50</td>
</tr>
<tr>
<td>TUBB3</td>
<td>9</td>
<td>50</td>
</tr>
<tr>
<td>TS</td>
<td>5</td>
<td>27.8</td>
</tr>
<tr>
<td>ARID1</td>
<td>2</td>
<td>11.1</td>
</tr>
<tr>
<td>BRAF</td>
<td>1</td>
<td>5.6</td>
</tr>
<tr>
<td>ERBB2</td>
<td>1</td>
<td>5.6</td>
</tr>
<tr>
<td>NRAS</td>
<td>1</td>
<td>5.6</td>
</tr>
<tr>
<td>TERT</td>
<td>1</td>
<td>5.6</td>
</tr>
<tr>
<td>CDKN2A/B</td>
<td>1</td>
<td>5.6</td>
</tr>
<tr>
<td>RET</td>
<td>1</td>
<td>5.6</td>
</tr>
<tr>
<td>RRM</td>
<td>1</td>
<td>5.6</td>
</tr>
</tbody>
</table>
Method: More than 10,000 glycopeptide peaks digested from serum glycoproteins from 396 patients were obtained by liquid chromatography/mass spectrometry (LC/MS). We chose reproducible 1712 serum glycopeptides to create a two-dimensional barcode that represented glycoprotein expression patterns from patient blood and let a convolutional neural network (CNN) learn the patterns to distinguish the difference between EOC and non-EOC patients. A training set, EOC stage I (n = 62) and non-EOC (n = 172) dataset, and a test set, EOC stage I (n = 26) and non-EOC (n = 74) dataset, were applied to this deep learning algorithm.

Results: The glycopeptide pattern was rearranged according to a principal component analysis (PCA) loading factor in advance to facilitate CNN's recognition. When we gave the test sample dataset to the trained model, it clearly distinguished stage I EOC from non-EOC with an accuracy of 89%, whereas the accuracy for CA-125 and HE4 was 79% and 85%, respectively. Moreover, AUC for the deep learning model was significantly higher in distinguishing stage I EOC from non-EOC: deep learning 93% (95% CI 86%–99%), CA-125 87% (95% CI 82%–92%), and HE4 87% (95% CI 82%–91%). See Figure 1.

Conclusion: Our study highlights the potential of CSGSA using deep learning technology as a potential useful screening tool for early detection of ovarian cancer.
Objective: Our goal is to describe how population-based statistics for rare epithelial ovarian cancers are evolving.

Method: This is a retrospective observational study examining the Surveillance, Epidemiology, and End Results (SEER) program from 1988 to 2016. Overall survival (OS) of clear cell (OCCC), mucinous (MOC), and low-grade serous (LGSOC) ovarian cancers were compared to high-grade serous ovarian cancer (HGSOC) by fitting a propensity score matching.

Results: Among 113,365 ovarian malignancies, 5,780 OCCCs (5.1%), 7,561 MOCs (6.7%), and 2,021 LGSOCs (1.8%) were compared to 38,199 HGSOCs. OCCCs and MOCs were more likely to be diagnosed with stage I disease compared to HGSOC (57.0%-59.5% vs 8.6%, \( P < 0.001 \)). For early-stage disease, OCCC (HR = 0.91, 95% CI 0.82–1.01) and MOC (HR = 0.94, 95% CI 0.85–1.04) had OS similar to that of HGSOC, whereas LGSOC had superior OS (HR = 0.93, 95% CI 0.89–0.97) versus HGSOC. Conversely, for advanced-stage disease, OCCC (HR 1.42, 95% CI 1.32–1.53) and MOC (HR = 1.11, 95% CI 1.09–1.13) had poorer OS, whereas LGSOC (HR = 0.86, 95% CI 0.84–0.89) had superior OS compared to HGSOC. OCCC (HR range 1.92–2.45) and MOC (HR range 1.73–2.22) had particularly poorer OS in the first 3 years following diagnosis compared to HGSOC. Population-level statistics for advanced-stage disease showed that 5-year OS rates have increased in HGSOC (16.9% to 36.8%, \( P < 0.001 \)) and LGSOC (50.8% to 66.4%, \( P = 0.010 \)), but remain unchanged for OCCC (21.0% to 28.2%, \( P = 0.174 \)) and MOC (21.4% to 16.5%, \( P = 0.102 \)). See Figure 1.

Conclusion: OCCC, MOC, and LGSOC account for 2%–7% of ovarian malignancies and have distinct characteristics and survival compared to HGSOC. While these rare tumors have a favorable to comparable prognosis in early-stage disease, disproportionately poor survival in advanced-stage OCCC and MOC highlights the need for further research into novel treatment strategies.

![Figure 1](image-url)
Objective: Studies from other tumor sites have suggested that survival is improved in patients who travel a greater distance to undergo cancer-directed surgery. We examined the association between travel distance and short- and long-term outcomes in women with ovarian cancer who underwent primary surgery.

Method: Patients with stage II–IV ovarian cancer from 2004 to 2016 who underwent primary surgery were identified in the National Cancer Data Base. Distance traveled to the hospital performing surgery was estimated using zip code centroids from the patient’s home. Travel distance was categorized into quartiles (Q1 lowest to Q4 highest travel distance). Multivariate models were used to determine predictors of the greatest (Q4) travel distance compared to the shortest (Q1) travel distance. Propensity score (PS) weighting was used to balance patient characteristics across the travel distance quartiles. Readmission rates, 30-day and 90-day mortality, and survival were then examined based on travel distance after PS weighting and adjusting for receipt of chemotherapy.

Results: A total of 56,834 patients at 1,201 hospitals were identified. Median travel distance was 2.1 miles higher in 2004 (median 12.5, IQR 5.3–34.6 miles) compared to 2015 (14.6, IQR 6.3–36.8 miles) (P < 0.0001). Factors associated with the highest quartile of travel were more recent year of treatment, younger age, white race, Medicare coverage, residence in urban or rural areas (vs metropolitan), lower comorbidity, and stage IIIC disease (P < 0.05 for all). Compared to women with the shortest (Q1) travel distance, patients in the highest quartile (Q4) of travel had lower risk-adjusted 30-day readmission rate (9.1% vs 12.2%, aRR = 0.71, 95% CI 0.68–0.74) and 90-day mortality (6.1% vs 6.9%, aRR = 0.88, 95% CI 0.83–0.94). Two-year survival (71.9% vs 71.4%) and 5-year survival (39.9% vs 42.0%) and overall mortality were not different between the two groups (aHR = 0.99, 95% CI 0.97–1.01).

Conclusion: Increased travel distance to surgical center for patients with ovarian cancer in the United States is associated with improved short-term outcomes, but distance was not associated with long-term survival.

165 - Poster Session
The effect of liberal versus restrictive use of neoadjuvant chemotherapy (NACT) for ovarian cancer on postoperative mortality and long-term survival: A quasi-experimental study

aNew York-Presbyterian/Columbia University Medical Center, New York, NY, USA, bThe University of Texas MD Anderson Cancer Center, Houston, TX, USA

Objective: Some cancer treatment programs use neoadjuvant chemotherapy (NACT) to treat advanced ovarian cancer more often than others. This study compares the effect of liberal versus restrictive use of NACT on perioperative and long-term outcomes.

Method: Using the National Cancer Data Base, we identified patients who received upfront treatment for stage IIIC or IV epithelial ovarian cancer from 2004 to 2015. The period preceding adoption (preadoption) of NACT was defined as 2004–2009, while 2010–2015 was considered the postadoption period. We categorized each hospital as having liberal (primary chemotherapy ≥29%) or restrictive (primary chemotherapy <29%) NACT use in the postadoption period. We matched hospitals based on the frequency of NACT use in the preadoption period. The effect of liberal versus restrictive NACT utilization on postoperative mortality and overall survival was assessed in linear difference-in-differences models.

Results: We identified 33,877 women treated in 492 hospitals, of whom 18,900 were treated in hospitals that used NACT liberally in the postadoption period (48.9%). In the preadoption period, NACT use was similar in hospitals that developed restrictive and liberal NACT utilization (18.2% vs 18.9%). Use of NACT increased modestly (+1.7 percentage points, P = 0.02) in restrictive-NACT hospitals and drastically (+20.1 percentage points, P < 0.001) in liberal-NACT hospitals. Compared to restrictive use of NACT, liberal use led to a larger decline in 90-day postoperative mortality between the pre- and postadoption periods (7.1% to 3.9% vs 7.7% to 5.9%, P = 0.004). Over the same interval, survival improved in hospitals with restrictive (median survival 33.5 to 36.7 months) and liberal (median survival 33.5 to 36.5 months) use of NACT, and the magnitude of these improvements was similar (P = 0.33). See Figure 1.

Conclusion: Liberal use of NACT for advanced ovarian cancer led to a larger decline in perioperative mortality than restrictive use. Long-term survival improved equally in both groups.
Fig. 1.
Minimally invasive surgery for early-stage ovarian cancer: Association between surgical volume and perioperative outcomes

Objective: The aim of this study was to examine trends and characteristics associated with and outcomes of minimally invasive surgery (MIS) for women with early-stage ovarian cancer.

Method: The Nationwide Inpatient Sample was queried to examine early-stage ovarian cancer treated with MIS from 2001 to 2011. Annualized MIS hospital surgical volume was defined in the unweighted model as the average number of procedures performed per year in which at least 1 procedure was performed: low volume (average 1 procedure per year), mid volume (average >1 but ≤2 procedures per year), and high-volume (average >2 procedures per year). Trends, characteristics, and outcomes related to MIS use were assessed in a weighted model.

Results: Among 73,707 patients, there were 4,822 (6.5%) MIS procedures. Utilization of MIS increased from 3.9% to 13.5% between 2001 and 2011 (3.4-fold increase, \( P < 0.001 \)). MIS was associated with a decreased complication rate (13.3% vs 28.4%) and lower median hospital stay (2 vs 4 days) compared to laparotomy (both, \( P < 0.05 \)). Of the 472 hospitals at which MIS was performed, the majority were low volume (340 [72.0%] hospitals, \( n = 1,929 [40.0\%] \)), followed by mid volume (85 [18.0%] hospitals, \( n = 1,272 [26.4\%] \)), and high volume (47 [10.0%] hospitals, \( n = 1,621 [33.6\%] \)). The high-volume group had the highest rate of lymphadenectomy compared to other groups (62.2% vs 39.2–55.1%, \( P < 0.05 \)). On multivariate analysis, the high-volume group had a 25% decreased risk of complications compared to the low-volume group (adjusted-odds ratio = 0.75, 95% CI 0.59–0.95, \( P = 0.018 \)). The low-volume group had the highest risk of acute kidney injury, vesico-uterine injury, ileus, abscess, sepsis, pneumonia, respiratory failure, prolonged hospital stay, and perioperative death, whereas the high-volume group had the highest risk of venous thromboembolism (all, \( P < 0.05 \)). The number of low-volume hospitals decreased from 2001 to 2011 (58.6% to 26.1%, 55.4% relative decrease, \( P = 0.001 \)). See Figure 1.

Conclusion: Utilization of MIS for early-stage ovarian cancer has significantly increased in the United States during the study period; by 2011, 1 in 8 surgeries performed for ovarian cancer were performed via MIS. MIS procedures performed at hospitals with higher surgical volume may be associated with improved perioperative outcomes.
Objective: The aim of this study is to determine whether cancer care setting is associated with refusal of recommended surgical treatment of ovarian cancer.

Method: This is a retrospective cohort study of women with ovarian cancer, diagnosed between January 1, 2004, and December 31, 2016, recorded in the National Cancer Data Base. The primary outcome was refusal of recommended surgical treatment. The exposure of interest was cancer care setting. Bivariate and multivariate tests were used to examine associations.

Results: A total of 211,937 patients with ovarian cancer were identified. In this population, 2,062 patients (1%) refused recommended surgery. These patients were more likely to be black race (296, 14.4%, vs 17,278, 8.2%), to be age 60 years or older (1,874, 90.9%, vs 120,537, 57.4%), and to have metastatic disease at the time of diagnosis (823, 39.9%, vs 47,656, 22.7%; all \( P < 0.001 \)). They were more likely to live in the central United States (832, 40.4%, vs 78,488, 37.4%; \( P = 0.006 \)), to report a median yearly income below $40,000/year (727, 35.3%, vs 63,843, 30.4%; \( P < 0.001 \)), and equally likely to live in an area where high school diplomas are possessed by >85% of the population. Patients who refused surgery were more likely to have Medicare or Medicaid insurance (1,710, 82.9%, vs 101,270, 48.3%; \( P < 0.001 \)) and to be treated at a hospital performing the lowest volume of ovarian cancer surgeries per year (952, 46.2%, vs 51,561, 24.6%; \( P < 0.001 \)). Patients treated at community hospitals were more likely to refuse recommended surgery (1,170, 1.3%, vs 892, 0.7%, \( P < 0.001 \)) even after adjustment for race, age, income, insurance, metastatic disease, percentage of the surrounding area with high school diplomas, and hospital volume.
population with a high school diploma, and hospital ovarian cancer case volume (aOR = 1.2, 95% CI 1.1–1.3). Patients who refused recommended surgery had an increased risk of death (HR = 4.5, 95% CI 4.3–4.7), which persisted after adjustments for race, age, income, insurance, metastatic disease, percentage of the surrounding population with a high school diploma, and hospital ovarian cancer case volume (HR = 3.0, 95% CI 2.9–3.2).

**Conclusion:** In this cohort study of U.S. ovarian cancer patients, care at a community hospital was associated with higher likelihood of refusing recommended surgical treatment even after adjustment for various demographic and regional characteristics. Given the association between treatment refusal and decreased survival, site of care may represent a modifiable contributor to differences in ovarian cancer outcomes.

---

**168 - Poster Session**

**Minimally invasive interval debulking surgery after neoadjuvant chemotherapy for metastatic ovarian cancer: A national study in the United States**

S. Matsuzaki, R.S. Mandelbaum, K. Matsushima, M. Klar, L.D. Roman, J.D. Wright and K. Matsuo. aUniversity of Southern California, Los Angeles, CA, USA, bUniversity of Freiburg, Fahnkenbergplatz, Germany, cLAC+USC Medical Center - Women and Children’s Hospital, Los Angeles, CA, USA, dColumbia University College of Physicians and Surgeons, New York, NY, USA

**Objective:** The aim of this study is to examine patient characteristics and perioperative outcomes associated with minimally invasive surgery (MIS) for women with metastatic ovarian cancer who received interval debulking surgery (IDS) after neoadjuvant chemotherapy (NACT).

**Method:** This is a population-based retrospective observational study utilizing the National Inpatient Sample from January 2012 to September 2015. Women with metastatic ovarian cancer who underwent inpatient IDS after NACT were included (n = 1820), and utilization and perioperative outcomes were assessed based on surgical approach (MIS vs laparotomy).

**Results:** There were 75 (4.1%) women who underwent MIS, of which the majority of procedures were performed using robotic assistance (66.7%). On multivariate analysis, black/Asian, morbid obesity, higher Charlson comorbidity index, and higher household income remained independent factors for the MIS approach (all, P < 0.05). Lymphadenectomy rate at surgery was similar between the 2 groups (MIS vs laparotomy: 26.7% vs 28.4%, P = 0.795), but none of the MIS cases had intestinal or liver resection (0% vs 22.3%, P < 0.001). Among those without intestinal or liver resection (n = 1,430), women in the MIS group had a significantly lower perioperative complication rate than those in the laparotomy group (20.0% vs 31.0%, P = 0.044). On multivariate analysis, the MIS approach remained an independent factor associated with decreased perioperative complications compared to the laparotomy approach (OR = 0.36, 95% CI 0.19–0.69, P = 0.002). The MIS group had significantly shorter length of hospital stay than the laparotomy group (median, 2 vs 4 days, P < 0.001). See **Figure 1.**

**Conclusion:** Between 2012 and 2015, the laparotomy approach remained the mainstay of IDS after NACT for metastatic ovarian cancer, and the MIS approach was infrequently utilized. Our results suggest that surgeons are unlikely to choose MIS when there is a possibility for gastrointestinal or hepatic procedures during IDS. Whether the MIS approach may be associated with decreased perioperative complication needs further investigation.

**Fig. 1.**
169 - Poster Session
An evaluation of the effect of hospital procedure volume on the achievement of complete surgical resection and overall survival at the time of primary debulking surgery
M.J. Worley Jr.a,b, V. Sarda, A. Melamedd, A.A. Gockleye,f, P. Orioa,b, M. Kinga,b, S. Uppals, O. Zivanovich, N.S. Horowitzi and R.S. Berkowitzb,e,j.
aBrigham and Women’s Hospital and Harvard Medical School, Boston, MA, USA, bDana-Farber Cancer Institute, Boston, MA, USA, cBoston Children’s Hospital, Boston, MA, USA, dNew York-Presbyterian/Columbia University Medical Center, New York, NY, USA, eBrigham and Women’s Hospital, Boston, MA, USA, fHarvard Medical School, Boston, MA, USA, gUniversity of Michigan Health Systems, Ann Arbor, MI, USA, hMemorial Sloan Kettering Cancer Center, New York, NY, USA, iBrigham and Women’s Hospital/Dana-Farber Cancer Institute, Boston, MA, USA, jNew England Trophoblastic Disease Center, Boston, MA, USA

Objective: The aim of this study was to evaluate the effect of hospital procedure volume on rate of complete surgical resection (CSR) and overall survival (OS), among women who underwent primary debulking surgery (PDS) for advanced-stage ovarian cancer.

Method: Using the National Cancer Data Base (NCDB), we conducted a retrospective cohort study of patients with advanced-stage ovarian cancer who underwent PDS between 2011 and 2013. The number of PDS procedures from each hospital was used to determine annual PDS volume. The 50th percentile for annual PDS volume was used to separate high-volume and low-volume hospitals. Rates of CSR and OS were then evaluated based on annual PDS volume.

Results: A total of 11,120 patients were identified. High-volume hospitals had an increased rate of CSR (35.6% vs 27%, P < 0.0001). On multivariate analysis, stage 3 versus 4 (OR = 1.77, 95% CI 1.59–1.97) and PDS volume, high versus low (OR = 1.30, 95% CI 1.06–1.60), were associated with CSR. Median OS was greater for patients undergoing a CSR at a high-volume hospital (63.4 months) than for patients undergoing CSR at a low-volume hospital (55.5 months, P = 0.006), incomplete resection at a high-volume hospital (43.9 months, P < 0.0001), and incomplete resection at a low-volume hospital (37 months, P < 0.0001). When the entire cohort was evaluated, multivariate analysis revealed multiple factors that influenced OS, including CSR, age, stage, comorbid conditions, and PDS volume. A total of 3,874 patients (34.8%) had a CSR and were then evaluated separately for factors associated with OS. Multivariate analysis of this cohort revealed age, stage, and comorbid conditions had an impact on OS. Annual PDS volume did not independently affect OS (HR = 0.88, 95% CI 0.71–1.10) among patients with a CSR. See Figure 1.

Conclusion: Patients operated on at high-volume hospitals are more likely to undergo CSR, and CSR is independently associated with OS. Hospital annual PDS volume is not associated with OS, if CSR can be achieved. Even in the setting of a high-volume hospital, OS is significantly diminished when CSR is not achieved. All efforts should be made toward a CSR, so that OS is maximized.

![Figure 1](image1.png)

Fig. 1.

170 - Poster Session
Emerging immune checkpoint receptors in epithelial ovarian cancer
Objective: Epithelial ovarian cancer (EOC) is the most deadly of all gynecologic cancers, with a 5-year survival rate of only 40%. Currently, the focus of EOC clinical trials involves immune checkpoint inhibitors, such as programmed cell death protein-1 (PD-1), which impairs antitumor function of CD8+ T cells. However, these PD-1 based inhibitors have exhibited low response rates in early clinical trials, indicating that new immunotargets should be investigated in order enhance EOC patient response to immunotherapy. Therefore, our goal was to characterize intratumoral expression of emerging immune checkpoint molecules in EOC and compare levels to PD-1.

Method: Immunohistochemistry (IHC) was employed to stain stage III, grade III serous EOC patient tissue for immune receptors (PD-1, TIM-3, OX40, and LAG-3) in CD8+, CD4+, and CD4+/FOXP3+ intratumoral T cells.

Results: The immune checkpoint inhibitor TIM-3 was found to be the most abundantly expressed T cell receptor, with intratumoral levels highest among all T cell subtypes. LAG-3 and PD-1 were lowly expressed on CD8+ and CD4+ T cells, but exhibited moderate expression on CD4+/FOXP3+ T cells. OX40 exhibited modest expression across all T cell subtypes. Interestingly, more than 85% of all immune receptor staining was located in the stroma of the tumor, rather than in the intraepithelial compartment.

Conclusion: We identified few PD-1 cells in patient EOC tissue, which could explain the low success rate of PD-1 inhibitors in EOC patients. TIM-3 was found to be the most prominently expressed immune receptor, indicating that it may be a more efficacious EOC immunotarget. Finally, due to the fact that the majority of immune receptor staining was located in the tumor stroma, further investigation is warranted in order to determine the significance of this finding.

---

171 - Poster Session
Therapeutic targeting of PTK6 oncogene in ovarian cancer
S. Tomita, S.V. Blank and H.Y. Irie. Icahn School of Medicine at Mount Sinai, New York, NY, USA

Objective: PTK6 is expressed in all ovarian cancer subtypes, and PTK6 amplification has been reported in high-grade serous carcinomas. In addition, PTK6 expression has prognostic significance and may have a role in the development of resistance to platinum. This study aims to validate PTK6/Brk, a nonreceptor tyrosine kinase, as a novel candidate therapeutic target for ovarian cancer. We hypothesize that PTK6 inhibition can suppress platinum-resistant ovarian cancer cell growth and survival and impair metastatic growth.

Method: Ovarian cancer cells (HeyC2, OV2008, CP70) were cultured in monolayer and 3D Matrigel cultures. Expression of PTK6 in ovarian cancer cells was downregulated using PTK6 shRNA vectors, which was confirmed by Western blot analysis. Cell viability was assessed by Cell Titer Glo assays. Cells grown in 3D Matrigel cultures were observed for phenotypic changes, specifically inhibition of anchorage-independent survival.

Results: ShRNA vectors were used to downregulate expression of PTK6 in ovarian cancer cell lines, including platinum-resistant cells. Knockdown was confirmed by Western analysis. PTK6 downregulation inhibited viability and invasiveness of all tested ovarian cancer cells in monolayer and 3-dimensional cultures. PTK6 downregulation inhibited anchorage-independent survival of ovarian cancer cells. See Figure 1.

Conclusion: Since anchorage-independent survival is a prerequisite for metastatic spread, these results support a critical role for PTK6 in ovarian cancer metastasis regulation. PTK6 inhibition suppresses growth and survival of ovarian cancer cells in 2- and 3-dimensional models and holds promise as a future novel therapeutic strategy for chemotherapy-resistant disease.

Fig. 1. OV2008 3D cell culture assay – DMSO control (left), cells with PTK6 inhibition (right).
Effect of travel to high-volume centers on short- and long-term outcomes for patients with ovarian cancer


aNew York-Presbyterian/Columbia University Medical Center, New York, NY, USA, bColumbia University College of Physicians and Surgeons, New York, NY, USA

Objective: Concentration of care for complex cancer surgeries to high-volume hospitals has been proposed as a way to improve outcomes. The objective of our study was to assess short- and long-term outcomes for patients with ovarian cancer who traveled to a high-volume center to receive care compared to patients who remained local and received care at a low-volume center.

Method: Patients in the National Cancer Data Base with stage II–IV ovarian cancer who underwent primary surgery from 2004 to 2016 were stratified into 2 groups based on distance traveled to surgical center and the patient volume at that facility. The local group included patients with travel in the lowest quartile (<6.1 miles), who received care at low-volume facilities (<6.23 patients/year). The travel group included patients with travel distance in the fourth quartile (>37.1 miles), who received care at high-volume facilities (>16.9 patients/year). After propensity score weighting, we determined the association between travel distance and short-term outcomes.

Results: A total of 5,806 patients in the local group and 5,446 patients in the travel group were identified. Patients treated in more recent years, white patients, and residents in urban/rural areas (vs metropolitan) were more likely to travel a longer distance to high-volume hospitals (P < 0.05 for all). Patients in the travel group had a decreased 30-day readmission rate (8.6% vs 11.6%, aRR = 0.63, 95% CI 0.45–0.88) but no difference in 30-day (2.9% vs 3.3%) or 90-day (6.7% vs 7.5%) mortality rates. There was a reduction in mortality in women in the travel group in the first 2 years after diagnosis (HR = 0.85 at <2 years, 95% CI 0.72–0.99), after which time the survival curves crossed and there was no difference in mortality (HR = 0.95 >2 years, 95% CI 0.80–1.12). The unadjusted 2-year survival was 72.4% (95% CI 71.1–73.7%) in the travel group and 69.2% (95% CI 67.9–70.4%) in the local group, while the 5-year survival was 40.3% (95% CI 38.8–41.8%) versus 40.9% (95% CI 39.5–42.3%) (log rank test P = 0.676). See Figure 1.

Conclusion: Patients with stage II–IV ovarian cancer who travel longer distances to high-volume centers have reduced mortality in the first 2 years after diagnosis, after which time there is no long-term survival difference compared to women who receive care at low-volume, local hospitals.

Fig. 1. Unadjusted long-term Kaplan-Meier survival curves in travel and local groups.
Method: We retrospectively reviewed the medical records of 268 epithelial ovarian cancer patients who received 3 or 4 cycles of NACT and underwent optimal resection in IDS. The effects of disease burden (peritoneal cancer index [PCI]), complexity of surgery (surgical complexity score [SCS]), and residual disease at IDS were assessed using the Kaplan-Meier method and Cox regression analysis.

Results: Patients with high disease burden had shorter PFS (15.1 vs 24.6 months, \( P < 0.001 \)) and OS (45.1 vs 76.5 months, \( P < 0.001 \)) than those with low disease burden (PCI ≤ 6). Patients with residual disease less than 1 cm had worse prognosis than those with no residual disease (R0) (PFS 18.2 vs 22.0 months, \( P = 0.001 \); OS 51.8 vs 79.2 months; \( P = 0.007 \)). In R0 patients, high SCS had shorter PFS (17.3 vs 31.5 months, \( P = 0.004 \)) and OS (74.7 months vs not reached; \( P = 0.008 \)) than low SCS. In a subset analysis of R0 patients with low disease burden, there were significant differences in PFS (31.5 vs 17.3 months, \( P = 0.045 \)) or OS (not reached vs 49.0 months, \( P = 0.049 \)) between low SCS and high SCS. In multivariate analysis, low disease burden with low SCS was an independent predictor of OS.

Conclusion: In ovarian cancer patients treated with NACT, low disease burden before IDS and low SCS were significant prognostic factors.

---

174 - Poster Session
More toxic than treatment? The financial impact of living with ovarian cancer: A qualitative exploration of financial toxicity in women with recurrent ovarian cancer
L. Meyer\(^1\), A.K. Schneider\(^2\), E. Molina\(^3\), M. Villanueva\(^3\), L.M. Lowenstein\(^3\), L.A. Williams\(^3\) and C.C. Sun\(^3\). \(^1\)The University of Texas MD Anderson Cancer Center, Houston, TX, USA, \(^2\)The University of Texas Health Science Center at Houston, Houston, TX, USA

Objective: The chronicity of ovarian cancer (OC) places patients at increased risk of financial toxicity. Patient-reported outcome measures lack the ability to understand the depths of financial toxicity. We qualitatively explored financial toxicity among patients with recurrent OC.

Method: Patients were recruited by purposive sampling for semistructured interviews on the financial impact of OC. Interviews were audio-recorded, transcribed verbatim, and coded. Framework analyses guided content analysis with ATLAS.tiV8.

Results: A total of 29 patients completed interviews. See Table 1. Median age was 62 years (range 43–78 years). A dominant theme was financial struggle among patients of varying socioeconomic levels. Loss of income and job lock were common. “The impact of the finances seemed much more devastating than the impact of the disease itself ... it blows up whatever you felt you had, in terms of financial security, and turns your world upside down ... you not only feel vulnerable because of the illness, but you feel totally vulnerable because your finances are destroyed, basically.” Strategies to manage financial toxicity included downsizing, adjusting lifestyle and spending, as well as accepting financial assistance from family, friends, and charitable organizations. Uncertainty about the future was common with descriptions of debt, liquidation of assets, and use of savings/retirement to meet basic needs. A patient described her continual downsizing after diagnosis, “The first time, I had to end up selling my house and moving into an apartment because I couldn’t afford to live there anymore...This time, I just pay what I can, and I hope to pay it off before I get out of this world. ... I keep downsizing. I had a house, then I went to a two-bedroom apartment, and now I’m at a one-bedroom apartment, and then my next step is to move in with relatives and have one room. And then the next step is a box.” The emotional impact of financial toxicity included loss, grief, guilt, fear, worthlessness, and helplessness. “You grieve when you realize that ... those plans that give most people security will not be your plans.” Another stated, "It affects your feeling of worthiness that we don’t even know if this is going to work and they’re spending all this money, and maybe it’ll help and maybe it won’t ... Is it really worth it? Should I just say I’m done with treatment and take whatever happens?"

Conclusion: Financial toxicity was experienced in a multifaceted fashion. Understanding financial toxicity via qualitative methods is vital for informing policy and tailored interventions.

Table 1.

<table>
<thead>
<tr>
<th>Age (median)</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>n</td>
<td>Range</td>
</tr>
<tr>
<td>61.8</td>
<td>42-77</td>
</tr>
<tr>
<td>FACIT-COST score (median)</td>
<td>n</td>
</tr>
<tr>
<td>17</td>
<td>1-42</td>
</tr>
<tr>
<td>Primary coverage</td>
<td></td>
</tr>
<tr>
<td>Medicare</td>
<td>11</td>
</tr>
<tr>
<td>Private</td>
<td>18</td>
</tr>
<tr>
<td>Hispanic</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>23</td>
</tr>
<tr>
<td>Yes</td>
<td>6</td>
</tr>
<tr>
<td>Marital Status</td>
<td></td>
</tr>
<tr>
<td>------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Married/Partnered</td>
<td>21</td>
</tr>
<tr>
<td>Divorced/Widowed/Single</td>
<td>8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of children &lt;18 yrs</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>26</td>
<td>89.7</td>
</tr>
<tr>
<td>1+</td>
<td>3</td>
<td>10.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Education</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>High school or less</td>
<td>4</td>
<td>13.8</td>
</tr>
<tr>
<td>Some college or higher</td>
<td>25</td>
<td>86.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Employment</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Employed outside home - full time</td>
<td>6</td>
<td>20.7</td>
</tr>
<tr>
<td>Employed outside home - part time</td>
<td>3</td>
<td>10.3</td>
</tr>
<tr>
<td>Homemaker</td>
<td>5</td>
<td>17.2</td>
</tr>
<tr>
<td>Retired</td>
<td>9</td>
<td>31.0</td>
</tr>
<tr>
<td>Disabled</td>
<td>3</td>
<td>10.3</td>
</tr>
<tr>
<td>Unemployed</td>
<td>3</td>
<td>10.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Annual household income</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than $25,000</td>
<td>6</td>
<td>20.7</td>
</tr>
<tr>
<td>$25,000-$34,999</td>
<td>3</td>
<td>10.3</td>
</tr>
<tr>
<td>$35,000-$49,999</td>
<td>3</td>
<td>10.3</td>
</tr>
<tr>
<td>$50,000-$74,999</td>
<td>1</td>
<td>3.4</td>
</tr>
<tr>
<td>$75,000 or more</td>
<td>12</td>
<td>41.4</td>
</tr>
<tr>
<td>Missing</td>
<td>4</td>
<td>13.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Race</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Black /African American</td>
<td>3</td>
<td>10.3</td>
</tr>
<tr>
<td>White</td>
<td>24</td>
<td>82.8</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>6.9</td>
</tr>
</tbody>
</table>

175 - Poster Session
A.T. Knisely, C.M. St. Clair, J.Y. Hou, F. Khoury Collado, A.I. Tergas, J.D. Wright and A. Melamed. New York-Presbyterian/Columbia University Medical Center, New York, NY, USA

Objective: The effect of neoadjuvant chemotherapy uptake on survival in advanced ovarian cancer is unknown. We sought to examine time trends in the use of primary chemotherapy and median survival among women with advanced ovarian cancer in the United States.

Method: We used the National Cancer Data Base to identify women who received treatment (chemotherapy, surgery, or both) for stage IIIC or IV epithelial ovarian cancer from 2004 to 2016. We calculated the proportion of women diagnosed in each year who were treated with primary chemotherapy. For women with mature survival data (diagnosed 2004–2013), we calculated the median survival rates using the Kaplan-Meier method. Trends in primary chemotherapy use and median survival were evaluated by fitting joinpoint models.

Results: We identified 72,171 women who were treated for advanced epithelial ovarian cancer between 2004 and 2016. From 2004 to 2006, the probability of receiving primary chemotherapy was 17.6% and remained unchanged ($P = 0.54$). Starting in 2006, the frequency of primary chemotherapy began to increase ($P < 0.001$ for change of trend) rising by 7.9% per year (95% CI 7.0–8.7) between 2006 and 2011. Uptake of primary chemotherapy accelerated in 2011 ($P = 0.01$ for change of trend), rising by 10.3% per year (95% CI 9.1–11.5) between 2010 and 2016. By 2016, 45.1% of patients received primary chemotherapy. Median survival improved by 2.1% per year (95% CI 1.3%–2.8%), increasing from 31.1 months in 2004 to 37.8 months in 2013. There was no evidence of a change in trend of survival ($P = 0.37$ for change of trend) in response to changes in the use of primary chemotherapy. See Figure 1.

Conclusion: Use of primary chemotherapy for patients with stage IIIC and IV epithelial ovarian cancer increased from 17.6% in 2004 to 45.1% in 2016. Uptake of neoadjuvant occurred concurrently with improvements in median survival.
Feasibility and outcomes of bevacizumab-containing neoadjuvant chemotherapy followed by interval debulking surgery in advanced ovarian cancer

J. Park and J.Y. Lee. Yonsei University College of Medicine, Seoul, South Korea

Objective: There are limited data on the efficacy and feasibility of bevacizumab-containing neoadjuvant chemotherapy (NACT) in the real world. In this study, we evaluated whether bevacizumab could improve clinical outcomes and lead to more successful optimal interval debulking surgery (IDS) in real-world practice.

Method: We retrospectively reviewed the medical records of patients with pathologically confirmed epithelial ovarian cancer who received NACT (carboplatin with paclitaxel [CP]) at Yonsei Cancer Hospital between August 2016 and May 2019. We divided patients according to the additional use of bevacizumab in NACT and compared patient characteristics, response to NACT, and surgical and survival outcome. The primary endpoint was complete resection rate at IDS. CA-125 normalization after NACT, chemotherapy response score, and perioperative complication were secondary endpoints.

Results: A total of 104 patients in conventional NACT (carboplatin with paclitaxel [CP]) and 16 patients in bevacizumab containing NACT (bevacizumab with carboplatin with paclitaxel [BCP]) received a median of 3 cycles of NACT. After NACT treatment, all patients underwent IDS. In comparison with adverse event during NACT and postoperative complication, there was no significant difference between the 2 groups ($P = 0.459$). Blood transfusion (18.8%) was the most common complication in the BCP group. CA-125 normalization after NACT was significantly higher in the BCP group ($P = 0.003$).

Fig. 1. Trends in use of primary chemotherapy and median survival in patient with advanced epithelial ovarian cancer.

The frequency of treatment with primary chemotherapy (red circles) and 95% confidence intervals (red spikes), median survival (blue circles) and 95% Cis (blue spikes), and trends obtained from jointpoint model are plotted against year of diagnosis. Use of primary chemotherapy was unchanged from 2004-2006 and began to increase in 2008 ($P < 0.001$), increasing by 7.9% per year (95%CI 7.0-8.7) from 2006-2011. Use of primary chemotherapy increased more rapidly after 2011 ($P = 0.01$) rising by 10.3% per year (95%CI =9.1-11.5) from 2011-2016. Median survival increased by 2.1% per year (95%CI =1.3-2.8) from 2004-2013, without significant change in the rate of increase ($P = 0.37$).
normalization after NACT was not significantly different between the CP and BCP groups (56.2% vs 43.8%, $P = 0.914$). Chemotherapy response score of 3 (26.0% vs 25.0%, $P = 0.721$) was not significantly different between the 2 groups. Although not significant, the BCP group showed a trend of improvement in the complete resection rate at IDS (48.1% vs 56.3%) and progression-free survival (PFS) at 2 years (32.4% vs 48.6%, $P = 0.130$).

**Conclusion:** Bevacizumab containing NACT followed by IDS showed feasible and safe outcomes in real clinical practice. Because the follow-up period was too short to show results of PFS and overall survival, survival benefit of bevacizumab-containing NACT should be investigated further. However, early bevacizumab use could be safely considered in NACT candidate ovarian cancer patients.

---

**177 - Poster Session**

**Why have increasing R0 resections in advanced ovarian cancer not led to improved survival outcomes?**

D.P. Mysona,a,b, V.L. Bae-Jumpa,c, S. Ghamande,b, B.J. Rungruang,b, J.X. She,b, J.K. Chan,b, L.K.H. Tran,b, P. Tranb and P.A. Gehriga,c. aUniversity of North Carolina at Chapel Hill, Chapel Hill, NC, USA, bMedical College of Georgia, Augusta, GA, USA, cUniversity of North Carolina Lineberger Comprehensive Cancer Center, Chapel Hill, NC, USA, California Pacific and Palo Alto Medical Foundation/Sutter Health Research Institute, San Francisco, CA, USA

**Objective:** The aim of this study was to investigate how rates of neoadjuvant chemotherapy (NACT) and R0 resection have changed and the impact on patient survival.

**Method:** The National Cancer Data Base was queried for patients with stage IIIIC–IV ovarian cancer who had cytoreductive status recorded from 2010 to 2015. Optimal debulking was defined as an R0 or R1 resection. $\chi^2$, Student $t$ test, Cox proportional hazards, and Kaplan-Meier were used for analysis.

**Results:** Of 6,446 patients, primary debulking surgery (PDS) was associated with younger age, non-Medicare insurance, low volume (<10 patients/year) and type of treatment center, region of country, diagnosis in 2010, increased surgical complexity, stage 3C, nonserous, low/moderate grade histology, LVSI, and residual upper abdominal disease (all, $P < 0.05$). An optimal resection was associated with fewer patient comorbid conditions, high volume and type of treatment center, insurance, diagnosis post 2010, surgical complexity, stage 3C, endometroid or clear cell histology, no LVSI, and IDS (all, $P < 0.05$). From 2010 to 2015, NACT increased by 26% (18% vs 44%, $P < 0.001$). From 2010 to 2015, R0 resections rose 26% (24% vs 50%, $P < 0.001$); R1 resections were stable (32% vs 27%, $P = 0.57$); and R2 resections decreased 22% (45% vs 23%, $P < 0.001$). The number of high (38% vs 39%), moderate (40% vs 37%), and low (22% vs 25%) surgical complexity cases did not change ($P = 0.74$). Despite the increase in R0 resections over this time period, there was no increase in overall survival (41.1 vs 41.2 months, $P = 0.57$). On multivariate analysis, there was similar survival between PDS and NACT (HR = 1.07, 95% CI 0.98–1.16, $P = 0.12$).

**Conclusion:** Increased utilization of NACT correlates with increased R0 resections; however, it does not correlate with a change in surgical complexity or survival. The lack of improvement in survival may be due to the fact that those who receive an optimal PDS have an improved survival compared to those who have an optimal resection after NACT, thus causing the overall groups to look similar when they are not. Nevertheless, it is clear that new systemic therapies are needed to result in improved patient survival, as surgical intervention and standard chemotherapy, no matter the order, have not sufficiently moved the pendulum.

---

**178 - Poster Session**

**No residual disease at the time of interval debulking surgery: It is all or nothing**

D.P. Mysona,a,b, V.L. Bae-Jumpa,c, S. Ghamande,b, B.J. Rungruang,b, J.K. Chan,b, P. Tranb, L.K.H. Tran,b, J.X. She,b and P.A. Gehriga,c. aUniversity of North Carolina at Chapel Hill, Chapel Hill, NC, USA, bMedical College of Georgia, Augusta, GA, USA, cUniversity of North Carolina Lineberger Comprehensive Cancer Center, Chapel Hill, NC, USA, California Pacific and Palo Alto Medical Foundation/Sutter Health Research Institute, San Francisco, CA, USA

**Objective:** The aim of this study was to investigate survival differences between equivalent residual disease (R0, R1, R2) between primary debulking (PDS) and interval debulking (IDS) surgery.

**Method:** The National Cancer Data Base was used to identify patients with stage IIIIC or IV ovarian cancer who had residual disease recorded from 2010 to 2015. Optimal debulking was defined as an R0 or R1 resection. Propensity score matching was used to correct for differences in characteristics between PDS and IDS groups. Statistical techniques used were $\chi^2$, Cox proportional hazards, and Kaplan-Meier.

**Results:** Of 6,446 patients with advanced ovarian cancer, 2,385 (37%), 2,130 (33%), and 1,931 (30%) had an R0, R1, or R2 resection, respectively. In a comparison of PDS to IDS, fewer patients had an R0 resection (36% vs 40%, $P = 0.005$); R1 resections were similar (33% vs 33%, $P = 0.91$); and R2 resections were more frequent (31% vs 27%, $P = 0.002$). Overall, there was no survival difference
between PDS and IDS (42 vs 39 months, \( P = 0.10 \)). An R0 resection at PDS was associated with the longest median survival (50 months) (Figure 1). The differences were significant when PDS and IDS R0 (\( P = 0.04 \)) and R1 (\( P = 0.02 \)) resections were compared.

**Conclusion:** There was no survival difference between PDS and IDS among all patients, a finding that aligns with prior randomized control trials in which optimal debulking was the goal. Those who underwent an R0/R1 resection at the time of IDS have worse survival than those undergoing an R0/R1 resection at PDS. In the context of these results, the use of a tool such as the Fagotti score should also be applied at the time of IDS to determine whether an R0 resection is achievable; if not, the patient may benefit from additional rounds of chemotherapy to make an R0 resection achievable. These findings highlight the importance of maximal surgical effort at the time of debulking surgery regardless of the timing.

**Fig. 1.** Survival differences in patients grouped by residual disease (R0, R1, R2) and whether they received PDS or IDS. Global p-value shown.

---

**179 - Poster Session**

**Outcomes of newly diagnosed stage II ovarian, primary peritoneal and fallopian tube cancer receiving intravenous or intraperitoneal platinum based chemotherapy in combination with veliparib and bevacizumab**

C.R. Washington\(^a\), A. Miller\(^b\), K.N. Moore\(^c\), K.M. Bell-McGuinn\(^d\), R. Schilder\(^e\), J.L. Walker\(^f\), W.E. Brady\(^g\), R.E. O’Cearbhaill\(^h\), S.R. Guntupalli\(^i\), D.K. Armstrong\(^j\), A.R. Hagemanni\(^j\), H.J. Gray\(^k\), L.R. Duska\(^l\), C.A. Mathews\(^m\), A. Chen\(^n\), D.M. O’Malley\(^o\), S.W. Gordon\(^p\) and C. Aghajani\(^q\).

\(^a\)The University Of Oklahoma Health Sciences Center, Oklahoma City, OK, USA, \(^b\)Gynecologic Oncology Group Statistical and Data Center, Buffalo, NY, USA, \(^c\)The University of Oklahoma Stephenson Cancer Center, Oklahoma City, OK, USA, \(^d\)Memorial Sloan Kettering Cancer Center, New York, NY, USA, \(^e\)Thomas Jefferson University, Philadelphia, PA, USA, \(^f\)The University of Oklahoma, Oklahoma City, OK, USA, \(^g\)Memorial Sloan Kettering Cancer Center and Weill Cornell Medical College, New York, NY, USA, \(^h\)University of Colorado Denver, Aurora, CO, USA, \(^i\)Johns Hopkins Kimmel Cancer Center, Baltimore, MD, USA, \(^j\)Washington University School of Medicine in St. Louis, St. Louis, MO, USA, \(^k\)University of Washington Medical Center, Seattle, WA, USA, \(^l\)University of Virginia, Charlottesville, VA, USA, \(^m\)Women & Infants Hospital, Brown University, Providence, RI, USA, \(^n\)National Cancer Institute, National Institutes of Health, Department of Health & Human Services, Bethesda, MD, USA, \(^o\)The Ohio State University, James Cancer Hospital, Columbus, OH, USA, \(^p\)Virginia Commonwealth University, Richmond, VA, USA

**Objective:** The aim of this study was to determine progression-free survival (PFS) and overall survival (OS) among stage II epithelial ovarian, peritoneal, or fallopian tube cancer (EOC) patients enrolled on GOG 9923 a phase I study every 21-day carboplatin/paclitaxel (C/T), weekly C/T or intravenous and intraperitoneal paclitaxel/cisplatin (IP) in combination with continuous or intermittent ABT-888 and bevacizumab in newly diagnosed previously untreated EOC.

**Method:** Three regimens (6 cohorts) were evaluated in this study. Each regimen had 2 subcohorts to evaluate continuous veliparib dosing twice daily PO (BID) days 1–21 or intermittent dosing twice daily PO BID day 2 to 5. Veliparib was only administered during the 6 cycles of chemotherapy. Regimen 1 treated patients with C/T, bevacizumab 15 mg/kg IV day 1 (starting cycle 2) followed by bevacizumab maintenance cycles 7–22. Regimen 2 used weekly C/T, bevacizumab 15 mg/kg IV day 1 (starting cycle 2) followed by bevacizumab maintenance cycles 7–22. Regimen 3 used IV/IP paclitaxel and cisplatin, bevacizumab 15 mg/kg IV day 1 (starting cycle 2) followed by bevacizumab maintenance cycles 7–22. Primary endpoints of maximum tolerated dose (MTD) and recommended phase 2
Results: A total of 424 patients were enrolled, 54 (12.7%) patients with stage II disease. Fifty-three of the 54 stage II patients had microscopic residual disease; therefore, residual disease status was ignored in analysis. Six (7.8%) of the patients had a BRCA1 or BRCA2 mutation; 27 (50%) of patients were BRCAwt; and 21 (38.9%) had unknown BRCA status. PFS was 79.4 months (95% CI 36.6–79.4) for BRCA1 or BRCA2 mutation patients. PFS for BRCAwt and BRCA unknown patient has not been reached. Multivariate analysis revealed that stage was the most prominent independent prognostic factor in terms of PFS (stage II vs stage III, HR = 0.372, 95% CI 0.214–0.645, and stage II vs stage IV, HR = 0.240, 95% CI 0.130–0.444).

Conclusion: Stage II EOC was included in analyses of early-stage tumors historically, but is now recognized to be higher risk and should be treated in a similar fashion to advanced-stage tumors. This study is one of the few prospective analyses of stage II patients detailing demographics and oncologic outcomes and gives prognostic information to inform patient counseling and treatment selection.

180 - Poster Session
The Cdk1 inhibitor RO3306 has anti-tumorigenic effects in high-grade serous ovarian cancer

Objective: Over-expression of cyclin-dependent kinase 1 (Cdk1) is associated with poor survival in high-grade serous ovarian cancer (OC). Cdk1 is a critical regulator of cell cycle progression, specifically G2 and S phase transit. In addition, Cdk1 is required for the efficient recruitment of BRCA1 to sites of DNA damage. We evaluated the in vitro and in vivo effects of Cdk1 inhibition by RO3306 in serous OC.

Method: Two OC cell lines, OVCAR5 and SKOV3, were used. Cell proliferation and apoptosis were assessed using MTT and Annexin V-FITC assays. Cellular stress was evaluated using the DCFH-DA assay. Cell cycle progression was evaluated by Cellometer. Adhesion and invasion were assessed by laminin and wound healing assays. Expression of targets of Cdk1 signaling were determined by Western blot. A high-grade serous OC transgenic mouse model (K18-gT121±; p53fl/fl; Brca1fl/fl[KpB]) was used to assess RO3306 in vivo. Upon tumor onset, mice were treated for 4 weeks with RO3306 (4 mg/kg, IP, q3 days). Immunohistochemistry was used to assess the impact of RO3306 on proliferation and angiogenesis in the OCs. Serum VEGF was measured by ELISA assay.

Results: RO3306 inhibited cell proliferation in a dose-dependent manner (IC50, 28 uM = OVCAR5; 50 uM = SKOV3). RO3306 induced cellular stress and apoptosis, along with increased expression of PERK, BIP, and CHOP, and decreased expression of MCL-1 and Bcl-2. Treatment with RO3306 resulted in G2 phase arrest with increased expression of p21 and p27. RO3306 reduced cell adhesion and cell migration, accompanied by decreases in B-catenin, Slug, Snail, Vimentin, and VEGF. RO3306 reduced tumor weight by 78% in KpB mice and decreased serum VEGF (P < 0.05). RO3306 reduced Ki-67 and VEGF and increased BIP expression in the OCs (P < 0.05).

Conclusion: RO3306 exhibits antitumorigenic effects in serous OC. Targeting CDK1 may be a promising strategy for treatment of OC, particularly given the interrelationship between Cdk1 and BRCA1.

181 - Poster Session
Optimizing number of preoperative neoadjuvant chemotherapy cycles and survival in newly diagnosed ovarian cancer

Objective: Although clinical trials of neoadjuvant chemotherapy (NACT) followed by interval debulking surgery (IDS) in ovarian cancer (OC) use 3 NACT cycles as a standard, real-world practice varies. We seek to evaluate the association of number of NACT cycles with survival, accounting for interval imaging results and surgical outcomes.

Method: Utilizing a prospective OC database at a single institution, we identified 199 women with newly diagnosed OC who were recommended NACT and underwent IDS from July 2015 to December 2018. Nonparametric tests were used to compare clinical characteristics based on 3, 4, or ≥5 NACT cycles received. The Kaplan-Meier method was used to estimate differences in progression-free survival (PFS) and overall survival (OS), and the log rank test was used to assess the relationship of covariates to outcome. The CoxPH model with time-dependent covariates was applied to variables collected after IDS.

Results: Median number of NACT cycles was 4 (range 3–8) with 56 women receiving ≥5 cycles. Compared to those receiving 3 or 4 NACT cycles, women with ≥5 cycles received fewer or no postoperative cycles (P < 0.001) but had no differences in other clinical factors
including age, stage, comorbidity score, NACT indication, chemotherapy regimen, response on interval CT scan, or rates of optimal debulking and complete gross resection (CGR) \((P > 0.05)\). There were no significant differences in PFS or OS in comparing 3 versus 4 NACT cycles. However, more NACT cycles (≥5 vs 4) was associated with worse PFS, even after adjustment for BRCA status and CGR (HR = 2.20, 95% CI 1.45–3.33, \(P < 0.001\)) and worse OS, even after adjustment for histology, interval CT response, and CGR rates (HR = 2.78, 95% CI 1.37–5.63, \(P = 0.016\)). See Figure 1. Most common reasons cited for ≥5 NACT cycles were inadequate response to NACT and patient performance status.

**Conclusion:** Although there were no differences between 3 or 4 NACT cycles, receiving ≥5 cycles was associated with worse PFS and OS compared to 4 cycles, even after adjusting for interval imaging results and CGR rates. This suggests that patients who are not fit for IDS after 4 NACT cycles may have a poorer prognosis, independent of response to NACT and maximal cytoreduction.

**Fig. 1.** PFS by NACT cycle number.

---

**182 - Poster Session**

ENGOT-ov43/keylynk-001: A phase III, placebo- and active-controlled trial of pembrolizumab plus chemotherapy with olaparib maintenance for first-line treatment of advanced BRCA-nonmutated epithelial ovarian cancer


aThe University of Texas MD Anderson Cancer Center, Houston, TX, USA, bSaitama Medical University International Medical Center, Hidaka, Japan, cCharité Universitätsmedizin Berlin, Berlin, Germany, dPoliclinico Universitario Agostino Gemelli, Rome, Italy, eUniversity of Turin, Turin, Italy, fUniwersytet Medyczny im K. Marcinkowskiego w Poznaniu and Szpital Kliniczny Przemienienia Pańskiego, Poznań, Poland, gJosef Buchmann Gynecology and Maternity Center, Ramat Gan, Israel, hInstitut Gustave-Roussy, Villejuif, France, iCharles University and General Faculty Hospital, Prague, Czech Republic, jPrincess Margaret Cancer Centre, University Health Network, Toronto, ON, Canada, kSamsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, Korea, Republic of (South), lChang Gung Memorial Hospital and Chang Gung University, Kueishan, Taoyuan, Taiwan, mGEICO and Clinica Universidad de Navarra, Pamplona, Spain, nMerck & Co., Inc., Kenilworth, NJ, USA, oIstanbul Medical Faculty Hospital, Faith, Istanbul, Turkey, pBiltmore Cancer Center, Phoenix, AZ, USA, qUniversity of Alabama at Birmingham, Birmingham, AL, USA, rThe Ohio State University, Columbus Cancer Council, Hilliard, OH, USA, tBelgian Gynecologic Oncology Group (BGOG) and University of Leuven, Leuven Cancer Institute, Leuven, Belgium

**Objective:** Primary debulking surgery (PDS) followed by paclitaxel-carboplatin chemotherapy (CT) is the current standard-of-care treatment for advanced epithelial ovarian cancer (EOC). However, most patients receiving this regimen relapse within 3 years of stopping treatment. In the phase 1–2 study, TOPACIO/KEYNOTE-162, combination therapy with the PD-1 inhibitor pembrolizumab (pembro) plus the PARP inhibitor niraparib, demonstrated antitumor activity in women with platinum-resistant, relapsed EOC. The PARP inhibitor olaparib is approved in the United States for patients with platinum-sensitive, recurrent OC regardless of BRCA1/2 status, as well as for patients with newly diagnosed BRCA-mutated OC. Pembro plus CT followed by olaparib maintenance therapy is being investigated in ENGOT-ov43/KEYLYNK-001 (NCT03740165), a phase 3, randomized, double-blind, active- and placebo-controlled study for first-line treatment of women with advanced BRCA1/2 status.

**Method:** Eligible women must have BRCA-nonmutated stage III or stage IV EOC, primary peritoneal cancer, or fallopian tube cancer. Before randomization, stratification will be performed by PD-L1 combined positive score (<10 or ≥10), planned bevacizumab use at investigator’s discretion before randomization (yes or no), and surgery status (residual tumor after PDS [yes or no] or planned interval
debunking). After 1 lead-in cycle of CT, patients will be randomized 1:1:1 to receive pembro plus CT followed by pembro plus olaparib maintenance; pembro plus CT followed by pembro with placebo maintenance; or placebo with CT followed by placebo maintenance. The CT regimen will be administered for 5 cycles, and pembro 200 mg every 3 weeks will be administered for 35 cycles. After the end of CT, maintenance therapy with olaparib 300 mg twice daily or matching placebo will be administered as concomitant treatment with pembro until discontinuation or for 2 years if the patient has no evidence of disease. Primary endpoints are progression-free survival (PFS) per Response Evaluation Criteria in Solid Tumors (RECIST) v1.1 by investigator review and overall survival. Key secondary endpoints include PFS per RECIST v1.1 by blinded independent central review, PFS after next-line treatment, safety and tolerability, and health-related quality of life. Patient accrual is ongoing.

Results: The trial is in progress.

Conclusion: The trial is in progress.

183 - Poster Session
Characterization of homologous recombination deficiency in uncommon epithelial ovarian cancer subtypes
J.A. Howa, K.M. Timmsb, A.A. Jazaeria, K.H. Lua and M.S. Yatesa. aThe University of Texas MD Anderson Cancer Center, Houston, TX, USA, bMyriad Genetic Laboratories, Inc., Salt Lake City, UT, USA

Objective: The Homologous Recombination Deficiency (HRD) score is a measure of genomic instability that has been associated with sensitivity to platinum-based therapy and poly ADP-ribose inhibitors in patients with epithelial ovarian cancer. The objective of this study was to compare the frequency of HR defects and related tumor aberrations between high-grade serous (HGS) and other histologic subtypes of epithelial ovarian cancers.

Method: A consecutive series of previously untreated nonmucinous ovarian cancer patients was enrolled under an Institutional Review Board-approved protocol. Patients underwent germline testing for HR gene mutations. When sufficient tissue was available, tumor BRCA1 and BRCA2 characterization and HRD scoring were conducted as previous described. High HRD score (≥42) indicates an HR defect. Characteristics of HGS ovarian cancers with complete HRD testing (n = 77) have been described previously and are not reported in detail here. Low-grade serous (n = 26), clear cell (n = 10), endometrioid (n = 7) and high-grade mixed histology (n = 24) ovarian cancers were included.

Results: Among the 67 non-HGS ovarian cancer cases, 6 germline deleterious mutations in HR genes were identified in mixed histology (2 BRCA1, 1 BRCA2, 1 NBN, and 1 RAD51C) and clear cell (1 BRCA1) subtypes. Of 34 non-HGS cases with HRD score determined, high HRD score was identified in 12 cases, including 1/7 clear cell, 0/4 endometrioid, 0/8 low-grade serous, and 11/14 mixed histology tumors. Tumors with mixed histology were more likely to have high HRD score (11/14, 78.6%) compared with the HGS (36/77, 46.8%) cohort (P = 0.03). A BRCA1 germline mutation was noted in the clear cell case with a high HRD score. Among the 11 mixed histology tumors with high HRD scores, 4 germline or somatic BRCA1 and BRCA2 mutations, 1 germline NBN mutation, and 3 BRCA1 promoter methylation were identified; 3 patients had unexplained high HRD scores.

Conclusion: High HRD scores were most common in ovarian cancers with high-grade mixed histology. Additional studies with larger cohorts are needed to confirm differences in HR defects or related tumor characteristics in mixed histology compared to pure high-grade serous ovarian cancers. In addition, understanding the underlying aberrations that contributing to HR defects provides important information for treatment and prevention.

184 - Poster Session
Gemcitabine and novel Chk1 inhibitor GDC-0575 demonstrate synergistic effect against high-grade serous ovarian cancer in 3D cell culture, PDX models and patient tumors

Objective: The purpose of this study was to demonstrate that response to combination gemcitabine plus novel Chk1 inhibitor GDC-0575, both in vitro and in vivo, is more potent compared to either single agent in treatment of high-grade serous ovarian cancer (HGSO).

Method: A total of 18 HGSOC tumor models were grown in 3-dimensional culture. Cells grown in low-binding U-bottom plates were treated with gemcitabine, GDC-0575, or combination therapy at titrating concentrations. Cell viability was measured 72 hours after exposure, and synergy of drug combination was determined using CalcuSyn software (synergy defined as any combination index [CI] <1 at fraction affected 50% [Fa50%]). In vivo, immunodeficient mice were injected with human HGSOC tumors intraperitoneally and
randomized to control, single-agent gemcitabine, single GDC-0575, or combination therapy. Tumor size was followed by ultrasound, and weight was measured at mouse sacrifice after a 28-day treatment regimen. Three-dimensional cell culture was performed on 4 dissociated HGSOC primary patient tumor surgical specimens from platinum refractory or resistant HGSOC.

**Results:** Four of 18 3-dimensional culture models demonstrated synergy of gemcitabine plus GDC-0575 in vitro with CI at Fa50% of 0.360, 0.6, 0.784, and 0.745 (CI < 1.0). In 10 of 20 in vivo PDX models, combination therapy significantly improved tumor growth inhibition compared to single agent. Five models sensitive to single-agent gemcitabine had greater tumor inhibition with combination therapy (1/5, \( P < 0.05 \)), and 9 models resistant to single-agent gemcitabine were sensitive to combination therapy (7/9, \( P < 0.05 \)). Patient tumors in 3-dimensional culture demonstrated synergy in 3 of 4 tumors with CI at FA50% of 0.412, 0.88, and 0.999.

**Conclusion:** Combination of gemcitabine plus GDC-0575 demonstrates synergistic tumor killing effects in vitro PDX tumors and patient tumors. Combination therapy also improves tumor killing in vivo PDX models. Further investigation into mechanisms of synergy and resistance is required.

---

**185 - Poster Session**

**Trends in germline and somatic BRCA1/2 testing before and after SOLO1**

T. Anwer, H. Stack-Dunnbier, M.R. Hacker, M. Shea\(^{ab} \) and K.M. Esselen.\(^{ab} \) *Beth Israel Deaconess Medical Center, Boston, MA, USA, Harvard Medical School, Boston, MA, USA*

**Objective:** In October 2018, the SOLO-1 trial showed maintenance olaparib compared to placebo had a 70% lower risk of disease progression or death among women with newly diagnosed, advanced epithelial ovarian cancer (EOC) with germline or somatic BRCA1 and BRCA2 mutation. Our study objective was to determine whether patterns of genetic and genomic testing in patients with advanced EOC at our institution changed after SOLO1 trial announcement.

**Method:** This is a retrospective analysis of patients diagnosed with advanced EOC from October 2016 to April 2019. The SOLO1 trial results were disclosed October 21, 2018, at the European Society for Medical Oncology Meeting. We compared offer and receipt of genetic and genomic testing for women with a pathologic diagnosis before and after November 1, 2018. Data are presented as percentage and median (interquartile range) and compared with \( \chi^2 \) and Wilcoxon rank sum tests.

**Results:** Among 61 women who met criteria, 69% were diagnosed with advanced EOC before SOLO1, and 31% were diagnosed after. While the percentages of women offered and receiving genetic testing did not change from before to after SOLO1 (both \( P \geq 0.74 \)), significantly more women were offered and received genomic testing after SOLO1 than before (both \( P < 0.004 \)). Median time from diagnosis to receiving genetic testing decreased significantly from 87 (45–165) days before to 54 (33–72) after SOLO1 (\( P = 0.03 \)). Similarly, median time from diagnosis to receiving genomic testing decreased significantly from 358 (239–427) days before SOLO1 to 121 (103–141) days after SOLO1 (\( P < 0.001 \)). See **Table 1**.

**Conclusion:** After release of SOLO1 trial results, genetic testing frequency did not change, but the frequency of genomic testing after SOLO1 significantly increased. In addition, the length of time from diagnosis to receiving genetic and genomic testing decreased significantly.

**Table 1.** Genetic and genomic testing trends before and after SOLO1 results.

<table>
<thead>
<tr>
<th></th>
<th>All</th>
<th>Before SOLO1 Results</th>
<th>After SOLO1 Results</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offered genetic testing</td>
<td>90</td>
<td>n=42</td>
<td>n=19</td>
<td>1.00</td>
</tr>
<tr>
<td>Received genetic testing</td>
<td>80</td>
<td>79</td>
<td>84</td>
<td>0.74</td>
</tr>
<tr>
<td>Offered genomic testing</td>
<td>36</td>
<td>24</td>
<td>63</td>
<td>0.004</td>
</tr>
<tr>
<td>Received genomic testing</td>
<td>32</td>
<td>20</td>
<td>63</td>
<td>0.003</td>
</tr>
<tr>
<td>Days to genetic testing</td>
<td>66 (44–131)</td>
<td>87 (45–165)</td>
<td>54 (33–72)</td>
<td>0.03</td>
</tr>
<tr>
<td>Days to genomic testing</td>
<td>153 (120–332)</td>
<td>358 (239–427)</td>
<td>121 (103–141)</td>
<td>(&lt;0.001)</td>
</tr>
</tbody>
</table>

Data are presented as percent or median (interquartile range).
**Intrauterine lavage as a novel method of detecting somatic mutations present in high-grade serous cancer of the ovary, fallopian tube or peritoneum**

E. Smith, A.D.C. Paula, S.S. Lee, D.S. Chi, N.R. Abu-Rustum, B. Weigelt and K. Long Roche. Memorial Sloan Kettering Cancer Center, New York, NY, USA

**Objective:** The aim of this study was to determine whether intrauterine lavage (IUL) samples from patients with high-grade serous carcinoma (HGSC) of the ovary, fallopian tube, or peritoneum harbor detectable genetic mutations and whether they reflect their matched tumor somatic mutation profiles. Our goal was to optimize mutation detection methods and shed light on novel diagnostic and screening techniques for ovarian cancer.

**Method:** Under an Institutional Review Board-approved protocol using standard transcervical collection technique, saline IUL samples were obtained prior to surgical incision from patients with known or suspected HGSC \( n = 4 \) and adnexal masses \( n = 3 \), and those undergoing risk-reducing adnexectomy \( n = 6 \). IUL samples were centrifuged to isolate free-floating tissue. DNA was extracted and submitted for massively parallel sequencing targeting 468 cancer-related genes in patients with confirmed HGSC on final surgical pathology \( n = 4 \). In parallel, IUL DNA samples were subjected to high-sensitivity droplet digital PCR (ddPCR) assays for \( TP53 \) \( n = 3 \) or \( ARID1B \) \( n = 1 \) to detect tumor mutations in IULs from the respective patients.

**Results:** Extracted DNA totals differed significantly between washings from patients with HGSC (median 1,274 ng, range 744–8,557 ng) versus benign pathology (median 148 ng, range 34–3,303 ng; \( P = 0.03 \)). Ovarian tumor mutation profiles varied, but all harbored pathogenic \( TP53 \) mutations \( n = 4, 100\% \). Initial hybrid-capture massively parallel sequencing of IUL DNA at a median depth of 1,372x (range 884x–1,770x) identified mutations concordant with the respective somatic tumor mutation profiles in 2 of 4 cases (50%). Subsequent ddPCR testing detected mutations in 2 of the 4 submitted assays (50%), although results were within or near assay sensitivity limits. Overall, 3 of 4 cases had mutations from their respective matched tumor detected in their IUL (Table 1).

**Conclusion:** Our results suggest that HGSC-specific mutations, specifically in \( TP53 \), can be detected via IUL sequencing analysis, a minimally invasive technique with the potential for broader applications. The need for sensitive mutation identification via this approach requires optimization, but the opportunity for further investigation into its use as a diagnostic or screening tool remains.

<table>
<thead>
<tr>
<th>Sample ID</th>
<th>Total DNA extracted from IUL (ng)</th>
<th>Somatic mutation of interest</th>
<th>IUL mutation(s) also in somatic profile</th>
<th>IUL ddPCR assay for mutation of interest</th>
</tr>
</thead>
<tbody>
<tr>
<td>KLR1</td>
<td>1436</td>
<td>( ARID1B ) ( p.G326^* )</td>
<td>Identified</td>
<td>Detected</td>
</tr>
<tr>
<td>KLR2</td>
<td>8557</td>
<td>( TP53 ) ( p.X261_splice )</td>
<td>Not identified</td>
<td>Detected</td>
</tr>
<tr>
<td>KLR3</td>
<td>744</td>
<td>( TP53 ) ( p.D281E )</td>
<td>Not identified</td>
<td>Not detected</td>
</tr>
<tr>
<td>KLR4</td>
<td>1110</td>
<td>( TP53 ) ( p.R175H )</td>
<td>Identified</td>
<td>Not detected</td>
</tr>
</tbody>
</table>

---

**187 - Poster Session**

**Prognostic analysis of splenic parenchymal metastasis in advanced ovarian cancer: Does parenchymal metastasis matter?**

S.L. Chang, J.H. Son, J.H. Shim, J. Kim, S. Kim, T.W. Kong, J. Paek and H.S. Ryu. Ajou University School of Medicine, Suwon, South Korea

**Objective:** Splenic metastasis is generally a part of peritoneal seeding with multi-organ involvement in advanced ovarian cancer. Although splenic parenchymal lesion is classified into FIGO stage IVB disease, it is usually surgically resectable disease. The aim of this study was to evaluate the patterns and prognostic value of splenic parenchymal metastasis in advanced ovarian cancer.

**Method:** We retrospectively reviewed medical records of patients who received splenectomy as part of cytoreductive surgery in advanced ovarian cancer from 2007 to 2018. Patients were divided into the parenchymal invasion group and the capsular/hilar invasion group. Clinical characteristics including histologic invasion patterns and survival outcomes were analyzed.

**Results:** A total of 76 ovarian cancer patients received splenectomy; 37 (48.7%), 26 (34.2%), and 13 (17.1%) during primary debulking surgery, interval debulking surgery, and at the time of disease recurrence, respectively. The median age was 55 years, and all patients had FIGO stage IIIIC–IV disease. Nineteen (25%) patients had splenic parenchymal invasions, and all the lesions were accompanied by capsular or hilar metastasis without solitary parenchymal invasion. Among the patients with primary disease \( n = 63 \), 30 (47.6%) had stage IV disease including 13 (21.7%) with splenic parenchymal metastasis. There was no difference in terms of residual disease \( P = 0.367 \), progression-free survival \( P = 0.688 \), and overall survival \( P = 0.492 \) between patients with parenchymal invasion and capsular/hilar metastasis.
Conclusion: Although splenic parenchymal metastasis reflected widespread tumor dissemination, all the lesions were followed by hilar or capsular involvement and surgically treatable disease. The prognosis of splenic parenchymal metastasis was not inferior to capsule or hilar invasion.

188 - Poster Session
Death-domain-associated protein (DAXX) is a novel prognostic factor in metastatic high-grade serous carcinoma
B. Davidson, M. Brunetti, E. McFadden, V.A. Florenes and A. Holth. The Norwegian Radium Hospital, Oslo, Norway

Objective: The aim of this study was to analyze the expression and clinical role of the mitosis regulators atalassemia/mental retardation syndrome X-linked (ATRX) and death-domain-associated protein (DAXX) in metastatic high-grade serous carcinoma (HGSC).

Method: ATRX and DAXX protein expression by immunohistochemistry (IHC) was analyzed in 400 HGSC effusions. DAXX expression was additionally studied in 70 HGSC effusions using Western blot.

Results: ATRX and DAXX expression by IHC was found in HGSC cells in 386/400 (96%) and 348/400 (87%) effusions, respectively. Western blot showed DAXX expression in 62/70 (89%) HGSC effusions. DAXX expression by IHC was higher in pleural compared to peritoneal effusions ($P = 0.006$) and in post-chemotherapy compared to pre-chemotherapy effusions ($P = 0.004$), and its expression was significantly associated with poor overall survival in univariate ($P = 0.014$) and Cox multivariate ($P = 0.011$) survival analysis. ATRX expression was unrelated to clinicopathologic parameters or survival.

Conclusion: DAXX is associated with disease progression and is a novel prognostic marker in metastatic HGSC. Silencing this molecule may have therapeutic relevance in this cancer.

189 - Poster Session
Serous tubal intraepithelial carcinoma (STIC) at the time of primary debulking surgery (PDS) of high-grade serous ovarian cancer (HGSOC): Does it matter?

Objective: The aim of this study was to evaluate the clinical significance and genomic associations of concurrent serous tubal intraepithelial carcinoma (STIC) fallopian tube lesions identified in women with high-grade serous carcinoma (HGSC) undergoing primary debulking surgery (PDS).

Method: All patients undergoing PDS for HGSC between July 2015 and December 2018 were captured in a prospectively maintained institutional database. Patients were categorized based on the presence (+STIC) or absence (no-STIC) of a concurrent STIC fallopian tube lesion noted on final surgical pathology. Demographic, perioperative, and outcomes data were collected and groups compared by using standard statistical tests. Progression free (PFS) and overall survival (OS) were evaluated using the Kaplan-Meier method.

Results: Two-hundred and sixty-five patients with HGSC who underwent PDS were included, of which 75 (28%) were found to have a concurrent STIC lesion (+STIC) and 190 (72%) did not (no-STIC). The +STIC and no-STIC groups were similar with regard to age (62.4 years, range 33.1–86.3 years, vs 62.8 years, range 34.9–88.4 years; $P = 0.683$), FIGO stage IV (20, 27%, vs 57, 30%; $P = 0.590$), BRCA+ germline status (15, 22%, vs 33, 19%; $P = 0.631$), and residual disease after PDS ($P = 0.875$), respectively. Median PFS of the entire cohort was 24.8 months and was similar ($P = 0.263$) between +STIC (21.4 months, 95% CI 16.1–26.7) and no-STIC groups (25.7 months, 95% CI 23.3–28.0) (Figure 1). The median OS of the entire cohort was not reached after a median follow-up time of 26.1 months for survivors. The 2-year and 3-year OS was 93.8% and 82.5%, respectively. The 2- and 3-year OS was similar ($P = 0.596$) between the +STIC group (90.3% and 76.7%) and the no-STIC group (95.4% and 83%, respectively).

Conclusion: There are no identifiable clinical differences in patients found to have concurrent STIC lesions at time of PDS for HGSOC. These data suggest a comparable, if not identical, disease process.
Objective: The aim of this study was to evaluate correlations between rucaparib pharmacokinetic (PK) exposure and safety/efficacy in patients with recurrent ovarian cancer (rOC) using pooled data from Study 10 (NCT01482715) and ARIEL2 (NCT01891344).

Method: Patients received escalating doses of rucaparib in phase 1 and recommended starting dose of 600 mg BID in phase 2. A published population PK model was used to estimate actual dose-normalized average steady-state AUC (AUCss) and Cmax. Safety was evaluated in patients who received ≥1 rucaparib dose; efficacy was assessed in patients who had a deleterious BRCA mutation or had LOH high tumors. Linear logistic, linear, and Cox exposure-efficacy/safety regressions were tested for binary, continuous, and time-to-event response endpoints, respectively. Clinical covariates were tested in multivariate models.

Results: Rucaparib PK was well described by the published population PK model. Rucaparib PK exposure was dose-proportional and not associated with baseline patient weight or baseline platelet counts. In the exposure-safety analyses (n = 375), patients received 40 mg QD to 840 mg BID starting doses. Most patients received 600 mg BID starting dose, with 27% and 21% of patients receiving 1 or ≥2 dose reductions, respectively. Rucaparib was well tolerated overall, with a mean dose ratio of 0.88 (i.e., on average 12% lower than starting dose). Cmax was significantly correlated with grade ≥2 serum creatinine increase and grade ≥3 ALT/AST increase, platelet decrease, fatigue/asthenia, and maximal hemoglobin decrease. In exposure-efficacy analyses of patients with a BRCA mutation (n = 102), AUCss was positively associated with independent radiologist reviewer (IRR)-assessed ORR in platinum-sensitive (n = 75, P = 0.017) but not platinum-resistant (n = 27, P = 0.661) patients who had received ≥2 prior lines of chemotherapy. Analyses with additional efficacy endpoints and for patients with platinum-sensitive rOC and BRCA wildtype/LOH high tumors will be presented.
**Conclusion:** High C\text{max} was associated with more frequent clinical safety events but not associated with low patient weight or baseline platelet counts. Higher rucaparib AUC\text{ss} was associated with improved IRR-assessed response in platinum-sensitive, BRCA-mutated rOC. These analyses support the approved starting dose of rucaparib 600 mg BID with subsequent dose reductions following occurrence of treatment-emergent adverse events.

---

**191 - Poster Session**

**Inhibition of PORCN in a p53\textsuperscript{-/-} knockout syngeneic ovarian cancer model**


**Objective:** Wnt/β-catenin pathway upregulation has been correlated with immune evasion in epithelial ovarian cancer. Porcupine (PORCN) enzyme is necessary for cells to produce WNT. Data from our laboratory showed that inhibiting PORCN decreased tumor burden in an ID8 syngeneic ovarian cancer model, which was partially reliant on CD8\textsuperscript{+} T cells and dendritic cells (DCs). Our objective was to inhibit tumor growth (by knocking out β-catenin in DCs and treating with PORCN inhibitor) in a model resembling high-grade serous ovarian cancer (ID8p53\textsuperscript{-/-}) and investigate changes in the tumor microenvironment (TME).

**Method:** A PORCN inhibitor, CGX1321 (1 mg/kg orally daily \times 14 days) (\(n = 4\)) or untreated control (\(n = 9\)), was administered to C57Bl6 mice injected intraperitoneally with luciferase-tagged ID8p53\textsuperscript{-/-}. We measured ascites, bioluminescence, and omentum weight. Tumor burden was measured in mice injected with ID8p53\textsuperscript{-/-} (treated \(n = 5\) vs untreated \(n = 5\)). Total number of CD8\textsuperscript{+} T cells, Tregs, and DCs were quantified via flow cytometry in the TME. Using a model in which β-catenin is knocked out in DCs (CD11c cre × β-catenin\textsuperscript{-/-}-flox C57Bl6 mice) (\(n = 12\)), we injected ID8p53\textsuperscript{-/-}. Tumor burden was compared to control (β-catenin\textsuperscript{-/-}-flox mice) (\(n = 11\)).

**Results:** CGX1321 decreased tumor burden via bioluminescence (\(P = 0.076\)) and omental weight (\(P = 0.038\)) in mice with luciferase-tagged ID8p53\textsuperscript{-/-}. Ascites were also decreased in CGX1321-0 treated mice (\(P = 0.141\)). No difference in tumor burden was seen in mice injected with ID8p53\textsuperscript{-/-} (not luciferase-tagged) (treated vs untreated). There were no differences in CD8\textsuperscript{+} T cells (\(P = 0.095\)), Tregs (\(P = 0.151\)), or DCs (\(P = 0.548\)) with treatment via flow cytometry of omentum tumor. Tumor burden was not different in CD11c-cre × β-catenin\textsuperscript{-/-}-flox mice injected with Idp53\textsuperscript{-/-} (\(P = 0.751\)).

**Conclusion:** CGX1321 treatment inhibited tumor growth in ID8p53\textsuperscript{-/-}-luciferase tagged tumors; this was not seen in ID8p53\textsuperscript{-/-} nonluciferase-tagged mice. Immune changes in the TME were not significant in this model, but were not measured in the luciferase-tagged model. There was no difference in tumor burden in ID8p53\textsuperscript{-/-} injected DC-intrinsic β-catenin absent model. These results could reflect experimental timing or other immune or WNT-related differences between ID8 parental cells and ID8p53\textsuperscript{-/-} cells or luciferase and nonluciferase tagged cells that warrant further investigation.

---

**192 - Poster Session**

**Survival outcomes for patients with recurrent low-grade serous ovarian carcinoma**

A. Yazigi\textsuperscript{ab}, I.L. Ray-Coquard\textsuperscript{b}, E. Pujade-Lauraine\textsuperscript{c,d}, F. Lecuru\textsuperscript{e} and H. Bonsang-Kitzise. \textsuperscript{a}CHU Toulouse, Toulouse, France, \textsuperscript{b}Centre Leon Berard, Lyon, France, \textsuperscript{c}ARCAGY-GINECO, Paris, France, \textsuperscript{d}HôpitalHôtel-Dieu, Paris, France, \textsuperscript{e}Hôpital Européen Georges-Pompidou, Paris, France

**Objective:** Low-grade serous ovarian cancer (LGSOC) is a rare ovarian tumor. Management of recurrences is not well established today. We describe clinical and biological features and treatments for patients with recurrent LGSOC.

**Method:** We conducted a retrospective multicentric study using the prospective French national database for rare ovarian cancers (TMRG). We described clinical, biological, and radiological features and treatments for patients with recurrent LGSOC. We analyzed survival after treatment of first relapse.

**Results:** Between 2000 and 2017, 149 patients with LGSOC were registered in the TMRG database, among which 47 patients (31.5%) had a recurrence. In univariate analysis, OS was significantly poorer in case of age older than 45 years (HR = 3.21, 95% CI 1.41–7.29, \(P = 0.003\)); postmenopausal status (HR = 3.28, 95% CI 1.19–7.31; \(P = 0.002\)), presence of ascites (HR = 2.21, 95% CI 1.19–4.1, \(P = 0.012\)); mesentry involvement (HR = 2.6, 95% CI 1.34–5.07, \(P = 0.003\)); and chemotherapy as first treatment of the recurrence (HR = 2.64, 95% CI 1.37–5.06, \(P = 0.003\)). Factors associated with a better OS were primary debulking surgery as initial treatment (HR = 0.37, 95% CI 0.18–0.79, \(P = 0.007\)); estrogens receptors positivity (HR = 0.19, 95% CI 0.07–0.54, \(P = 0.001\)); and surgery as first treatment of recurrence (HR = 0.11, 95% CI 0.04–0.31, \(P < 10^{-4}\)).

**Conclusion:** In this study surgery remains the most important treatment at the time of first recurrence. Estrogens receptors expression is associated with a better outcome.
193 - Poster Session
Role of CA-125 in achieving optimal secondary cytoreduction
Stanford University School of Medicine, Stanford, CA, USA, Stanford Women’s Cancer Center, Palo Alto, CA, USA, Stanford Hospital and Clinics, Stanford, CA, USA

Objective: Our purpose was to investigate the role of routine utilization of CA-125 in the diagnosis and treatment of recurrent ovarian cancer, with particular attention to surgical outcomes of secondary cytoreductive surgery (SCS).

Method: We completed a retrospective cohort study of all patients with primary ovarian cancer who achieved complete remission and had recurrence treated at our institution. Patients were categorized into recurrence group by the primary method in which their provider suspected disease recurrence: CA-125, imaging, symptoms, or physical examination. Differences in clinicopathologic features, primary treatment characteristics, and outcomes data including SCS outcome and overall survival (OS) were collected.

Results: A total of 102 patients were identified who met inclusion criteria and were treated from 2003 to 2015 at our tertiary referral center. There were 62 recurrences (61%) diagnosed by primarily asymptomatic rise in CA-125, 5 (5%) by pelvic examination in an otherwise asymptomatic patient, 15 (15%) by imaging in the absence of known examination abnormality or rise in CA-125, and 20 (20%) by symptoms. Patients whose recurrence was found by CA-125 were more likely to have higher CA-125 at initial cancer diagnosis (median 914 vs 605, \(P = 0.020\)) and have had stage IV disease (27.4% vs 22.8%, \(P < 0.001\)). There were no differences in primary treatment methods, initial surgical outcomes, or CA-125 at initial chemotherapy completion. There was no difference in time to recurrence between those diagnosed by CA-125 versus other means (16.7 months vs 18.5 months, \(P = 0.403\)). Patients whose disease was detected by CA-125 were less likely to undergo SCS than those whose disease was detected by other means (21.7% vs 35.0%, \(P = 0.007\)). However, there were no differences in SCS outcome \((P = 0.613)\) and/or OS \((P = 0.965)\) related to manner of diagnosis of recurrence.

Conclusion: In our retrospective cohort study, we did not find that routine CA-125 screening was associated with higher rates of optimal SCS. In contrast, we found that those diagnosed by CA-125 were less likely to undergo SCS compared to other groups. In addition, there was no difference in rate of optimal SCS or in OS. Additional larger studies should be conducted to evaluate potential SCS outcomes differences associated with recurrence detection method, as this was not evaluated in the MRC OV05/EORTC 55955 trial.

194 - Poster Session
S.H. Chung and J.H. Sang. Soonchunhyang University Bucheon Hospital, Bucheon, South Korea

Objective: This study was carried out to compare conventional laparotomy with laparoscopic surgery for ovarian cancer and identify any difference between conventional laparotomy and laparoscopic surgery for advanced ovarian cancer.

Method: Targeting 249 patients who had been diagnosed with ovarian cancer and undergone treatment in general university hospitals over 10 years, this study was conducted with 2 gynecologic oncologists. The patients were placed in a laparotomy group (group 1) and a laparoscopic surgery group (including robotic surgery) (group 2).

Results: Of a total of 249 patients, 192 belonged to a laparotomy group and 57 to a laparoscopic surgery group. In regard to ovarian cancer staging, 80 of 249 patients (32.1%) were at stage I–II, and 129 of 249 patients were at stage III—IV. Of 249 patients, 20 (8%) (16 of 192 patients in group 1, 4 of 57 patients in group 2) suffered from operative complications, and 1 great vessel injury was found in group 1. Of 249 patients, 69 (27.7%) (58 of 192 patients in group 1, 11 of 57 patients in group 2) had a relapse. In terms of the correlation between recurrence and operation methods and risk, the hazard risk (HR) was measured at 0.552 (0.267–5.343), which means there was no close correlation.

Conclusion: Laparoscopic surgery is not inferior to laparotomy for advanced ovarian cancer, and it is therefore anticipated that laparoscopic surgery can be considered as a treatment for early-stage ovarian cancer and unidentified stage ovarian cancer with low HE 4 and CA-125.

195 - Poster Session
Role of alpha catenin in ovarian cancer cell line sensitivity to platinum-based chemotherapy and PARP inhibitors
H. Miller, R. Bassiouni, Y. Li, L.D. Roman and J. Carpten. University of Southern California, Los Angeles, CA, USA
**Objective:** Human alpha-catenin gene (CTNNA1) is a tumor suppressor gene involved in maintaining the adherens junctions between cells. Loss or downregulation of CTNNA1 has been described in a variety of cell lines and primary tumors, including high-grade serous ovarian carcinoma, and has been correlated to higher tumor grade, metastasis, and poorer overall survival. The role of CTNNA1 in treatment of ovarian cancer, however, has not been elucidated. The objective of this study is to describe the expression pattern of CTNNA1 in ovarian cancer cell lines and elucidate the role of CTNNA1 in response to treatment with platinum-based chemotherapy and poly-ADP ribose polymerase (PARP) inhibitors.

**Method:** Ovarian cancer cell lines OVCAR3, SKOV3, CAOV3, COV413A, and A2780 were obtained and cultured under recommended conditions. Once cells reached confluency, protein lysates were prepared and Western blot performed with standard techniques. Based on high CTNNA1 expression, the SKOV3 and OVCAR3 ovarian cancer cell lines were selected for generation of a knockout counterpart. This was achieved with CRISPR/Cas9-mediated gene editing and verified by Western blot. To assess sensitivity to platinum-based chemotherapy and PARP inhibitors, cells were treated separately with carboplatin and olaparib. Cell viability was determined after treatment with CellTiterGlo reagent.

**Results:** CTNNA1 was found to be expressed in all the ovarian cancer cell lines that were tested. CRISPR/Cas9-mediated gene editing of CTNNA1 in SKOV3 and OVCAR3 cells resulted in a complete knockout of CTNNA1 expression in each cell line. When treated with carboplatin, both SKOV3 and OVCAR3 knockout cell lines were less sensitive to the drug than the parental lines. However, both knockout cell lines were more sensitive to treatment with olaparib compared to parental cell lines.

**Conclusion:** Decreased expression of alpha-catenin leads to reduced sensitivity of SKOV3 and OVCAR3 cells to treatment with carboplatin and increased sensitivity to treatment with olaparib. This suggests that alpha-catenin may play a role in the response of ovarian cancer to platinum-based chemotherapy and PARP inhibitors. Profiling CTNNA1 could direct treatment options for personalized therapy of ovarian cancer in the future.

---

**196 - Poster Session**

**Neoadjuvant chemotherapy for epithelial ovarian cancer in Japan: A JSGO-JSOG joint study**

H. Machida, K. Matsu, W. Yamagami, Y. Ebina, Y. Kobayashi, T. Tabata, M. Kaneuchi, S. Nagase, T. Enomoto, M. Kikami. *Tokai University School of Medicine, Isehara, Kanagawa, Japan, LAC+USC Medical Center - Women and Children’s Hospital, Los Angeles, CA, USA, University of Southern California, Los Angeles, CA, USA, Keio University, School of Medicine, Tokyo, Japan, Kobe University Graduate School of Medicine, Kobe, Japan, Kyorin University School of Medicine, Tokyo, Japan, Tokyo Women’s Medical University, Tokyo, Japan, Otaru General Hospital, Hokkaido, Japan, Yamagata University, Yamagata, Japan, Niigata University Graduate School of Medical and Dental Sciences, Niigata, Japan

**Objective:** Our goal was to examine time-specific trends of the proportion of women treated with neoadjuvant chemotherapy plus interval debulking surgery (NACT) among primary epithelial ovarian cancer in Japan.

**Method:** This was a nationwide society-based retrospective study in Japan between 2002 and 2015 (n = 48,426). Time-specific trends of NACT use were examined per patient age, grouped according to the Ministry of Health, Labor and Welfare definition in Japan: nonelderly (≤64 years), young elderly (65–74 years), and elderly (≥75 years). Similarly, time-specific trends of NACT use were examined per histology type (serous, mucinous, endometrioid, and clear cell).

**Results:** In the entire cohort, there were 5,153 (10.6%, 95% CI 10.3–10.9) women who received NACT. Women who received NACT were more likely to be old, have a recent diagnosis, and be East Japan residents but less likely to be West Japan residents (all, P < 0.05). There was a significant increase in the utilization of NACT during the study period: 2.1% to 16.0% (7.6-fold relative increase, P < 0.001). Among 4 histology types, only serous (13.8% to 29.7%, 2.2-fold relative increase, P < 0.001) and clear cell (1.4% to 4.8%, 3.4-fold relative increase, P = 0.014) types showed interval increases in the utilization of NACT, and mucinous and endometrioid types did not (both, P > 0.05). The cohort level 5-year overall rates increased from 66.1% to 72.3% (9.4% relative increase, P < 0.001). See Figure 1.

**Conclusion:** In Japan, NACT has been utilized more frequently in recent years: in 2015, 1 in 6 women with epithelial ovarian cancer received this treatment. This increase in the utilization of NACT was particularly evident in elderly women and clear cell histology. Shifting to NACT may be associated with improved survival as a cohort.
Diagnosis shift between low-grade serous ovarian cancer and serous borderline ovarian tumor: A population-based study

S. Matsuzaki\textsuperscript{a}, H. Machida\textsuperscript{b}, S. Matsuzaki\textsuperscript{a}, M. Klar\textsuperscript{a}, B.H. Grubbs\textsuperscript{a}, L.D. Roman\textsuperscript{a}, A.K. Sood\textsuperscript{d}, D.M. Gershenson\textsuperscript{d} and K. Matsuo\textsuperscript{a}. \textsuperscript{a}University of Southern California, Los Angeles, CA, USA, \textsuperscript{b}Tokai University School of Medicine, Kanagawa, Japan, \textsuperscript{c}University of Freiburg, Fahnenbergplatz, Germany, \textsuperscript{d}The University of Texas MD Anderson Cancer Center, Houston, TX, USA

Objective: The aim of this study was to determine changes in the characteristics of low-grade serous ovarian cancer (LGSOC) and serous borderline ovarian tumor (serous BOT) in a time-specific manner.

Method: We conducted a population-based retrospective study examining the Surveillance, Epidemiology, and End Results (SEER) program from 1988 to 2000. Trends, demographics, and outcomes of 775 women with well-differentiated serous ovarian cancer, used as a surrogate for LGSOC, were compared to 3,937 women with serous BOT.

Results: In multivariate analysis, women with LGSOC were more likely to be older, have stage II–IV disease, and have undergone hysterectomy at surgery, but less likely to be a western U.S. resident compared to those with serous BOT (all, adjusted $P < 0.05$). During the study period, the number of LGSOCs decreased by 25.9%, particularly stage I disease (37.6% relative decrease) compared to stage II–IV disease (21.1% relative decrease) (all, $P < 0.05$). With a median follow-up of 16.9 years, there was a decreasing trend in the 15-year overall survival rates among LGSOC (28.7% relative decrease, $P = 0.056$) but not in serous BOT (2.5% relative increase, $P = 0.416$) as a whole cohort. The magnitude of hazard risk from all-cause death for women with LGSOC compared to those with serous BOT increased by 68.9% from 1988 to 2000 ($P < 0.001$). LGSOC remained an independent prognostic factor for decreased overall survival (adjusted $P < 0.05$). See Figure 1.

Conclusion: Our study suggests that the decreasing number and survival of LGSOC over time may be due to a diagnosis shift from LGSOC to serous BOT. Given the distinct characteristics and outcomes of LGSOC compared to those of serous BOT, our study endorses the importance of making the correct diagnosis upfront. Whether this diagnostic shift supports a hypothesis that serous BOT is a precursor lesion of LGSOC merits further investigation.

Fig. 1. Trends in the utilization of neoadjuvant chemotherapy (cohort level).
Objective: Olaparib (Lynparza®) was first FDA-approved as a capsule (400 mg bd) for the treatment of women with BRCAm recurrent OC after ≥3 lines of therapy. To reduce pill burden, a tablet (300 mg bd) was approved for this indication, and for maintenance treatment in platinum-sensitive recurrent (PSR) OC, regardless of BRCAm status. Despite dosing and bioavailability differences between olaparib capsules and tablets, clinical trial results suggest similar efficacy and tolerability profiles; real-world data are of interest.

Method: A retrospective, observational cohort analysis using a self-controlled, pre–post design was performed using treatment and hospital claims data from Symphony Health’s Patient Integrated Dataverse database, covering >80% of the U.S. population (~280 million lives). Using initiation of olaparib capsules as baseline, adverse events 12 months prior to starting capsules (baseline period) and 3 months after the first dose of capsules and tablets were captured for patients who switched from capsules to tablets between January 2015 and February 2019. Seven adverse events were evaluated based on frequency (nausea, fatigue, anemia, vomiting, diarrhea) and clinical importance (neutropenia, thrombocytopenia). Descriptive incidence and repeated measures logistic regression are reported.

Results: The majority of patients analyzed (n = 48, mean age 61 years [SD 8]) were commercially insured (67%). Most patients initiated olaparib at the licensed starting dose (capsules 88% [SD 5], tablets 81% [6]) with limited dose modification (capsules 8% [4], tablets 10% [4]). The likelihood of experiencing an adverse event of interest (any adverse event) was similar with capsules and tablets, and not influenced by having the adverse event prior to starting olaparib (Figure 1). Proportion of patients with any adverse event during the first 3 months of capsule and tablet use was 45.8% (95% CI 32.7–59.5) and 35.4% (23.4–49.1); the difference was –10.4% (–28.8, 9.0). Repeated measures logistic regression confirmed no significant difference in proportion of patients with any adverse event by exposure period (95% CI log OR for having an adverse event during time on capsules vs tablets; baseline vs tablets; baseline vs capsules all overlapping 1).

Conclusion: Switching from olaparib capsules to tablets was manageable with no evidence of increased toxicity. This real-world study supports the favorable tolerability of olaparib in women with OC.
Fig. 1. Difference in the probability of an AE during the first 3 months of olaparib tablets versus capsules, stratified by baseline AE experience. Results are plotted for all patients [red] and stratified by whether the patient experienced the relevant AE in the baseline [pre-olaparib; blue] period or not [green]. Negative values indicate that the incidence was lower for tablets compared with capsules.

199 - Poster Session
Physician's opinions regarding salpingectomy as a risk-reducing procedure for ovarian cancer
V. McDonald, M. Gandhi, Y. Wang and D. Black. Louisiana State University Health Sciences Center, Shreveport, LA, USA

Objective: Bilateral salpingectomy (BS) at the time of sterilization and hysterectomy has been proposed as a method to decrease the incidence of ovarian cancer. Recent studies have shown BS to be an equivalent procedure to bilateral tubal ligation (BTL) in terms of complication rate and a more efficacious procedure in terms of sterilization. The purpose of this study was to assess current practices in offering BS and to gather opinions regarding barriers preventing general obstetrician gynecologists from offering BS to their patients.

Method: A web-based survey was sent to all members listed in the American College of Obstetricians and Gynecologists directory; subspecialists, fellows, residents, medical students, and mid-level providers were excluded. The survey contained demographic information regarding practice types, questions regarding standard practices, and opinions on performing BS.

Results: Of the 1,286 physicians who responded, 71% (857/1,213) stated that they strongly believed that ovarian cancer originated in the fimbria of the fallopian tubes, while only 56% (598/1071) offered it to all patients in lieu of BTL. The most cited reasons for not offering BS were increased risk of complications 16% (169/1,071) and insurance coverage 11% (114/1,071). Among those who did not routinely offer BS, 36% (68/190) stated there was insufficient evidence to support BS as a superior method for sterilization.

Conclusion: While a paradigm shift has occurred in the gynecologic oncology community about the origins of the most deadly type of ovarian cancer, this has not translated into a consensus among general obstetrician gynecologists' surgical approach to the fallopian tube. In addition, many insurance providers do not recognize BS as a sterilization procedure. There is a need for further studies to
investigate the long-term mortality benefits of this procedure, increased education, and specialty-wide emphasis on BS as an alternative to BTL.

200 - Poster Session
The combination of HE4 and CA-125 is superior to either marker alone for monitoring women with ovarian cancer
A. Samborski, A.M. Blackman, M.C. Miller, S. MacLaughlan David, A.L. Jackson, E. Eklund, G. Messerlian and R.G. Moore. *University of Rochester Medical Center, Rochester, NY, USA, †University of Illinois Chicago, Chicago, IL, USA, ‡University of Cincinnati Academic Health Center, Cincinnati, OH, USA, §Women & Infants Hospital, Brown University, Providence, RI, USA

**Objective:** CA-125 is the current gold standard biomarker for monitoring women with epithelial ovarian cancer (EOC). Human epididymal protein 4 (HE4) is a novel biomarker elevated in 80% of EOC patients. The objective of this trial was to examine the utility of HE4 for monitoring women with EOC.

**Method:** This was an Institutional Review Board-approved retrospective trial. Residual longitudinal serum samples drawn for CA-125 levels during treatment and monitoring from women with EOC were obtained. The samples were drawn every 3–5 weeks for patients on chemotherapy and every 3 months during monitoring. Serum CA-125 and HE4 levels in the residual sera were analyzed at each time point, and a velocity of change was calculated and correlated with clinical status. The null hypothesis was HE4 is inferior to CA-125, and this was tested using concordance and a 2-sided Fisher exact test.

**Results:** A total of 129 patients with 272 events (185 treatment, 87 monitoring) with 1,739 serum samples were evaluated. There were 11 (8.5%) patients with stage I disease, 12 (9.3%) stage II, 94 (72.9%) stage III, and 12 (9.3%) stage IV. For treatment, 69 (37.3%) were first-line therapies, 48 (25.9%) second-line, and 68 (36.8%) third-line or greater. Using a velocity of change cut point of >5.0 U per month to indicate progressive disease (PD), HE4 had an accuracy of 79.8% (95% CI 74.5%–84.4%), specificity of 90.6% (95% CI 85.0%–94.7%), sensitivity of 64.3% (95% CI 54.7%–73.1%), positive predictive value (PPV) of 82.8% (95% CI 73.2%–90.0%), and a negative predictive value (NPV) of 78.4% (95% CI 71.7%–84.1%). In comparison, CA-125 had an accuracy of 78.6% (95% CI 73.2%–83.3%), specificity of 92.5% (95% CI 87.3%–96.1%), sensitivity of 58.6% (95% CI 48.8%–67.8%), PPV of 84.4% (95% CI 74.4%–91.7%), and NPV of 76.3% (95% CI 69.7%–82.1%). Concordance comparison of agreement for the velocities for PD and non-PD resulted in a ratio (HE4/CA-125) of 1.098 (P < 0.05); therefore the null hypothesis that HE4 is inferior to CA-125 for monitoring EOC is rejected. The combination of HE4 and CA-125 velocities at the same thresholds had an overall accuracy of 80.5% (95% CI 75.3%–85.1%), specificity of 84.4% (95% CI 77.8%–89.6%), sensitivity of 75.0% (95% CI 65.9%–82.7%), PPV of 77.1% (95% CI 68.0%–84.6%), and NPV of 82.8% (95% CI 76.1%–88.3%).

**Conclusion:** HE4 is equivalent to CA-125 for monitoring patients with EOC. The combination of CA-125 and HE4 is superior to either marker alone.

201 - Poster Session
Cancer risk associated with fluid observed during transvaginal ultrasound
C.S. Dietrich III, J.W. Gorski, C. Davis, L. Erol, H. Dietrich, B.T. Burgess, A.B. McDowell Jr, M.B. Riggs, L.A. Baldwin, R.W. Miller, C.P. Desimone, H.H. Gallion, F.R. Ueland, J.R. van Nagell Jr, E.J. Pavlik. †University of Kentucky College of Medicine, Lexington, KY, USA, ‡University of Kentucky Medical Center, Lexington, KY, USA, §University of Kentucky, Lexington, KY, USA, ‡Tripler Army Medical Center, Honolulu, HI, USA

**Objective:** Incidental pelvic free fluid is occasionally observed during transvaginal ultrasonography (TVS). There is little information in the literature regarding the importance of free fluid and its relationship to underlying pathology. This study reviews the malignant and nonmalignant findings related to the presence of free fluid on ultrasound.

**Method:** Data have been prospectively collected since 1987 on 48,122 women who had 326,998 TVS encounters in the University of Kentucky Ovarian Screening Program. Any free fluid observed on ultrasound was reported as a positive finding.

**Results:** Evaluable cases included 78 ovarian malignancies, 20 borderline tumors, 23 malignancies of nonovarian origin, 614 benign findings, 46,266 negative screens (TN), and 21 false negative screens (FN). A total of 1,100 patients were excluded, leaving 47,022 patients in this study. The overall rate of free fluid detection in the screening cohort was 4.6%. The relative frequency (RF) of free fluid was >42 times higher in women with invasive ovarian malignancy than in normal nonobese premenopausal TN women. It was also increased for benign abnormal TVS findings (12.8X), borderline tumors (25.3X), and nonovarian malignancies (33X) (see Figure 1). A total of 1,951 TN women (4.2%) had free fluid of which 76.4% resolved over a time course of 2.2 ± 0.07 encounters if the screen was normal or 2.1 ± 0.07 encounters if the screen was abnormal (NS). Of TN fluid volumes, 17.5% were >10 ml, and 56.7% were present for only 1 encounter, while 9% persisted for more than 3 encounters. Fluid was evident in 28 TN women (1.4%) for >10 encounters. There was no significant difference in the RF of free fluid between normal and abnormal TVS findings for the overall TN group, premenopausal
TN women, or postmenopausal TN women. Pre- and postmenopausal women with a BMI >30 were found to have a lower RF of free fluid than those with BMI ≤30. Notably, in patients with FN screens, 4/21 (19%) had free fluid as the only finding on TVS.

**Conclusion:** The RF of free fluid on TVS images is very elevated in women with ovarian malignancy, but can also be present in nonmalignant conditions. While most free fluid resolves over time, it is important that fluid accumulation be recognized as a possible indicator of malignancy. Serial monitoring should be considered to assess whether fluid accumulation is transient.

---

**Fig. 1.**

202 - Poster Session

**Frailty based on the Memorial Sloan Kettering Frailty Index is associated with surgical decision making, clinical trial participation, and overall survival among older women with ovarian cancer**


- **a**Memorial Sloan Kettering Cancer Center, New York, NY, USA
- **b**Ponce Health Sciences University, Ponce, Puerto Rico

**Objective:** The aim of this study was to apply the previously reported Memorial Sloan Kettering Frailty Index (MSK-FI) to a population of older women treated surgically for advanced-stage epithelial ovarian cancer (EOC).

**Method:** The MSK-FI was retrospectively applied to women, 70 years and older, with newly diagnosed advanced-stage EOC treated at our institution between January 2001 and May 2017. Women treated with chemotherapy alone were excluded. Components of the MSK-FI were extracted from the medical record and included 10 comorbid conditions as well as a functional assessment. The score ranges from 0 to 11, with a higher score indicating a higher level of frailty. The primary outcome was to determine the association between frailty and rate of primary debulking surgery (PDS), for which a multivariate logistic regression was used, adjusted for stage and histology.

**Results:** During the study period, 430 women were treated with PDS or neoadjuvant chemotherapy (NACT) followed by interval debulking surgery (IDS) and had complete data. Median age was 75 years (range 70–95 years). A total of 256 women (60%) presented with stage IIIC disease, and 152 (35%) with stage IV. There were 231 women (54%) treated with PDS, and 199 (46%) with NACT/IDS (median number of NACT cycles 5, range 2–9). Surgical outcomes were as follows: complete gross resection 165 (38%), 0< residual ≤1 cm 189 (44%), and suboptimal 76 (18%). The MSK-FI was 0 in 95 patients (22%), 1 in 172 (40%), 2 in 89 (21%), and 3+ in 74 (18%). Patients identified as more frail (i.e., higher MSK-FI score) were less likely to have PDS (OR for a unit increase of MSK-FI = 0.64, 95% CI 0.53–0.77, \( P < 0.0001 \), **Figure 1**). Grade 3+ complications and unintended intensive care admission occurred in 40 (9%) and 38 (9%) women, respectively, but were not associated with frailty (OR = 1.21, 95% CI 0.96–1.52, \( P = 0.11 \)). Patients with higher MSK-FI score were more likely to initiate postoperative chemotherapy later (nonlinear association \( P = 0.009 \)) and were less likely to enroll in a trial (OR = 0.84, 95% CI 0.70–1.00, \( P = 0.049 \)). Greater frailty was associated with worse overall survival (HR = 1.16, 95% CI 1.05–1.30, \( P = 0.005 \)).

**Conclusion:** The MSK-FI strongly parallels the clinical decision-making process for choosing a treatment approach for older women with advanced EOC. Its use as a formal decision aid should be tested in a prospective fashion.
Identification of epigenetic markers in circulating tumor DNA for early detection of high-grade serous ovarian carcinoma

H. Miller\textsuperscript{a}, D.N. Buckley\textsuperscript{a}, G.C. Gooden\textsuperscript{a}, M.A. Spillman\textsuperscript{b}, L.D. Roman\textsuperscript{a}, B.Y. Tew\textsuperscript{a} and B. Salhia\textsuperscript{a}.\textsuperscript{a}University of Southern California, Los Angeles, CA, USA, \textsuperscript{b}Baylor University Medical Center, Dallas, TX, USA

**Objective:** High-grade serous ovarian carcinoma (HGSOC) is the most lethal gynecologic malignancy with a 5-year survival rate of 40\% or less when diagnosed with late-stage disease. There is a dramatic benefit to early diagnosis of HGSOC with a 5-year survival rate of nearly 90\% for stage I disease. Unfortunately, the majority of HGSOC is diagnosed as late-stage disease, and there are no reliable early screening or diagnostic tests. The objective of this study is to identify tumor-specific aberrant DNA methylation alterations detectable in circulation in order to develop a biomarker to detect early-stage HGSOC.

**Method:** We performed reduced representation bisulfite sequencing (RRBS) on 33 stage 1 HGSOC tissues and 10 normal fallopian tube tissues from the contralateral side of patients with ovarian cancer. We selected the top 82 regions from RRBS for validation by targeted bisulfite amplicon sequencing in plasma. We successfully designed assays for 35 of 82 regions. Targeted bisulfite amplicon sequencing was performed on the top 35 regions in a separate cohort of circulating tumor DNA extracted from 27 stage 1 HGSOC and 11 benign ovarian masses. We constructed a novel classifier model to differentiate between patients with HGSOC and those with benign ovarian lesions.

**Results:** We identified 10,972 statistically significant differentially methylated regions between stage 1 HGSOC and normal fallopian tube tissue using RRBS. We then applied the classifier model on the top 35 regions determined by targeted bisulfite amplicon sequencing data on an independent cohort of plasma samples. This demonstrated that 13 of the 35 regions were able to discriminate stage 1 HGSOC from benign tumors with a high sensitivity and specificity (AUC = 0.909).

**Conclusion:** These novel, noninvasive biomarkers show promise as an early detection test for HGSOC.
**Objective:** The imipridone ONC201 (Oncoceutics), a dopamine receptor D2 (DRD2) antagonist, has antitumorigenic effects in preclinical studies, including high-grade serous (HGS) ovarian cancer (OC). ONC206, a derivative of ONC201 that shares the imipridone core structure, is a DRD2 antagonist that exhibits distinct receptor pharmacology and nanomolar potency. Thus, we investigated the antitumorigenic potential and potency of ONC206 in serous OC cell lines and mouse models.

**Method:** Human OC cell lines (OVCAR5, SKOV3) were treated with ONC206. Cell proliferation and apoptosis were assessed by MTT and Annexin V assays. Cell cycle progression was determined by flow cytometry. Reactive oxygen species (ROS) were measured by DCFH-DA assay. Adhesion and invasion were assessed by laminin and wound healing assays. Western blot evaluated effects of ONC206 on cell cycle control, cellular stress, apoptosis, and invasion. The K18-gT121+ p53+/p53+ BRCA1+/− (KpB) HGS OC mice were fed either a low-fat (LFD, 10% calories from fat) or a high-fat diet (HFD, 60% calories from fat) to mimic diet-induced obesity. Following tumor onset, obese and lean mice were treated with vehicle or ONC206 (130 mg/kg qweek, oral lavage) for 4 weeks.

**Results:** ONC206 inhibited cell proliferation in a dose-dependent manner in both OC cell lines after 72 hours of treatment, with a lower IC50 than ONC201 (mean 0.4 μM vs 5 μM). ONC206 caused an increase in G1 cell cycle arrest ($P < 0.05$) as well as decreased expression of the cell cycle-related proteins, CDK4 and CDK6. ONC206 induced apoptosis and ROS production ($P < 0.05$). Western immunoblotting found that ONC206 increased expression of the cellular stress proteins PERK, Ero1, and Calnexin, and decreased expression of the antiapoptotic proteins BCL-2 and MCL-1. ONC206 reduced cell adhesion and migration ($P < 0.05$) that was accompanied by decreases in β-catenin and VEGF and increases in vimentin and N-cadherin. In addition, ONC206 significantly reduced tumor weight in both obese (61%) and lean (47%) KpB mice after 4 weeks of treatment ($P < 0.05$).

**Conclusion:** ONC206 exhibited nanomolar potency for inhibiting OC cell growth and was efficacious in reducing OC tumor growth in both obese and lean mice. Thus, ONC206 may be a promising therapeutic agent to be explored in future clinical trials in HGSOC.

---

**205 - Poster Session**

Mitochondrial transcription and translation are upregulated in high-grade serous ovarian cancers

Z. Koca, A. Swailes, E.C. Koc and J. Kesterson. aPenn State College of Medicine, Hershey, PA, USA, bMarshall University School of Medicine, Huntington, WV, USA

**Objective:** Mitochondrial dysfunction is emerging as a major contributor of aggressiveness and chemoresistance in high-grade serous ovarian cancer (HGSOC). Our objective was to determine components of mitochondrial transcription and translation machinery contributing to impaired oxidative phosphorylation (OXPHOS) in HGSOC tumors that may serve as potential targets for treatment.

**Method:** To identify the key factors involved in energy metabolism, we performed genomics and proteomics analyses of proteins and genes involved in mitochondrial biogenesis. The data published by The Cancer Genome Atlas (TCGA), The Clinical Proteomic Tumor Analysis Consortium (CPTAC), and The Institut Curie were analyzed using Ingenuity Pathway Analysis (IPA). Alterations in the expression of mitochondrial transcription and translation factors were also confirmed by Western blot analysis of normal and HGSOC tissues.

**Results:** Evaluation of proteomics data available for 127 and 174 frozen HGSOC samples from the Curie and CPTAC cohorts, respectively, suggests that increased OXPHOS expression makes these tumors more sensitive to conventional chemotherapies. In addition to the high OXPHOS levels, expression of mitochondrial transcription and translation factors such as SSBP1 ($P < 0.0001$) and TUFM ($P = 0.0006$) were also increased in HGSOC tumors. We confirmed the increased expression of OXPHOS complexes, mitochondrial transcription factors PGC1a and TFAM, and mitochondrial translation factor TUFM by Western blot analysis of normal and HGSOC tissues. These observations suggest that chemotherapies directed against mitochondrial targets such as those involved in transcription and translation machineries should be considered in addition to conventional therapies.

**Conclusion:** Integrating proteomics and genomics data yielded a number of insights into how alterations in mitochondrial genes and proteins influence OXPHOS and mitochondrial biogenesis to promote progression of disease. Determination of factors upregulating mitochondrial transcription and translation in HGSOC could potentially serve as an effective target for treatment.

---

**206 - Poster Session**

Is toxicity burden worth the PFS benefit of second-line maintenance for epithelial ovarian cancer? Patient and provider perspectives from a discrete choice experiment.

R.L. Stone, K. Beusterien, M.J. Cambron-Mellott, M.C. Maculaitis, S. Ritz, E. Mulvihill, M.J. Monberg, S. Amin and K. McLaurin. aJohns Hopkins School of Medicine, Baltimore, MD, USA, bKantar, New York, NY, USA, cMerck & Co., Inc., Kenilworth, NJ, USA, dAstraZeneca, Gaithersburg, MD, USA
Objective: The aim of this study was to understand the preferences of U.S. oncologists and patients for poly(ADP-ribose) polymerase inhibitors (PARPi’s) as second-line maintenance therapy for epithelial ovarian cancer, including tradeoffs they are willing to make between efficacy and toxicity risks.

Method: Oncologists and patients were recruited by a health care research panel to complete an online, cross-sectional survey, which included a discrete choice experiment (DCE) to assess treatment preferences. In the DCE, participants chose between hypothetical treatment profiles with varying levels of attributes associated with PARPi’s approved for second-line maintenance therapy. Attributes of greatest importance were first identified via in-depth qualitative interviews. For patients, attributes included median progression-free survival (PFS), risk of all grades of fatigue and diarrhea, risk of a grade 3–4 adverse event, and dosing schedule. Oncologists were also asked about risk of grade 3–4 thrombocytopenia and anemia, but not diarrhea, and all attributes were in the context of the BRCA mutant population. Hierarchical Bayesian modeling was used to estimate preference weights for each attribute level.

Results: Patients (n = 128, interim results) had a mean age of 55 years; 32% completed their first treatment regimen and 68% were on a second-line or later treatment regimen. Oncologists (n = 151) averaged 15 years in practice; 54% were in private practice, 17% in a comprehensive care center, and 29% in a hospital practice. Oncologists most valued an increase in PFS from 17 to 30 months and required a 6.3-month increase in PFS to accept an increased risk of grade 3–4 adverse events from 37% to 74%. Patients most valued a decrease in risk of grade 3–4 adverse events from 74% to 37% and required a 17% lower risk of grade 3–4 adverse events to accept a decrease in PFS from 30 months to 17 months. For oncologists and patients to accept a 10% higher risk of fatigue, PFS would need to increase by 1.1 and 3.1 months, respectively. The least important attributes were grade 3–4 anemia (oncologists) and dosing schedule (patients). See Figure 1.

Conclusion: Oncologists and patients are willing to make tradeoffs between efficacy and toxicity risks among PARPi’s in the second-line maintenance setting, suggesting that the PFS gains seen in second-line maintenance studies with selected PARPi’s in BRCA mutant carriers are worth the toxicity risk to patients and their oncologists.

---

**Figure 1.**

<table>
<thead>
<tr>
<th>30 months</th>
<th>21 months</th>
<th>17 months</th>
<th>37%</th>
<th>54%</th>
<th>74%</th>
<th>59%</th>
<th>69%</th>
<th>2 tablets, BID</th>
<th>3 capsules, QD</th>
<th>1%</th>
<th>15%</th>
<th>34%</th>
<th>19%</th>
<th>25%</th>
<th>19%</th>
<th>33%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**207 - Poster Session**

Secondary validation of an ovarian cancer-specific comorbidity index in a U.S. population

**Objective:** Preoperative assessment of risk is important for individualizing treatment planning in ovarian cancer (OC) patients. The Ovarian Cancer Comorbidity Index (OCCI) is an age-stratified index developed and previously found to be more predictive of cancer-specific (HR = 1.51) and overall survival (HR = 1.44) than the Charlson Comorbidity Index (CCI) in OC patients. Our goal was to perform secondary validation of the OCCI in a U.S. population.

**Method:** A study cohort of OC patients undergoing primary or interval cytoreductive surgery from 2005 to 2012 was identified in the Surveillance, Epidemiology and End Result (SEER)–Medicare database. At least 1 year of follow-up was required following diagnosis. The cohort’s OCCI scores were calculated with the regression coefficients determined from the original OCCI development cohort for the following comorbid conditions: coronary artery disease (CAD), hypertension (HTN), chronic obstructive pulmonary disease (COPD), diabetes, and dementia. Cox regression was performed to examine OCCI’s association with 5-year overall and cancer-specific survival in comparison to CCI.

**Results:** A total of 5,052 patients met inclusion criteria for analysis in the validation cohort. Patient mean age was 75 years; most had serous cancer (67%), and most were stage III–IV (71%). Prevalence for the 5 OCCI predictive comorbid conditions was CAD, 3.7%; HTN, 67.5%; COPD, 16.7%; diabetes, 21.8%; and dementia, 1.2%. Because of the older age of patients in our cohort, all patients had an OCCI score of either moderate (48.4%) or high risk (51.6%). Controlling for age, stage, and histology, worse overall survival was associated with both OCCI (HR = 1.54, 95% CI 1.38–1.72) and CCI (HR = 1.93, 95% CI 1.64–2.29). Cancer-specific survival was not associated with CCI (HR = 1.12, 95% CI 0.90–1.39). OCCI was marginally associated with cancer-specific survival (HR = 1.14, 95% CI 1.00–1.30). See Table 1.

**Conclusion:** In this validation cohort of OC patients in the SEER-Medicare database, OCCI is a valid predictor of overall survival and may perform better than CCI in prediction of cancer-specific survival. Most OC patients identified in SEER-Medicare are considered high risk by OCCI. Cohort differences in age and comorbidity prevalence may contribute to variation between this and the original study in OCCI’s prediction of cancer-specific survival.

**Table 1.** Demographic & Clinical Characteristics of Validation Cohort.

<table>
<thead>
<tr>
<th>Age, years</th>
<th>Median (IQR)</th>
<th>n=5052</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>n (%)</td>
<td>852 (16.9%)</td>
</tr>
<tr>
<td>II</td>
<td>n (%)</td>
<td>454 (9.0%)</td>
</tr>
<tr>
<td>III</td>
<td>n (%)</td>
<td>2375 (47.0%)</td>
</tr>
<tr>
<td>IV</td>
<td>n (%)</td>
<td>1197 (23.7%)</td>
</tr>
<tr>
<td>Unknown</td>
<td>n (%)</td>
<td>174 (3.4%)</td>
</tr>
<tr>
<td>Histology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serous</td>
<td>n (%)</td>
<td>3403 (67.4%)</td>
</tr>
<tr>
<td>Endometrioid</td>
<td>n (%)</td>
<td>496 (9.8%)</td>
</tr>
<tr>
<td>Mucinous</td>
<td>n (%)</td>
<td>227 (4.5%)</td>
</tr>
<tr>
<td>Clear Cell</td>
<td>n (%)</td>
<td>220 (4.4%)</td>
</tr>
<tr>
<td>Other</td>
<td>n (%)</td>
<td>706 (14.0%)</td>
</tr>
<tr>
<td>Charlson Comorbidity Index score</td>
<td>n (%)</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>n (%)</td>
<td>3494 (69.2%)</td>
</tr>
<tr>
<td>1</td>
<td>n (%)</td>
<td>1056 (20.9%)</td>
</tr>
<tr>
<td>2</td>
<td>n (%)</td>
<td>311 (6.2%)</td>
</tr>
<tr>
<td>3</td>
<td>n (%)</td>
<td>191 (3.8%)</td>
</tr>
<tr>
<td>OCCI Comorbidity Prevalence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coronary Artery Disease</td>
<td>n (%)</td>
<td>188 (3.7%)</td>
</tr>
</tbody>
</table>
COPD n (%) 843 (16.7%)
Hypertension n (%) 3409 (67.5%)
Diabetes n (%) 1101 (21.8%)
Dementia n (%) 62 (1.2%)

OCCI Risk Group
Low n (%) 0
Moderate n (%) 2446 (48.4%)
High n (%) 2606 (51.6%)

OCCI: Ovarian Cancer Comorbidity Index; COPD: chronic obstructive pulmonary disease.

208 - Poster Session
Systemic and intratumoral stress responses to primary debulking surgery in patients with epithelial ovarian cancer
L.A. Moukarzel, L. Ferrando, Y. Bykov, A. Stylianou, K. LaVigne, K. Long Roche, B. Weigelt and D. Zamarina. aMemorial Sloan Kettering Cancer Center, New York, NY, USA, bUniversity of Genoa, Genoa, Italy

Objective: There is evidence suggesting that surgical procedures may facilitate tumor growth and promote metastases because of paracrine and neuroendocrine stress response, which increases proangiogenic factors, suppresses antitumor immunity, and facilitates malignant cell invasion and proliferation. We sought to determine whether a protumorigenic stress response occurs in the course of ovarian cancer (OC) cytoreductive surgery and to define its impact on the tumor and tumor microenvironment.

Method: Blood, normal, and tumor tissue samples were collected at multiple time points during 13 primary OC cytoreductive surgeries, including postincision (TP1) and 2 hours (TP2) and 4 hours (TP4) postincision. Cytokine expression patterns within the blood were performed using luminex multiplex technology. Tissues samples from 3 cases were subjected to RNA sequencing, and the predominance of specific immune cell subtypes in each sample was defined.

Results: Analysis of serologic immune response markers revealed a significant increase in protumorigenic and pro-inflammatory markers including IL-6 (P = 0.030), IL-8 (P = 0.002), and IL-10 (P = 0.009) as time interval from initiation of surgery increased. Gene expression profiling by RNA sequencing in the first 3 cases analyzed revealed consistent upregulation of inflammation-related genes in both tumor and normal peritoneal tissue. Specifically, the stress response pathway was significantly upregulated as the surgery proceeded (P = 0.006), including an increased expression of protumorigenic genes FGF7, which is involved in new vessel formation, as well as HIF1A and NFkB, which are involved in hypoxia, cytokine production, and cell survival (P = 0.006).

Conclusion: Our findings demonstrate that inflammatory, and possibly protumorigenic signaling, is induced early in the course of surgery and can be directly measured in tumors. In addition, in the setting of elevated pro-inflammatory cytokines, certain gene transcripts, which may help perpetuate a pro-neoplastic environment, were found to be upregulated in tumors. Our results provide evidence to suggest the need to exploit the perioperative period to reduce the inflammatory response and attenuate the creation of protumorigenic environments.

209 - Poster Session
Targeting one-carbon metabolism in syngeneic mouse model of BRCA-mutated high-grade serous ovarian cancer
L.A. Rubinska, A. Wallace-Povirk, Z. Hou, C. O’Connor, A. Gangjee, R.T. Morris and L. Matherly. aKarmanos Cancer Center/Wayne State University, Detroit, MI, USA, bBarbara Ann Karmanos Cancer Institute, Detroit, MI, USA, cDuquesne University, Pittsburgh, PA, USA, dBarbara Ann Karmanos Cancer Institute/Wayne State University School of Medicine, Detroit, MI, USA

Objective: In evaluating the next generation of targeted therapies in high-grade serous ovarian cancer (HGSOC), relevant mouse models that recapitulate human disease and have a functioning immune system are needed. Our previous work has identified novel 1-carbon (C1) inhibitors, which are transported by folate receptor alpha (FRα), a receptor shown to be over-expressed in HGSOC. Based upon potent in vivo efficacy in an immuno-compromised mouse model, we sought to investigate this series of FRα-delivered therapies using p53/BRCA-mutated HGSOC syngeneic mouse models (BR5 and BR1uc).

Method: BR5 and BR1uc mouse ovarian models were characterized in vitro. Relative expression levels of folate transporters and enzyme targets in cytosolic C1 metabolism (glycinamid ribonucleotide formyltransferase, GARFase) were measured by qPCR and compared to mouse liver. FRα levels were measured by radioligand binding and compared to those for the human ovarian cancer cell lines IGROV1 and SKOV3. Antiproliferative effects of novel C1 inhibitors were determined by using fluorescence-based assays.
**Results:** BR5 and BRluc cells grown in culture expressed major folate transporters and intracellular targets of C1 metabolism including GARFTase. FRα levels were comparable to those in the established human cell lines. Potent antiproliferative effects with mean IC\textsubscript{50} values <10 nM in both models (6.1 ± 3.4 nM in BR5, 7.3 ± 2.7 nM in BRluc) were observed with compound AGF94, a lead GARFTase inhibitor. IC\textsubscript{50} values of structurally diverse C1 inhibitors ranged from 15.4 to 67.8 nM. Inhibitory effects were attenuated with excess folic acid, indicating FRα-mediated drug uptake.

**Conclusion:** In a syngeneic mouse model of BRCA-mutated HGSOC, expression of folate transporters and intracellular C1 metabolism targets was confirmed. In vitro inhibition data suggest a potential role in targeting C1 metabolism via FRα in HGSOC. In vivo studies using Brluc xenografts are ongoing to investigate both antitumor effects and the impact of C1 inhibitors on the HGSOC microenvironment.

---

210 - Poster Session

**Hyperthermic intraperitoneal chemoperfusion (HIPEC) with carboplatin and its effect on the transcriptome of ovarian cancer and normal tissues**

*L.A. Moukarzel*, L. Ferrando, A. Stylianou, K. Su, R.E. O’Cearbhaill, D.S. Chi, Y. Sonoda, O. Zivanovic and B. Weigelt. *aMemorial Sloan Kettering Cancer Center, New York, NY, USA, bUniversity of Genoa, Genoa, Italy*

**Objective:** Hyperthermic intraperitoneal chemoperfusion (HIPEC) has been shown to be associated with improved survival in patients with ovarian cancer; however, the effects and the mechanism of action of combining hyperthermia and chemotherapy at the cellular level has yet to be fully understood. We sought to determine the effect of HIPEC with carboplatin on gene expression patterns of normal and ovarian cancer tissues.

**Method:** Under an Institutional Review Board-approved protocol, normal and tumor samples from 3 ovarian cancers were prospectively collected before and immediately after HIPEC treatment and subjected to RNA sequencing. Differential gene expression analyses were performed between pre- and post-treatment tumor and normal tissue samples. Genes found to be differentially expressed were subjected to gene ontology enrichment and pathway analyses using a LIMMA package. In addition, the expression of a recently described homologous recombination (HR) DNA repair defect gene signature was assessed in the pre- and post-HIPEC samples.

**Results:** RNA sequencing revealed that 539 and 569 genes were significantly differentially expressed between pre- and post-treatment normal and tumor tissues, respectively. Gene enrichment analyses demonstrated that the most significantly upregulated differentially expressed genes in normal tissues played a role in immune response (FDR < 0.001). In contrast, HIPEC induced an increased expression of heat response- and protein folding-related genes in tumor tissues (both, FDR < 0.001). We further found that the HR DNA repair defect gene signature was not significantly altered in either normal or tumor tissue following HIPEC exposure.

**Conclusion:** The effect of HIPEC with carboplatin on normal and tumor cells is distinct, with the genes differentially expressed in post-treatment normal tissues being enriched for immune-related signatures, whereas an enrichment in genes related to heat response and protein folding was found in the post-treatment tumor samples.

---

211 - Poster Session

**Ovarian cancer in women with known BRCA mutations: How much screening is too much?**


**Objective:** The purpose of this study was to evaluate the utilization of ovarian cancer surveillance methods in BRCA mutation carriers and ovarian cancers diagnosed during surveillance.

**Method:** This was a retrospective cohort study of all women with deleterious BRCA mutations in an integrated health care system diagnosed between 1997 and 2018, with at least 1 intact ovary and no prior history of ovarian cancer, for whom surveillance with transvaginal ultrasound (TVUS) and CA-125 would be recommended. Demographic and clinical data were collected from the electronic medical record from the date of genetic testing until they underwent risk-reducing surgery, developed ovarian cancer, or until July 1, 2019, and descriptive statistics were performed. The primary outcome was CA-125 tests and TVUS findings in women with BRCA mutations. Secondary outcome included epithelial ovarian cancers diagnosed on surveillance.

**Results:** A total of 2,415 women with BRCA mutations were identified; 320 were excluded due to either a prior ovarian cancer diagnosis or bilateral oophorectomy. Of the remaining 2,095 women, 1,255 (60%) had at least 1 CA-125 test done and 848 (40%) had at least 1 TVUS. There were 5,169 CA-125 laboratory tests done, averaging 4 per patient. There were 1,861 TVUS performed, averaging 2 per patient. There were 1,390 (75%) TVUS done for screening; 176 (9%) for follow-up of a previously identified lesion; 102 (5%) for...
preoperative evaluation; and 187 (11%) that were diagnostic. Of the 1,390 TVUS done for screening, 1,196 (86%) reported normal ovaries or simple cyst; 26 (2%) reported likely hemorrhagic or functional cyst; and 8 (<1%) reported an ovarian mass. There were 37 patients who were diagnosed with ovarian cancer after BRCA testing. Of these patients, 24 (65%) were diagnosed at the time of risk-reducing surgery; 4 (11%) were diagnosed on surveillance; and 9 (24%) were diagnosed after presenting with symptoms. Of the 4 cases diagnosed on surveillance, all 4 had both an abnormal CA-125 and TVUS. See Table 1.

**Conclusion:** Many women with BRCA mutations undergo TVUS and CA-125 testing. Abnormal surveillance testing led to diagnosis in only a small number, most of whom were advanced stage. These findings question the role of CA-125 and TVUS surveillance for ovarian cancer in women with BRCA mutations.

### Table 1. Total ovarian cancer diagnoses n = 37.

<table>
<thead>
<tr>
<th></th>
<th>RRSO n=24 (65%)</th>
<th>Surveillance n=4 (11%)</th>
<th>Symptoms n=9 (24%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median age ovarian cancer diagnosis (years)</td>
<td>57</td>
<td>54</td>
<td>58</td>
</tr>
<tr>
<td>Early stage (0-II)</td>
<td>18 (75)</td>
<td>2 (50)</td>
<td>2 (22) *</td>
</tr>
<tr>
<td>Late stage (III - IV)</td>
<td>5 (20)</td>
<td>2 (50)</td>
<td>7 (8)</td>
</tr>
<tr>
<td>Median interval from BRCA to OC (months) [IQR]</td>
<td>5 [3,18]</td>
<td>9 [2,12]</td>
<td>47 [23,70] *</td>
</tr>
<tr>
<td>Surveillance within 6 months BRCA diagnosis</td>
<td>17 (71)</td>
<td>3 (75)</td>
<td>3 (33)</td>
</tr>
<tr>
<td>Average No. CA 125 tests prior to diagnosis</td>
<td>1.2 ± 1.1</td>
<td>2 ± 0.7</td>
<td>2.4 ± 1.7</td>
</tr>
<tr>
<td>Average No. TVUS prior to diagnosis</td>
<td>1.3± 0.9</td>
<td>2 ± 1.7</td>
<td>1.5 ± 1.2</td>
</tr>
<tr>
<td>Overall survival (months) [IQR]</td>
<td>49 [26,93]</td>
<td>120 [54,148]</td>
<td>37 [26,89]</td>
</tr>
<tr>
<td>Median follow-up (months) [IQR]</td>
<td>55 [35,105]</td>
<td>137 [60,154]</td>
<td>98 [67,150]</td>
</tr>
<tr>
<td>Recurrence within 2 years</td>
<td>2 (8)</td>
<td>0</td>
<td>4 (44)</td>
</tr>
</tbody>
</table>

* P value < 0.05

*S one patient diagnosed on RRSO had no documented stage

---

### 212 - Poster Session

**Ablation and ultrasonic aspiration: Adjunct surgical techniques at the time of primary debulking surgery to address advanced-stage, miliary-type ovarian, fallopian tube and primary peritoneal cancer**

S. Li<sup>a,b</sup>, B.L. Manning-Geist<sup>a,b</sup>, A.A. Gockley<sup>b</sup>, A. Ramos<sup>a</sup>, R. Clarke<sup>c</sup>, M. del Carmen<sup>a</sup>, W.B. Growdon<sup>a</sup>, N.S. Horowitz<sup>b,c</sup>, R.S. Berkowitz<sup>b,c</sup> and M.J. Worley Jr.<sup>b,c</sup>.<sup>a</sup>Massachusetts General Hospital, Boston, MA, USA, <sup>b</sup>Brigham and Women’s Hospital, Boston, MA, USA, <sup>c</sup>Dana-Farber Cancer Institute, Boston, MA, USA

**Objective:** The aim of this study was to examine the use of adjunct surgical techniques (ASTs) at the time of primary debulking surgery among patients with epithelial ovarian, fallopian tube, and primary peritoneal cancer (EOC) who have advanced-stage, miliary-type disease.

**Method:** Medical records of patients with FIGO stage IIIC–IV EOC with disseminated intra-abdominal miliary-type disease undergoing primary debulking surgery from January 2010 to November 2014 were reviewed. ASTs were defined as ultrasonic surgical aspiration, argon-enhanced electrocautery, thermal plasma energy, and traditional electrocautery ablation. Patients undergoing debulking surgery with and without the use of ASTs were compared with respect to demographics, operative time, surgical complexity, intraoperative transfusion, postoperative complications (including wound complications, bowel perforation or anastomotic leak, deep vein thrombosis or pulmonary embolism, pneumonia, small bowel obstruction, myocardial infarction), residual disease, and survival.

**Results:** A total of 135 patients with disseminated intra-abdominal miliary-type disease underwent primary debulking surgery, of which 30 (22.2%) involved ASTs. The most common ASTs were ultrasonic surgical aspiration (40.0%) and argon-enhanced electrosurgery (36.7%). The most common sites of AST use were the diaphragm (63.3%), pelvic peritoneum (30.0%), bowel mesentry (20.0%), and large bowel serosa (20.0%). In a comparison of patients with and without use of ASTs, there were no differences in age, stage, primary site, histology, operative time, surgical complexity, or postoperative complications. Volume of residual disease was similar regardless of AST use (0.1–1 cm, 60.0% with ASTs vs 68.6% without; complete surgical resection, 16.7% with ASTs vs 13.3% without; P = 0.679). In evaluating patients with ≤1 cm of residual disease, median progression-free survival (15 vs 15 months, P = 0.658) and median overall survival (40 vs 55 months, P = 0.381) were also similar.

**Conclusion:** ASTs such as ablation and ultrasonic aspiration can be incorporated into a surgeon’s armamentarium at the time of primary debulking surgery for patients with disseminated intra-abdominal miliary-type EOC. The use of ASTs does not affect perioperative morbidity or oncologic outcome.
Use of a clinical score to predict chemotherapy response in stage I mucinous ovarian cancers


aStanford University School of Medicine, Stanford, CA, USA, bThe University of North Carolina, Greensboro, NC, USA, cGynecologic Cancer Center of Excellence, Uniformed Services University of the Health Sciences, Walter Reed National Military Medical Center, Bethesda, MD, USA, dStanford University, Stanford, CA, USA, ePalo Alto Medical Foundation Research Institute, Palo Alto, CA, USA, fGeorgia Regents University, Augusta, GA, USA, gMedical College of Georgia, Augusta, GA, USA, hUniversity of North Carolina at Chapel Hill, Chapel Hill, NC, USA, iKaohsiung Veterans General Hospital, Kaohsiung City, Taiwan, jUniversity of California, San Francisco, San Francisco, CA, USA, kCalifornia Pacific and Palo Alto Medical Foundation/Sutter Health Research Institute, San Francisco, CA, USA

Objective: The aim of this study was to determine which patients with stage I mucinous ovarian cancer (MOC) would benefit from adjuvant chemotherapy.

Method: Demographic and clinical data on patients diagnosed with MOC from 2004 to 2014 were collected from the National Cancer Data Base. \( \chi^2 \) test, independent samples \( t \) test, and Kaplan-Meier survival curves were applied. Propensity score matching was used to reduce bias due to potential confounding differences between patients who were observed and those who received chemotherapy. Cox regression was used to create a prognostic scoring system; this scoring system was then assessed for ability to predict survival.

Results: A total of 2,041 patients with stage I MOC were identified, 1,362 (67%) with stage IA–IB disease and 598 (29%) with stage IC disease. Median age at diagnosis was 51.6 (IQR 19) years. Of all patients, 737 (36%) received adjuvant chemotherapy. Patients with higher substage, higher grade, and malignant ascites were more likely to be treated with chemotherapy (each \( P < 0.001 \)). Five-year overall survival was similar for patients treated with chemotherapy versus no chemotherapy (90% vs 92%, \( P = 0.461 \)). Patients with stage I MOC were triaged into a low-risk or a high-risk group based on Cox regression modeling, which included the following variables: patient age, race, stage, tumor size, lymphovascular invasion, and presence of ascites. Chemotherapy did not improve overall survival in the low-risk group (5-year survival 91% vs 89%, HR = 1.28, CI = 0.53–1.16, \( P = 0.22 \)) but was associated with a survival benefit in high-risk patients (5-year survival 75% vs 81%, HR = 1.84, CI = 1.03–3.27, \( P = 0.04 \)). See Figure 1.

Conclusion: Adjuvant chemotherapy is not associated with survival in a low-risk subgroup of surgically stage I MOC patients. Chemotherapy may be beneficial in those determined to be high-risk by our Cox regression modeling. Chemotherapy should be individualized among stage I MOC patients using a prognostic scoring system.

Fig. 1.
promise; however, clinical trials show modest response rates. Ovarian cancer is known to be radiosensitive, but use of total abdominal radiation is not utilized because of high abdominopelvic toxicity. Conventional radiotherapy is delivered at a dose rate of 3–4 Gy/minute, while our ultra-rapid FLASH radiotherapy system uses a linear accelerator to deliver dose rates of 200 Gy/second. We have shown that our new treatment modality reduces intestinal radiation-induced toxicity. Importantly, we demonstrated efficient tumor control with FLASH irradiation in a preclinical model of ovarian cancer peritoneal metastasis. Here we sought to determine the efficacy and safety of FLASH irradiation combined with PD-1 inhibition in a syngeneic preclinical model of ovarian cancer.

Method: Female C57BL/6 mice were intraperitoneally inoculated with ID8-Asc ovarian cancer cells. Total abdominal FLASH irradiation was administered 10 days post-inoculation. Anti-PD-1 and isotype control antibodies were injected on days 7, 10, and 13 post-inoculation. Total body weight, stool count, stool weight, complete blood count, tumor burden, immune cell analysis, and survival were evaluated to determine acute and chronic toxicity as well as immune response.

Results: Four cohorts of mice were analyzed: isotype control antibody (IgG), anti-PD-1 (aPD-1), FLASH plus IgG, and FLASH plus aPD-1. Irradiated mice showed a decrease in total body weight with nadir at 5–6 days, associated with a 43% decrease in solid stool production, and recovery to baseline by day 8–9. There was no evidence of hematopoietic toxicity. Survival analysis is ongoing. Exploratory necropsy demonstrated significant tumor burden control in the FLASH cohorts and, in particular, a 25-fold decrease in tumor number in the FLASH plus aPD-1 cohort. FLASH plus aPD-1 also elicited increased intratumoral CD4+ and CD8+ T cells.

Conclusion: Combination FLASH and PD-1 inhibition enhanced tumor control compared to IgG and aPD-1 alone, while demonstrating safety and tolerability. Our data identify a new opportunity for FLASH and checkpoint inhibition in the treatment of ovarian cancer.

215 - Poster Session
Association of fusion genes with clinical outcomes and survival in high-grade serous ovarian cancer
A.M. Newtson, H.D. Reyes, Y.A. Lyons, N.D. Cardillo, D. Russo, E. Devor, M.J. Goodheart and J. Gonzalez-Bosquet. University of Iowa Hospitals and Clinics, Iowa City, IA, USA

Objective: Fusion genes result from chromosomal rearrangements leading to the formation of fusion transcripts. Many fusion genes have been associated with oncogenesis, such as BCR-ABL1 in chronic myelogenous leukemia. However, little is known of their role in the natural history and prognosis in high-grade serous ovarian cancer (HGSC). To explore this, we compared the presence of fusion genes between normal fallopian tubes and HGSC. Then, we assessed the association of fusion genes with surgical outcomes and survival in HGSC.

Method: RNA from 112 HGSC and 12 normal fallopian tube specimens from our Biobank tissue repository was purified and sequenced. Sequencing was carried out on the Illumina HiSeq4000 platform using 150 bp paired-end transcripts. Reads were mapped and aligned against version GRCh38 of the human genome. The suite STAR was used to identify and validate (in silico) fusion genes. Logistic regression was used to compare fusion genes between normal fallopian tubes and HGSC and to associate fusion genes with clinical outcomes, such as optimal cytoreduction. Association of fusion genes with survival was assessed via Cox proportional hazard ratios.

Results: Fusion gene RN7SKP71--RN7SKP48 between chromosomes 12 and 4 was present in all tube and HGSC samples. Fusion gene AC026191--RGAP3 was present in more normal fallopian tubes than in HGSC samples ($P = 0.009$). This fusion was also independently associated with poor surgical outcomes in multivariate analysis ($P = 0.039$). Altogether, 8 fusion genes were independently associated with worse survival, even after adjusting for other clinical variables. Fusion gene NRIP1--AJ009632.2 specifically had the worse prognosis with a risk of death 40+ times greater than the reference.

Conclusion: Fusion genes can be used to assess clinical outcomes in HGSC. More research is needed to investigate whether these fusion genes have a role in the natural history of HGSC and could be used for prognostication.

216 - Poster Session
Trends in the incidence of peritoneal, ovarian, fallopian tubal cancer in Korea
W.K. Shin, J. Lim, M.C. Lim and Y.J. Won. *National Cancer Center, Goyang-si, South Korea, †National Cancer Center, Goyang-si, Korea, Republic of (South)

Objective: The aim of this study was to investigate the incidence and clinical characteristics of primary peritoneal cancer (PPC), epithelial ovarian cancer (EOC), and fallopian tube cancer (FTC) based on cancer origin site and histologic type.

Method: Data from the Korea Central Cancer Registry between 1999 and 2016 were analyzed. The incidence rates and annual percentage changes for each tumor site were analyzed.
Results: Of the 37,852 women with cancers, 3,350 (8.85%) were PPC, 33,618 (88.81%) were EOC, and 884 (2.34%) were FTC. Age-standardized rate increased, 0.40 to 0.80, 5.03 to 6.65, and 0.06 to 0.28 in PPC, EOC, and FTC, respectively. The rate of FTC was increasing at the highest rate. The annual percentage change of PPC, EOC, and FTC during 1999–2016 was 4.00, 1.88, and 8.15, respectively. The incidence of PPC, EOC, and FTC was highest among patients in the 65–69, 60–65, and 55–59 age groups, respectively. See Figure 1.

Conclusion: The overall incidence of PPC, EOC, and FTC cancer has steadily increased in Korea. FTC is the most prominently increasing. FTC incidence showed a relatively young peak age, in contrast to EOC and PPC, which showed an older peak age.

217 - Poster Session
Novel use of folate hydrolase 1/glutamate carboxypeptidase II (PSMA) in PET-MRI evaluation of suspected gynecologic cancers

Objective: Folate hydrolase 1/glutamate carboxypeptidase II, or prostate-specific membrane antigen (PSMA), is expressed on prostate tumor cells and on the neovasculature of nonprostate cancers. PSMA-based 18F-DCFPyl PET imaging demonstrates very high tumor-to-background ratios when studied in prostate, lung, and renal cancers. A recent immunohistochemistry (IHC) study demonstrated high PSMA expression in neovascularature of uterine and ovarian tumors, but not in normal gynecologic tissues. We hypothesized that PSMA is more highly expressed in gynecologic cancers than in normal gynecologic tissues with resultant increased 18F-DCFPyl uptake on PET imaging.

Method: This was an Institutional Review Board-approved prospective pilot study of women with and without gynecologic cancers. Consenting women underwent PSMA 18F-DCFPyl PET–MRI and standard-of-care surgery. For normal and pathologic tissues, the average and range are reported for both the PET maximum standardized uptake value (SUVmax) and the intensity of the PSMA IHC staining on pathology specimens. PSMA staining intensity was semiquantitatively graded as 0 = none; 1 = weak; 2 = moderate; and 3 = strong.
Results: Fifteen patients have been enrolled: 13 have undergone PET–MRI imaging, and 7 have completed corresponding immunohistologic evaluation. Six patients were diagnosed with cancer: 2 endometrial, 3 ovarian, and 1 metastatic colorectal. Six unique benign adnexal lesions were imaged. Results of PET imaging and IHC staining are summarized in Table 1. Normal endometrium SUVmax was 4.8 compared to 9.8 with endometrial cancer. Normal ovarian tissue SUVmax was 2.37 compared to 6.4 with ovarian cancer.

Conclusions: On PSMA 18F-DCFyl PET-MR imaging there is a higher SUVmax for uterine and ovarian malignancies than for normal tissue. Corpus luteum have higher than normal SUVmax, but are easily identified by distinguishing imaging characteristics. PSMA IHC staining intensity corresponds to SUVmax for endometrial pathology. It appears that neoadjuvant chemotherapy decreases the 18F-DCFyl uptake in ovarian malignancies. This study is ongoing with continued enrollment to validate these initial observations.

Table 1: SUVmax and PSMA IHC intensity by tissue type.

<table>
<thead>
<tr>
<th></th>
<th>PSMA-based 18F-DCFypyl PET-MRI SUV</th>
<th>Immunohistochemistry (IHC) for PSMA/CD31</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SUVmax +/- SD</td>
<td>SUV Range</td>
</tr>
<tr>
<td>Blood Pool</td>
<td>1.9 +/- 0.4</td>
<td>1.3-2.4</td>
</tr>
<tr>
<td>Normal Myometrium</td>
<td>2.7 +/- 0.78</td>
<td>1.9-4.5</td>
</tr>
<tr>
<td>Normal Endometrium</td>
<td>4.8 +/- 1.84</td>
<td>2.9-8.3</td>
</tr>
<tr>
<td>Endometrial Cancer</td>
<td>9.8 +/- 1.9</td>
<td>8.4-11.1</td>
</tr>
<tr>
<td>Normal Ovary</td>
<td>2.37 +/- 0.96</td>
<td>0.3-3.5</td>
</tr>
<tr>
<td>Corpus Luteum</td>
<td>5.98 +/- 0.54</td>
<td>5.3-6.5</td>
</tr>
<tr>
<td>Ovarian Cancer</td>
<td>6.4 +/- 3.0</td>
<td>3.4-10.5</td>
</tr>
<tr>
<td>Ovarian Cancer Excluding Post Neoadjuvant Chemotherapy</td>
<td>7.4 +/- 2.72</td>
<td>5.3-10.3</td>
</tr>
</tbody>
</table>

218 - Poster Session

Mutations in HRD-associated genes in ovarian cancer patients: Expanding PARP inhibitor eligibility

J. Fehniger, S.S. Lee and B. Pothuri. NYU Langone Health, New York, NY, USA

Objectives: Interest in utilizing poly(ADP-ribose) polymerase inhibitors (PARPi) for the treatment of recurrent disease beyond BRCA1 and BRCA2 carriers has been growing. We sought to characterize the prevalence of somatic and germline mutations in non-BRCA1 and BRCA2 homologous recombination deficiency (HRD) pathway genes among ovarian cancer patients.

Method: We reviewed Foundation Medicine (Cambridge, MA) comprehensive genomic profiling (CGP) of tumor tissue for all patients from a single institution between January 2014 and July 2019 as well as germline genetic testing results for newly diagnosed ovarian cancer patients participating in a prospective research study of germline genetic testing from October 2015 to October 2018. Alterations in non-BRCA1 and BRCA2 HRD genes, including ATM, BARD1, BRIP1, PALB2, RAD51C, and RAD51D, were included. Clinicopathologic and treatment data were extracted from the electronic medical record. Descriptive statistics were used to report patient and treatment characteristics.

Results: Among 79 ovarian cancer patients whose tumors underwent tumor CGP, 3 (4%) had somatic mutations in non-BRCA1 and BRCA2 HRD genes. Among 133 patients who underwent germline genetic testing, no non-BRCA1 and BRCA2 HRD mutations were noted. One patient each had an ATM, BRIP1, and RAD51C mutation on tumor CGP. All patients with mutations on tumor testing underwent panel germline genetic testing, and no pathogenic mutations were identified. All patients with non-BRCA1 and BRCA2 HRD mutations had stage III disease, with initial disease-free intervals of 18–23 months after primary therapy. See Table 1.

Conclusion: Among patients with ovarian cancer, somatic, or germline mutations in non-BRCA1 and BRCA2 HRD genes are rare, detected in less than 5% of tumors. Although PARPi may benefit this patient population, our data suggest they represent a small percentage of ovarian cancer patients. Further study confirming these data in a larger cohort of ovarian cancer patients as well as testing efficacy of PARPi in these patients is needed.

Table 1.
Somatic testing, n=79  
Germline testing, n=133

Median age at diagnosis, (Range)  
63 (21-85)  
64 (23-90)

Race/ethnicity  
White, non-Hispanic  
58 (73%)  
94 (71%)

White, Hispanic  
6 (8%)  
14 (11%)

Black  
4 (5%)  
7 (5%)

Asian  
11 (14%)  
15 (11%)

Mixed  
0  
3 (2%)

Stage at diagnosis  
I/II  
7 (9%)  
30 (22%)

III  
53 (67%)  
73 (55%)

IV  
17 (21%)  
29 (21%)

Not available  
2 (3%)  
3 (2%)

High grade serous  
56 (71%)  
83 (62%)

BRCA1/2 mutation  
Somatic only  
6 (7.5%)  
5 (4%)

Germline  
6 (7.5%)  
18 (14%)

Somatic or germline  
12 (15%)  
23 (17%)

Non-BRCA1/2 HRD mutation  
3 (4%)  
NA

Somatic  
0  
0

Germline  
0  
0

219 - Poster Session  
The (f)utility of therapy in ovarian cancer after the development of platinum resistance  
R.W. Naumann\textsuperscript{a}, S. Trufan\textsuperscript{b}, A. Aneralla\textsuperscript{b}, R. Bose\textsuperscript{b}, E.K. Crane\textsuperscript{b}, D.L. Tait\textsuperscript{b}, R.V. Higgins\textsuperscript{b} and J. Brown\textsuperscript{b}.  
\textsuperscript{a}Levine Cancer Institute, Charlotte, NC, USA, \textsuperscript{b}Levine Cancer Institute, Carolinas Medical Center, Charlotte, NC, USA

Objective: The purpose of this study was to evaluate the response to therapy in patients with platinum-resistant ovarian cancer and the effectiveness of subsequent lines of therapy.

Method: Patients with platinum-resistant ovarian cancer were identified from a prospective database, and responses to therapy after the development of platinum resistance were reviewed. Patients treated with a single line of therapy versus multiple lines of therapy after platinum resistance were compared.

Results: A total of 56 of 60 consecutive patients with high-grade platinum-resistant ovarian cancer received at least 1 systemic therapy after platinum resistance. There were 21 patients (35%) who received only a single line, with 35 (58%) receiving 2–6 lines of therapy (2, 32%; 3, 15%; 4+, 12%) after development of platinum resistance. The chance of dying while on therapy increased with subsequent lines from 11% on first therapy, 14% on second therapy, 20% on third therapy, and 33% on 4+ therapies. For first-line platinum-resistant therapy, there were 6 complete responses (CR) and 1 partial response (PR) for an overall response rate of 13%. For the cohort with 2 or more therapies after platinum resistance, there were 2 PR in 54 lines of therapy for a recurrence rate (RR) of 3.7%. There were no responses in any line among the 9 BRCA(+) patients. There was no difference in survival from diagnosis between the group that received
only 1 therapy after platinum resistance and the group that received 2 or more therapies ($P = 0.37$). For patients eligible for more than 1 cycle of chemotherapy after platinum resistance, there was no difference in survival from platinum resistance with additional lines of therapy ($P = 0.77$). See Figure 1.

**Conclusion:** Given the low response rate in patients after platinum resistance, the value of continued chemotherapy after platinum resistance is questionable. Second-line chemotherapy after platinum resistance is unlikely to produce a meaningful response or significantly contribute to overall survival. Outside of a clinical trial, aggressive palliation is likely provide a better quality of life without compromising survival in this setting.

---

**Fig. 1.** Overall survival from diagnosis based on the number of lines of chemotherapy after the development of platinum resistance.

---

**220 - Poster Session**

**Excellent versus poor response to neoadjuvant chemotherapy is accompanied by unique proteomic alterations in post versus pretreatment HGSOC tumors**


**Objective:** Selection of neoadjuvant chemotherapy (NACT) for patients with advanced ovarian cancer is an important clinical decision. Our objective was to identify candidate proteins associated with excellent or poor response to NACT in high-grade serous ovarian cancer (HGSOC).

**Method:** HGSOC tissues samples were collected during pretreatment laparoscopic assessments from primary and metastatic disease sites (>50 tissue samples) for 17 patients. Matched post-NACT tissue samples were then collected at interval debulking surgery (IDS). Review of preoperative imaging and disease burden at IDS resulted in the identification of 9 patients who had detectable disease regression on imaging (excellent responders) versus 8 who did not (poor responders). Tumors were collected using laser microdissection and analyzed by a multiplexed, quantitative proteomics.

**Results:** A total of 6,934 total proteins were quantified across post- and pre-NACT treated tissues. We identified 987 significant (LIMMA adjusted $P < 0.01$) protein alterations in excellent and 627 alterations in poor responders in comparisons of post- versus pre-NACT samples. Comparative analyses revealed 305 proteins as coaltered between excellent and poor responders who further exhibited high quantitative correlation (Spearman = 0.954, $P < 0.0001$). These alterations included elevation of proteins regulating extracellular matrix.
(ECM) dynamics and decreases in proteins regulating nucleic acid metabolism. We further selected proteins uniquely altered in post-versus pre-NACT tumors from excellent (682 proteins) or poor (322) responders exhibiting a ±1.5-fold change between groups, prioritizing 89 protein alterations in excellent and 42 in poor responder patients. Alterations in excellent responders included elevation of proteins regulating ECM and decreases in proteins regulating chromosomal dynamics. Proteins altered in poor responders included decreases in members of the Glutathione S-trasferase family in post- versus pre-NACT tumors.

Conclusion: Our quantitative proteomic analysis revealed proteome alterations in post- versus pre-NACT tumors from patients experiencing excellent or poor NACT response. The alterations may enhance treatment decisions and rationale for selecting alternative therapy in those with poor response to NACT.

221 - Poster Session
Neoadjuvant chemotherapy does not disproportionately benefit postoperative complication rates or time to chemotherapy in obese ovarian cancer patients

*aMassachusetts General Hospital, Boston, MA, USA, bBrigham and Women’s Hospital and Harvard Medical School, Boston, MA, USA, cMassachusetts General Hospital/Harvard University, Boston, MA, USA, dHarvard Medical School, Boston, MA, USA, eBrigham and Women’s Hospital/Dana-Farber Cancer Institute, Boston, MA, USA, fDana-Farber Cancer Institute, Boston, MA, USA

Objective: The purpose of this study was to determine whether receiving neoadjuvant chemotherapy (NACT) for advanced-stage ovarian cancer disproportionately benefits obese patients (BMI ≥30) compared with nonobese patients (BMI <30) with respect to postoperative complications and time to chemotherapy.

Method: Demographic, treatment, and outcome data were collected from records of stage IIIC–IV ovarian cancer patients treated January 2010 to July 2015. X² and Wilcoxon rank sum tests were used to compare groups for proportions and medians, respectively. To determine whether the effect of NACT on postoperative complications changed with obesity status, we included an interaction term in logistic regression models.

Results: Of 510 patients, 115 (22.2%) were obese, and 395 (77.8%) were nonobese. Among obese patients, 63 (54.8%) underwent primary debulking surgery (PDS), and 52 (45.2%) had NACT. Among obese patients undergoing PDS versus NACT, rates of postoperative infection were 42.9% versus 30.8% (P = 0.12) and 30-day readmission/reoperation, 30.2% versus 11.5% (P < 0.02). Among obese patients, median time to (re)initiation of chemotherapy was 30.0 days after PDS versus 26.0 days after NACT (P = 0.12). Among nonobese patients undergoing PDS versus NACT, rates of postoperative infection were 26.6% versus 17.9% (P < 0.04) and 30-day readmission/reoperation were 16.9% versus 9.2% (P = 0.02). Among nonobese patients, median time to (re)initiation of chemotherapy was 26.0 days after PDS versus 26.0 days after NACT (P = 0.60). Using logistic regression, factors associated with postoperative infection included obesity (OR = 2.48, 95% CI 1.54–3.99) and use of NACT (OR = 0.63, 95% CI 0.40–0.98). Obesity (OR = 1.86, 95% CI 1.08–3.21) and NACT (OR = 0.45, 95% CI 0.27–0.76) were also associated with 30-day readmission/reoperation. When comparing obese to nonobese patients, there was a slightly smaller protective effect associated with NACT and postoperative infection (OR = 0.71 vs 0.60, respectively) and a slightly larger protective effect of NACT associated with 30-day readmission/reoperation (OR = 0.30 vs 0.53, respectively); however, there was not a significant interaction between patient weight and NACT in either of the models predicting postoperative complications, indicating that obese patients do not disproportionately benefit from NACT.

Conclusion: The decision to use NACT should not be predicated on obesity, as the reduction in postoperative complications in obese patients is similar to that in nonobese patients.

222 - Poster Session
Cost-effectiveness of maintenance hormonal therapy in patients with advanced low-grade serous ovarian cancer

aUniversity of Toronto, Toronto, ON, Canada, bPrincess Margaret Cancer Centre, University of Toronto, Toronto, ON, Canada

Objective: The aim of this study was to assess the cost-effectiveness of using maintenance hormonal therapy in patients with low-grade serous ovarian cancer (LGSC).

Method: A simulated decision analysis with a Markov model over a lifetime horizon was performed using the base case of a 47-year-old female with stage III, estrogen-receptor positive LGSC after primary treatment with cytoreductive surgery and adjuvant chemotherapy. Two treatment strategies were analyzed: maintenance letrozole until progression and routine observation. Probability and utility data were extracted from the literature, and direct medical costs were estimated using public data sources and reported in adjusted 2018 Canadian dollars (CAD). The model estimated lifetime cost, quality-adjusted life-years (QALY), absolute life years (LY), median overall
survival (OS), and number of recurrences with each strategy. Cost-effectiveness was compared using an incremental cost-effectiveness ratio (ICER). Deterministic sensitivity analysis was performed to assess the impact of changing key clinical and cost variables.

**Results:** Maintenance letrozole was the preferred strategy with an associated lifetime cost of $69,985 CAD and an observed improvement of 0.91 QALY and 1.55 LYs. At an additional lifetime cost of $10,016 CAD, the ICER for letrozole maintenance therapy was $11,037 CAD per QALY. The estimated median OS was 150 months with maintenance letrozole and 126 months in the observation strategy. The maintenance letrozole strategy resulted in 34% and 17% fewer first recurrences at 5-year and 10-year follow-up, respectively. Sensitivity analysis showed the model to be robust over a wide range of values. The model was sensitive to the probability of recurrence with observation and with maintenance letrozole. When the probability of recurrence with observation alone was set at 27% per year, which was derived from previous literature, letrozole maintenance was cost-effective if the probability of recurrence with therapy was set at less than 24% per year (Figure 1).

**Conclusion:** Maintenance letrozole is a cost-effective strategy in patients with treated LGSC resulting in a clinically relevant improvement in QALY, LY, and decreased number of recurrences.

![Fig. 1. Two-way sensitivity analysis evaluating probability of recurrence on letrozole and observation.](image)

---

**223 - Poster Session**

**Efficacy and toxicity of extended duration pegylated liposomal doxorubicin (PLD) in women with recurrent epithelial ovarian cancer**

L. Moulton Chambers\(^a\), A.B. Pendlebury\(^b\), M. Yao\(^c\), P.G. Rose\(^a\) and R. DeBernardo\(^c\). \(^a\)The Cleveland Clinic Foundation, Cleveland, OH, USA, \(^b\)Mercy Hospital for Women, Heidelberg, Australia, \(^c\)Cleveland Clinic, Cleveland, OH, USA

**Objective:** The aim of this study was to determine efficacy and toxicity of extended duration (≥7 cycles) pegylated liposomal doxorubicin (PLD) in recurrent epithelial ovarian carcinoma (EOC).

**Method:** Women with recurrent EOC who received ≥7 cycles of PLD were retrospectively identified from 1991 to 2016. Data were collected for patient and oncologic demographics, treatment history, and chemotherapy toxicity, which was assessed by Common Terminology for Adverse Events (CTCAE) v5.0. Response was determined by Response Evaluation Criteria in Solid Tumors (RECIST) v1.1. Kaplan-Meier estimates and Cox proportional hazards were used to evaluate progression-free survival (PFS) and overall survival (OS).

**Result:** There were 69 patients with recurrent EOC who received a median of 11.0 cycles (range 7–115 cycles) at a median cumulative dose of 400 mg/m² (range 210–4,600 mg/m²); 29.0% (n = 20) were platinum-sensitive; and 71.0% (n = 49) had platinum-resistant recurrent EOC. Frequently observed grade ≥3 toxicities were dermatologic (n = 13, 18.8%), hematologic (n = 6, 8.7%), fatigue (n = 4, 4.4%), and cardiac (1.4%). With a median follow-up duration of 32.2 months, 41 women (59.4%) experienced clinical benefit: CR in 17.4% (n = 12), PR in 13.0% (n = 9), and stable disease (SD) in 29.0% (n = 20). When stratified by platinum sensitivity, 70% (n = 14) of patients with platinum-sensitive recurrent EOC experienced a clinical benefit: CR in 20.0% (n = 4), PR in 15.0% (n = 3), and SD in 35.0% (n = 7). Similarly, in women with platinum-resistant disease, clinical benefit was observed in 55.1% (n = 27): CR in 16.3% (n = 8), PR in 12.2% (n = 6) and SD in 26.5% (n = 13). Median PFS was 13.0 months (95% CI 10.7–15.2). Median OS was 40.2 months (95% CI 30.0–
There was no significant difference in PFS ($P = 0.61$) or OS ($P = 0.07$) for platinum-sensitive versus platinum-resistant recurrent EOC (Figure 1).

**Conclusion:** Within this heavily pretreated population of women with EOC, extended duration (≥7 cycles) of PLD is well-tolerated, and approximately one-half experienced sustained clinical benefit. Modest response rates were observed for both platinum-sensitive and -resistant recurrent EOC. Incidence of grade 3–4 toxicity was low. These data support consideration of PLD maintenance therapy in women with both recurrent platinum-resistant and platinum-sensitive disease who have had stable disease or better as an initial response.

**Fig. 1.** Progression free survival and overall survival in women who received extended duration pegylated liposomal doxorubicin (PLD) chemotherapy in women with platinum sensitive vs. platinum resistant recurrent high grade epithelial ovarian cancer.

<table>
<thead>
<tr>
<th></th>
<th>Platinum Sensitive EOC (N=20)</th>
<th>Platinum Resistant EOC (N=49)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median PFS (months)</td>
<td>15.9 (10.2, 21.4)</td>
<td>12.3 (9.7, 14.2)</td>
<td>0.61</td>
</tr>
<tr>
<td>Median OS (months)</td>
<td>44.7 (35.8, 97.5)</td>
<td>33.3 (23.1, 49.0)</td>
<td>0.07</td>
</tr>
</tbody>
</table>

224 - Poster Session
Cisplatin chemotherapy impacts the gut microbiome in a preclinical murine model of epithelial ovarian cancer
L. Moulton Chambersa, E.L. Esakovb, C. Braleyb, N. Sangwan, R. Vargasa, P.G. Rosea, J.D. Lathia, C.M. Michenerb and O. Reizesb. aThe Cleveland Clinic Foundation, Cleveland, OH, USA, bCleveland Clinic, Cleveland, OH, USA

**Objective:** Recent data suggest that the gut microbiome modulates responses to cancer treatment, including platinum chemotherapy. The objective was to understand whether platinum chemotherapy changes the gut microbiome in a preclinical model of epithelial ovarian cancer (EOC).

**Method:** Two syngeneic EOC cell lines (ID8 and ID8-VEGF) were injected intraperitoneally (IP) into female C57Bl/6 mice. After tumor engraftment was confirmed via ultrasound in all mice at 18 days postinjection, mice were allocated to either IP cisplatin 5 mg/kg weekly or placebo. Tumor volume was monitored weekly via ultrasound. Cisplatin was continued until endpoint or for 8 weeks. Fecal samples were collected at baseline, at tumor engraftment, and weekly during treatment. Microbial DNA was isolated from fecal samples (Qiagen) and processed for 16S rRNA sequencing (Miami University of Ohio, Oxford, OH). Alpha and beta diversity analysis was calculated (R!, St Louis, MO). Multidimensional scaling was performed using Bray-Curtis dissimilarity matrix. Pairwise group analysis was performed using the White nonparametric t test with $P < 0.05$ considered statistically significant.

**Results:** EOC tumors (ID8 and ID8-VEGF) were significantly smaller in mice treated with cisplatin than in mice treated with placebo ($P < 0.05$). Shannon alpha diversity was reduced following cisplatin treatment compared to placebo ($P < 0.05$). Bray-Curtis dissimilarity analysis demonstrated significant differences with cisplatin versus placebo ($P = 0.003$, $R = 0.061$). Similarly, significant differences in pairwise dissimilarity at study endpoint were observed for cisplatin compared to placebo ($P < 0.05$). On taxonomic analysis at the phyla level, treatment with cisplatin led to increased proportion of bacteroidetes and reduced firmicutes compared to controls ($P < 0.05$). Cisplatin increased the abundance of bacteroides (18.3% vs 3.4%, $P = 0.04$) and reduced *lactobacillus* (2.6% vs 12.7%, $P = 0.01$) and *turicibacter* (0.4% vs 15.5%, $P < 0.001$) relative to controls (Figure 1).
**Conclusion:** In this murine model of EOC, cisplatin treatment changed both the microbial composition and the diversity of the gut microbiome while decreasing tumor size. Further study is warranted to understand how specific microbial populations affect cisplatin response and chemotherapy toxicities.

![Figure 1](image)

**Fig. 1.** Relative changes in total bacterial abundance and species diversity in murine models of epithelial ovarian cancer cell lines receiving cisplatin chemotherapy compared to placebo.

---

**225 - Poster Session**

**The gut microbiome attenuates epithelial ovarian cancer growth and platinum sensitivity: Novel opportunities for ovarian cancer treatment**

L. Moulton Chambersa, E.L. Esakovb, C. Braleyb, N. Sangwan, R. Vargas, P.G. Rose, J.D. Lathia, C.M. Michenerb and O. Reizes. *The Cleveland Clinic Foundation, Cleveland, OH, USA, Cleveland Clinic, Cleveland, OH, USA*

**Objective:** Recent data suggest that the gut microbiome may have an impact on response to platinum chemotherapy. We sought to investigate whether disrupting the gut microbiome would have an impact on epithelial ovarian cancer (EOC) growth and platinum response in a preclinical model.

**Method:** C57Bl/6 mice were assigned to two cohorts: antibiotic (ABX) water (H2O) to disrupt the gut microbiome (vancomycin, ampicillin, neomycin, metronidazole) or control (H2O). After 2 weeks, EOC cell lines (ID8 and ID8-VEGF) were injected intraperitoneally (IP). Mice were treated with IP cisplatin 5 mg/kg weekly or placebo at 18 days postinjection. Tumor volume was monitored weekly by ultrasound. Fecal samples were collected weekly during treatment. Microbial DNA was isolated (Qiagen) and processed for 16S rRNA sequencing (Miami University of Ohio, Oxford, OH). Alpha and beta diversity analysis was performed. Multidimensional scaling was performed using Bray-Curtis dissimilarity matrix. We performed an analysis of variance (ANOVA) among sample categories with $P < 0.05$ considered statistically significant (R!, St Louis, MO).

**Results:** Tumor growth was significantly accelerated in mice treated with ABX versus H2O ($P < 0.001$). In H2O mice, cisplatin reduced tumor size versus placebo ($P < 0.001$), but for ABX groups, no response in tumor size was seen with cisplatin versus placebo ($P > 0.05$). ABX mice had significantly worse survival versus H2O (ABX/cisplatin, 64 days; ABX/placebo, 66 days; H2O/cisplatin, 84 days; H2O/placebo, 68.5 days; $P < 0.0001$). Shannon and Simpson alpha diversity was significantly decreased in ABX versus H2O ($P < 0.05$).
Similarly, Bray-Curtis dissimilarity cluster analysis demonstrated significant differences in ABX versus H$_2$O ($p = 0.001$). On taxonomic analysis, ABX had significantly increased abundance of gammaproteobacteria species ($p < 0.001$). H$_2$O/cisplatin mice, with the slowest tumor growth and improved platinum response, had significantly increased abundance of bacteroides and lactobacillus species versus ABX/cisplatin mice. Microbial population changes across treatment groups throughout the study are displayed in Figure 1.

**Conclusion:** In this murine model of EOC, ABX disruption of the gut microbiome led to accelerated tumor growth, decreased survival, and reduced platinum sensitivity. This suggests that an intact microbiome is necessary for optimal platinum chemotherapy response in EOC.

![Figure 1](image)

**Fig. 1.** Relative changes in total bacterial abundance and species diversity in murine models of epithelial ovarian cancer cell lines undergoing cisplatin chemotherapy following ABX treatment to disrupt the microbiome.

---

**226 - Poster Session**

**Inflammatory markers for predicting surgical outcome and recurrence in ovarian cancer**


*a*Helen Schneider Hospital for Women, Tel Aviv, Israel, *b*Rabin Medical Center, Petah Tikva, Israel, *c*Rabin Medical Center, Sackler School of Medicine, Tel Aviv University, Petah Tikva, Israel

**Objective:** We aimed to evaluate the impact of inflammatory markers on diagnosis and on surgical outcome and recurrence in patients with epithelial ovarian carcinoma (EOC).

**Method:** This was a retrospective cohort study of all patients with EOC treated in 1 university-affiliated medical center (2005 to June 2017). We evaluated whether inflammatory markers predict surgical outcome and recurrence in ovarian cancer. Inflammatory markers that were assessed included neutrophil count, lymphocyte count, platelets, neutrophil-to-lymphocyte ratio (NLR), and platelet-to-lymphocyte ratio (PLR).

**Results:** Overall, 247 patients met inclusion criteria. Of them, 162 patients had recurrence, and 85 patients did not have recurrence. Patients with recurrent disease had higher rates of advanced stage (III and IV) and neoadjuvant chemotherapy treatment (75% vs 25% and 77.5% vs 22.5%, respectively, $p < 0.001$ for both). Of the inflammatory markers, platelet count, NLR, and PLR were all significantly associated with recurrent disease (Table 1). We also assessed whether inflammatory markers can be predictive of surgical outcome. Out of the initial cohort, 177 patients underwent surgical intervention; 150 patients had optimal cytoreduction and 27 had suboptimal cytoreduction. NLR and PLR were similar between groups (median 4.0 vs 3.4 and 223 vs 202, respectively), and these inflammatory markers did not predict surgical outcome (OR = 0.07, 95% CI 0.88—1.08, $p = 0.68$, and OR = 0.99, 95% CI 0.14—3.71, $p = 0.50$, respectively).

**Conclusion:** Higher levels of NLR and PLR are in negative correlation with recurrent disease. However, these inflammatory markers are not predictive for surgical outcome.
### Table 1. The hazard ratio for inflammatory markers as predictive for recurrent disease.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Hazard ratio</th>
<th>95% CI</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neutrophil count</td>
<td>1.04</td>
<td>0.97-1.11</td>
<td>0.19</td>
</tr>
<tr>
<td>Lymphocyte count</td>
<td>0.75</td>
<td>0.57-1.00</td>
<td>0.05</td>
</tr>
<tr>
<td>Platelet count</td>
<td>1.001</td>
<td>1.0-1.003</td>
<td>0.009</td>
</tr>
<tr>
<td>Neutrophil-to-lymphocyte ratio</td>
<td>1.04</td>
<td>1.01-1.08</td>
<td>0.01</td>
</tr>
<tr>
<td>Platelet-to-lymphocyte ratio</td>
<td>1.02</td>
<td>1.00-1.003</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

---

**227 - Poster Session**

**Proteomic evaluation of the fallopian tube: Insight into the pathogenesis of serous ovarian cancer**


*aGynecologic Cancer Center of Excellence, Walter Reed National Military Medical Center, Uniformed Services University of the Health Sciences, Bethesda, MD, USA, bInova Fairfax Hospital, Falls Church, VA, USA*

**Objective:** Serous ovarian cancer was thought to originate from ovarian surface epithelium, but contemporary opinion suggests precancerous lesions in the fallopian tube may be the origin for this disease. We sought to conduct a comprehensive proteomic profiling of serous ovarian cancer and adjacent fallopian tubes to improve our understanding of disease pathogenesis.

**Method:** Normal fallopian tube epithelium (n = 26), low-grade serous ovarian tumors (n = 13) with ipsilateral fallopian tube epithelium with or without tumor involved, as well as high-grade serous tumors (n = 25) with ipsilateral fallopian tube epithelium with or without tumor were collected from formalin-fixed, paraffin-embedded tissues using laser microdissection. Quantitative proteomic analyses were then performed using tandem mass tags (TMT-11) and high-resolution mass spectrometry (Q-Exactive HF-X).

**Results:** Unsupervised analyses of 6,491 total proteins quantified clearly stratified normal fallopian tube epithelium, low-grade serous, and high-grade serous ovarian tumors. More proteins were coalterted between ipsilateral tubes with disease and matched high-grade (32% alterations) and low-grade (15%) serous tumors versus tubes without disease compared to matched tumors. Proteins elevated between fallopian tubes with disease and matched low-grade serous tumors correlated with regulation of protein translation and RNA metabolism. Proteins elevated between tubes with disease and matched high-grade serous tumors also correlated with protein translation as well as regulation of chromosome condensation. Further comparative analyses revealed 4 proteins as coalterted between tubes with disease and matched low-grade (22 alterations) versus high-grade (45 alterations) tumors and mapped to several ribosomal proteins. See **Figure 1**.

**Conclusion:** Our study shows conservation of protein alterations between ipsilateral tubal epithelium with versus without disease and matched tumors versus normal tubal epithelium. Proteins coalterted between tubes with disease and matched low-grade and high-grade serous tumors correlated with protein translation regulation. These data provide support for the more contemporary hypothesis that serous ovarian cancer originates from fallopian tube fimbrae versus ovarian surface epithelium.

**Fig. 1.** Unsupervised cluster analysis of 519 (HGSOC and normal fallopian tube epithelium) and 304 (LGSOC and normal fallopian tube epithelium) variably abundant proteins (median absolute deviation > 1) across patient samples including matched diseased (IPS_Inv) or non-diseased (IPS_No) epithelium collected from ipsilateral (IPS) fallopian tubes.
228 - Poster Session
Machine learning: Automated tumor to stroma ratios to predict response in neoadjuvant chemotherapy
R. L. Dood, N. D. Fleming, J. Liu and A. K. Sood. The University of Texas MD Anderson Cancer Center, Houston, TX, USA

Objective: Most patients undergoing neoadjuvant chemotherapy for ovarian cancer respond to standard therapy; however, there are no standards for assessing response. This study utilized pretreatment and interval debulking pathologic samples to measure the tumor-to-stroma ratio (TSR) with a high-throughput automated method to predict neoadjuvant chemotherapy outcomes.

Method: This retrospective cohort study utilized pathologic samples from a random sample of patients with high-grade serous ovarian cancer who underwent neoadjuvant chemotherapy and interval debulking surgery with 5 years of follow-up and available pathologic specimens. The Definiens software (Munich, Germany) was used to measure the median TSR of a set of tumor sample slides obtained pretreatment, then at time of debulking surgery. Median TSR was then compared to progression-free survival (PFS) with Cox models for adjusted tests, and receiver operating curves were used to predict residual disease at post-treatment assessment.

Results: Thirty-four women met inclusion criteria with adequate follow-up. The Definiens software was successful in measuring the TSR in approximately 1 minute per slide. TSR decreased after treatment in all matched pairs (median pretreatment, TSR 1.08, range 0.03–4.33; post-treatment TSR 0.15, range 0.02–0.74). Pretreatment TSRs predicted PFS ($P=0.038$) but not post-treatment TSR ($P=0.40$) or change in TSR ($P=0.66$). Pretreatment TSR moderately predicts presence of disease after completion of adjuvant treatment (AUC 0.75), with a suggested TSR cutoff of 1.17.

Conclusion: This study demonstrates the feasibility of measuring TSR in patient samples with an efficient and high-throughput method. A lower TSR portended better response to therapy and better clinical outcomes.

---

229 - Poster Session
Characteristics and outcomes of women with gynecologic cancers undergoing heated intraperitoneal or intrathoracic chemotherapy
C. A. Kathawa, C. Dominick and A. J. Armstrong. University Hospitals Cleveland Medical Center, Cleveland, OH, USA

Objective: Heated intraperitoneal (HIPEC) and intrathoracic chemotherapy (HITEC) can be used to treat peritoneal dissemination of gynecologic cancers following cytoreductive surgery. The aim of this study was to investigate patient characteristics, disease outcomes, and perioperative adverse outcomes in women with gynecologic cancer receiving surgical debulking with HIPEC or HITEC.

Method: A retrospective, single-institution study of women with primary or recurrent gynecologic cancer who received surgical debulking and HIPEC or HITEC between 2010 and 2018 was performed.

Results: Twenty-two patients with a median age of 60 (range 37–81) years were eligible for analysis treated with HIPEC at the following time points: initial debulking (9%), interval debulking (41%), and recurrence (50%). The majority of patients had serous cancers (64%). Charlson comorbidity index was 0–4 in every patient. Mean CA-125 prior to surgery was 53.2 U/mL. Mean number of days since last chemotherapy was 342. Choice of chemotherapy was determined by prior treatment response; the most common regimen was a combination of paclitaxel and cisplatin (45%). Chemotherapeutic agents used included cisplatin (86%), paclitaxel (59%), adriamycin (32%), mitomycin-c (5%), and oxaliplatin (5%). Of all patients, 83% had platinum-sensitive disease. An optimal (<1 cm residual tumor) debulking was accomplished in every case; 77% of patients had a complete cytoreductive surgery to no gross residual disease. A small bowel resection was performed in 7 patients (32%), and a large bowel resection was performed in 6 patients (27%). A diversion was performed in 2 patients (9%). Complications are shown in Table 1. Median progression-free survival was 10.4 months (1.5–27.6) for recurrent patients. Median follow-up at University Hospitals was 14.3 months (0.4–81.8).

Conclusion: Women with gynecologic cancers who undergo HIPEC or HITEC at the time of debulking surgery were carefully selected preoperatively with low Charlson comorbidity indices, low CA-125 levels, and predominantly high-grade serous cancers. In these women, optimal debulking surgery and HIPEC or HITEC were achieved, even when bowel resections were required. The most common adverse events were hospital readmission, anemia, sepsis, postoperative acidosis, and pelvic abscess.

<table>
<thead>
<tr>
<th>Postoperative Adverse Events</th>
<th>Number of Patients (n=22) (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return to OR in &lt;48 hours</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Readmission &lt;30 days post-op</td>
<td>6 (27%)</td>
</tr>
<tr>
<td>Anemia</td>
<td>4 (18%)</td>
</tr>
</tbody>
</table>
Acidosis 3 (14%)
Sepsis 3 (14%)
Pelvic/abdominal abscess 3 (14%)
ICU admission 2 (9%)
Hypoxia/dyspnea 2 (9%)
Urinary tract infection 2 (9%)
Urinary retention 2 (9%)
Pneumonia 1 (5%)
Neutropenia 1 (5%)
Seroma 1 (5%)
Bowel ischemia 1 (5%)
Bowel perforation 1 (5%)
Gastrointestinal anastomotic leak 1 (5%)
Fever 1 (5%)
Superficial wound infection 1 (5%)
Ileus 1 (5%)

230 - Poster Session
Identification of novel lncRNAs in ovarian cancer and their impact on overall survival
*University of Iowa Hospitals and Clinics, Iowa City, IA, USA, bGynecologic Oncology, Iowa City, IA, USA

Objective: Long noncoding RNAs (lncRNA) are RNA sequences that do not encode proteins and are greater than 200 nucleotides in length. They regulate complex cellular mechanisms including those implicated in cancer genesis and have been associated with prognosis in various types of cancer. We aimed to identify lncRNA sequences associated with high-grade serous ovarian cancer (HGSOC) and assess their impact on overall survival.

Method: RNA was extracted from 112 HGSOC patients and 12 normal fallopian tube samples from our Biobank tissue repository. RNA was sequenced through Illumina RNA sequencing. The Ultrafast and Comprehensive lncRNA detection and quantification pipeline (UClncR) was used for identification of lncRNA sequences. Univariate logistic and multivariate lasso regression analyses identified lncRNA associated with HGSOC. Univariate and multivariate Cox proportional hazard ratios were used to evaluate independent predictors of survival.

Results: A total of 1,943 of 16,325 investigated lncRNAs were differentially expressed in HGSOC compared to controls ($P < 0.001$). Nine of these demonstrated association with cancer after multivariate lasso regression. Our multivariate analysis of survival identified 20 lncRNAs associated with survival in HGSOC. Nine out of these 20 were found to be independently significant after accounting for all clinical covariates. Three of these lncRNAs were associated with improved outcomes in HGSOC, and 6 were associated with decreased survival.

Conclusion: We identified 9 lncRNAs independently associated with HGSOC. The decreased expression of these lncRNAs in HGSOC could be related to the decreased regulation exhibited in HGSC. In addition, 9 different lncRNAs were independently associated with survival outcomes in these patients: 3 with improved and 6 with decreased survival. Most significantly, AC105105.4 was a strong predictor of poor overall survival. More research is needed, but there is potential for these lncRNAs to be used as biomarkers of HGSOC or predictors of treatment outcome in the future.

231 - Poster Session
Lack of utility of the Khorana score for predicting VTE in advanced ovarian cancer
bThe University of Texas MD Anderson Cancer Center, Houston, TX, USA, cA Beneficência Portuguesa de São Paulo, São Paulo, Brazil

Objective: Advanced ovarian cancer is associated with a high rate of venous thromboembolism (VTE). The Khorana score is a validated measure that has been used to identify cancer patients at high risk for VTE. We sought to determine the utility of the Khorana score in predicting VTE in patients with advanced ovarian cancer during primary therapy.

Method: A retrospective cohort study was performed from January 2013 to September 2017. Patients with advanced disease were triaged by laparoscopy to determine resectability at primary debulking surgery (PDS). Patients who were medically inoperable or had distant metastatic disease received neoadjuvant chemotherapy (NACT). VTE was evaluated from the first cycle of NACT or after PDS until the end of adjuvant chemotherapy. The Khorana score was assigned to each patient and a score ≥2 was defined as high risk. The
utility of a high-risk Khorana score in predicting VTE was stratified by patients receiving PDS and adjuvant chemotherapy compared to NACT. Logistic regression was used to identify the prognostic significance of the Khorana score on occurrence of VTE.

Results: A total of 699 patients were included; 452 patients underwent NACT and 231 underwent PDS. A total of 53 (7.6%) patients developed VTE. The proportion of patients with VTE was higher in the NACT (n = 46, 11%) than in the PDS groups (n = 7, 3.1%, \( P < 0.001 \)). Ten patients developed VTE during NACT (n = 10, 2.2%). More patients in the NACT (63%) group had a high-risk Khorana score than those in the PDS (42%) group (\( P < 0.001 \)). In the entire cohort, a high-risk Khorana score did not predict occurrence of VTE (55% vs. 68%, \( P = 0.07 \)). Similarly, in the NACT cohort (70% vs 63%, \( P = 0.36 \)) and those diagnosed with VTE during NACT (50% vs 64%, \( P = 0.38 \)), a high-risk Khorana score did not predict occurrence of VTE. A high-risk Khorana score was not prognostic for the occurrence of VTE in the entire cohort (\( OR = 1.74, 95\% CI 0.96–3.16, P = 0.07 \)), NACT cohort (\( OR = 1.36, 95\% CI 0.70–2.64, P = 0.36 \)), and during NACT (\( OR = 0.57, 95\% CI 0.16–2.01, P = 0.39 \)).

Conclusion: Although a high-risk Khorana score was seen more frequently in the NACT cohort, it did not accurately predict those patients at high risk for VTE occurrence. Use of the Khorana score to determine candidacy for routine thromboprophylaxis in patients with advanced ovarian cancer should be used with caution until disease-specific data exist outside of the postoperative setting.

---

232 - Poster Session
Analysis of advanced quantitative computed tomography imaging features in predicting progression free survival of advanced epithelial ovarian cancer
J.B. DiSilvestro\(^a\), P.A. DiSilvestro\(^a\), A. Pandey\(^b\), J. Gordon\(^b\), J. Ball\(^b\) and K. Moxley\(^c\).
\(^a\)Women & Infants Hospital, Brown University, Providence, RI, USA, \(^b\)Tempus, Inc., Chicago, IL, USA, \(^c\)The University of Oklahoma, Oklahoma City, OK, USA

Objective: Recent research efforts have focused on identifying novel clinical and imaging biomarkers capable of predicting optimal surgical resection, tumor response, and disease-specific outcomes. The objective of this study is to demonstrate the utility of quantitative CT image analysis in predicting progression-free survival (PFS) for advanced-stage epithelial ovarian cancer.

Method: Our initial retrospective cohort identified 40 patients who had CT imaging completed prior to cytoreductive surgery. The images and clinical outcomes data were evaluated using an established imaging platform at Tempus Labs, Inc. Primary and secondary lesions were identified by a trained radiologist. More than 2,000 quantitative imaging (radiomic) features were extracted from these images, and by using the Tempus proprietary imaging platform, feature selection was performed to identify factors predictive of PFS, defined as the interval of time from diagnosis to progression. Area under the curve (AUC) analysis of radiomic features was completed comparing PFS greater or less than 20 months. Statistical significance was calculated using single-sided \( t \) test.

Results: We analyzed 40 patients who had their initial debulking surgery with at least 1 year of follow-up. The mean age was 60.2 years (range 31–80 years). Thirty-eight cases were high-grade serous histology (95%), 2 were clear cell, and 1 was carcinosarcoma. The majority of cases were FIGO stage IIIC (73%) with 5 stage IV disease. At the time of the primary debulking surgery, 35% had no gross residual disease, 35% optimal (< 1 cm remaining disease), and 30% suboptimal (≥1 cm remaining disease). The univariate analysis identified 66 radiomic features with an AUC greater than 0.7 and \( P < 0.01 \) for primary lesions. Similarly, 31 predictive radiomic features were identified for secondary lesions. Within the 4 imaging feature categories, the top 3 predictive radiomic features were selected (Table 1).

Conclusion: Quantitative radiomic features can be used to predict PFS in advanced-stage ovarian cancer. Further development of this concept will be performed in a larger retrospective cohort with the ultimate goal of a prospective validation.

Table 1. Radiomic features associated with progression free survival greater than 20 months.

<table>
<thead>
<tr>
<th>Feature Category</th>
<th>Feature Name</th>
<th>AUC</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Lesions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shape</td>
<td>original_shape_SurfaceVolumeRatio</td>
<td>0.580</td>
<td>0.045</td>
</tr>
<tr>
<td></td>
<td>original_shape_SphericalDisproportion</td>
<td>0.542</td>
<td>0.765</td>
</tr>
<tr>
<td></td>
<td>original_shape_Sphericity</td>
<td>0.458</td>
<td>0.767</td>
</tr>
<tr>
<td>Intensity</td>
<td>original_firstorder_InterquartileRange</td>
<td>0.665</td>
<td>0.035</td>
</tr>
<tr>
<td></td>
<td>original_firstorder_RobustMeanAbsoluteDeviation</td>
<td>0.658</td>
<td>0.037</td>
</tr>
</tbody>
</table>
233 - Poster Session
Utility of a chemo-response pathologic score to predict outcomes in patients undergoing neoadjuvant chemotherapy for advanced ovarian cancer
Y. Zhong, J. Liu, S.N. Westin, A. Malpica, B.C. Lawson, B. Fellman, R.L. Coleman, A.K. Sood and N.D. Fleming. The University of Texas MD Anderson Cancer Center, Houston, TX, USA

Objective: The aim of this study was to create and validate a chemo-response pathologic scoring system to predict outcomes in patients with advanced ovarian cancer being treated with neoadjuvant chemotherapy.

Method: A retrospective cohort study was performed from January 1990 to December 2018 on patients with advanced ovarian cancer treated with neoadjuvant chemotherapy (NACT). All patients studied underwent interval tumor reductive surgery and had tissue available for analysis. One gynecologic pathologist performed review of defined pathologic criteria. Data were used to identify and validate a pathologic chemotherapy response score (CRS) to correlate with response to NACT and progression-free survival (PFS) and overall survival (OS). Regression analysis and an interaction test were used to create our CRS model.

Results: A total of 245 patients were divided into a derivation set (n = 78) and validation set (n = 167). Most patients had stage IIIC disease (42%) and were BRCA negative (71%). Median follow-up was 36 months (6.3–160 months). In the derivation set, higher scores for CRS (42.2 vs. 26.9 months, P = 0.01) and pattern of tumor infiltration (42.2 vs. 33.6 months, P = 0.03) were associated with improved OS. Similarly, higher scores for CRS (18.4 vs. 11.1 months, P = 0.002) and pattern of tumor infiltration (18.4 vs. 11.3 months, P = 0.002) were associated with improved PFS. In the validation set, the same cut point for high CRS was also associated with improved PFS (HR = 0.65, 95% CI 0.45–0.92, P = 0.016) compared to the derivation set (HR = 0.48, 95% CI 0.3–0.77, P = 0.002). Test of calibration showed similar discrimination of the model in both datasets.

Conclusion: A higher CRS score in our data was associated with improved survival outcomes. Utility of a CRS score at the time of interval TRS could be used to identify patients at high risk for recurrence and to consider different adjuvant therapy strategies or clinical trials.
**234 - Poster Session**

**Progesterone induces pyroptosis of p53-defective fimbrial epithelial cells through the paracrine by stromal fibroblast**

X. Zhang, N. Wu and J. Wang, Hunan Cancer Hospital and the Affiliated Cancer Hospital of Xiangya School of Medicine, Central South University, Changsha, China

**Objective:** Incessant ovulation and fimbrial origin with p53 deficiency have been considered the essential issues for ovarian cancer initiation. We previously reported that a physiologically high level of progesterone (P4) in the ovulating follicular fluid could eliminate p53-defective fimbrial epithelial cells by inducing necroptosis through the TNF-α/RIPK1/RIPK3/MLKL pathway, suggesting a preventive effect against cancer development. Epidemiological studies show that oral pill use can effectively prevent the occurrence of ovarian cancer. However, the increase P4 in serum is relatively low compared to that on treated epithelial cells. Our mouse model also found that in vivo a similar P4 level could wipe out p53-defective epithelial cells on oviduct. We therefore speculated that the systemic effect of P4 on the stroma, not directly on the epithelial, may exert cytotoxic activity through paracrine.

**Method:** Normal fimbrial fibroblasts were cultured with or without 1 uM P4, and the conditioned medium was collected regularly. Using a series of immortalized p53-defective human fimbrial epithelial cell lines and ovarian cancer cell lines, we compared cell viability, RNA levels, and protein expression levels, after the collected condition medium was treated. Further, cytokine array and RNA-sequencing analysis of P4-treated fibroblasts were done. Long and constitutive delivery of P4 by a capsule (Model 1004 pump)-releasing in ID8 cells-induced mouse ovarian HGSC model was used to verify the P4 effect on cancer prevention.

**Results:** Relative to control, exposure to the conditioned medium treated with P4 was associated with lower cell viability, and the effect could be blocked by progesterone receptor (PR) inhibitor, RU 486. Through extended treatments of P4, fibroblasts secreted more cytokines related to inflammation, including interleukin 6 (IL-6) and interleukin 8 (IL-8). Western blot analysis showed that the expression of proteins related to pyroptosis was upregulated after the conditioned medium was treated and could be ameliorated by PR inhibition. Moreover, the vehicle-treated mice showed significant tumor burden compared to P4-treated mice, and tumor size was related to the length of P4 treatment.

**Conclusion:** The results provide evidence that P4 can coordinate with stromal cells in ovarian cancer prevention. Therefore, it might explain the association between oral pill use and its additional role in reducing the risk of ovarian cancer.

---

**235 - Poster Session**

**Prognostic assessment of forkhead box protein O1 (FOXO1) and paired box 3 (PAX3) in epithelial ovarian cancer**

G.H. Hana, D. Chunga, D.B. Chayb, H. Chob, S. Kimb and J.H. Kima, Gangnam Severance Hospital, Seoul, South Korea, bYonsei University College of Medicine, Seoul, South Korea

**Objective:** The transcription factor Forkhead box protein O1 (FOXO1) has been reported to play an important role in various human cancers. However, its role in epithelial ovarian cancer (EOC) has not yet been clarified. Here, we evaluated the expression and clinical significance of FOXO1 in EOC.

**Methods:** Immunohistochemical analyses of FOXO1 and PAX3 in 212 EOCs, 57 borderline ovarian tumors, 153 benign epithelial ovarian tumors, and 79 nonadjacent normal epithelial tissues were performed using tissue microarray. Various clinicopathological variables, including the survival of EOC patients, were compared. In addition, the effect of FOXO1 on cell growth was assessed in EOC cell lines.

**Results:** FOXO1 and PAX3 protein expression levels were significantly higher in EOC tissues than in nonadjacent normal epithelial tissues, benign tissues, and borderline tumors (all \( P < 0.001 \)). Over-expression of FOXO1 was significantly associated with poor grade (\( P = 0.004 \)). In EOC tissues, FOXO1 expression was positively correlated with PAX3 expression (Spearman \( \rho = 0.118, P = 0.149 \)). Multivariate survival analysis revealed that high FOXO1 expression (HR = 2.74, 95% CI 1.22–13.10, \( P = 0.001 \)) could be an independent prognostic factor for overall survival. Most importantly, high expression of both FOXO1 and PAX3 showed a high hazard ratio (5.53, 95% CI 2.47–12.40, \( P < 0.001 \)) for overall survival. These in vitro results demonstrated that knockdown of FOXO1 was associated with decreased cell viability, migration, and colony formation.

**Conclusion:** This study revealed that high expression of FOXO1 and PAX3 is an indicator of poor prognosis in EOC. Our results suggest the promising potential of FOXO1 and PAX3 as prognostic and survival markers. The possible link between the biological functions of FOXO1 and PAX3 in EOC warrants further studies.

---

**236 - Poster Session**

**Impact of an early time to initiate chemotherapy on survival for patients with complete cytoreduction for advanced epithelial ovarian cancer**

S.M. Eisenkop, Women’s Cancer Center-Southern California, Agoura Hills, CA, USA
Objective: The purpose of this study is to investigate the prognostic (OS and PFI) influence of the time to initiate chemotherapy (TTC) relative to the distribution of abdominal disease (DAD), complexity of surgery (CS), and other reported prognostic variables after primary cytoreductive surgery (PriCRS) for patients with epithelial ovarian cancer (EOC) and complete cytoreduction (R0).

Methods: The clinical, laboratory, pathology, DAD, CS, and TTC data were recorded in SPSS within 48 hours of availability prospectively for 568 patients with stage IIb–IV EOC from January 2000 to December 2018. A total of 511 (89.9%) R0 patients were categorized into a TTC of ≤14 days (157 patients) versus 15–28 days (199 patients) versus >28 days (155 patients). The PFI and overall survival (OS) for categorical variables was compared by univariate analysis with a Kaplan-Meier analysis. Variables significant on univariate analysis (P ≤ 0.05) were evaluated on multivariate analysis with Cox regression.

Results: On univariate analysis, the PFI and OS were influenced by the TTC (Figure 1), age, age-adjusted Charlson comorbidity (AACC), ECOG, CA-125, grade, histology, ascitic volume, size of largest metastatic disease, CS, and DAD; the PFI was influenced by use of maintenance therapy (MT). On multivariate analysis the PFI was associated with the TTC (<14 days, HR = 1.00; 15–28 days, HR = 1.201; >28 days, HR = 1.677; P = 0.002), AACC (0–1, HR = 1.00; 2–3, HR = 1.050; >4, HR = 1.751; P = 0.025), grade (1, HR = 1.00; 2, HR = 2.655; 3, HR = 2.234; P = 0.016), histology (Ser, HR = 1.00; other, HR = 1.394; P = 0.019), DAD (Fagotti 0, HR = 1.00; 2–6, HR = 1.460; ≥8, HR = 2.165; P = 0.019), and MT (Y, HR = 1.00; N, HR = 1.597; P = 0.007). The OS was associated with the TTC (<14 days, HR = 1.00; 15–28 days, HR = 1.751; >28 days, HR = 2.802; P = 0.003), AACC (0–1, HR = 1.00; 2–3, HR = 1.180; >4, HR = 2.141; P = 0.012), grade (1, HR = 1.00; 2, HR = 3.390; 3, HR = 2.911; P = 0.044), histology (Ser, HR = 1.00; other, HR = 1.569; P = 0.006), CA-125 (≤500, HR = 1.00; 500–1,000, HR = 1.269; >1,000, HR = 1.608; P = 0.034), and DAD (Fagotti 0, HR = 1.00; 2–6, HR = 1.559; ≥8, HR = 2.352; P = 0.025; Eisenkop 1–4, HR = 1.00; 5–10, HR = 1.248; 11–15, HR = 1.728; P = 0.038).

Conclusion: For patients with EOC rendered R0, the TTC rapidity independently influenced the PFI and OS, with efficacy extended to a TTC ≤14 days (Figure 1). It would be of value to confirm efficacy of an early TTC in a phase III series with concurrent correlation of biological markers to determine patients who benefit most from early TTC, as confirmation of efficacy of early TTC would be applicable to use in a phase III study with HIPEC.

Fig. 1. Overall survival – analyzed by TTC.

237 - Poster Session

Clinical significance of tumor infiltrating lymphocytes in hormone receptors positive epithelial ovarian cancer


aGangnam Severance Hospital, Seoul, South Korea, bYonsei University College of Medicine, Seoul, South Korea, cNational Cancer Institute, Bethesda, MD, USA, dSungkyunkwan University School of Medicine, Seoul, South Korea

Objective: The efficacy of systemic cancer therapy often correlates with the presence of certain types of hormone receptors. In breast cancer, a larger proportion of tumor-infiltrating lymphocytes (TILs) is associated with particular hormone receptor expression patterns.
However, the relationship between TILs and hormone receptor expression has not been explored in epithelial ovarian cancer (EOC). In this study, we investigated the relationship between hormone receptor expression and TILs in EOC.

**Methods:** Immunohistochemical analysis of estrogen receptor α (ERα), estrogen receptor β (ERβ), progesterone receptor (PR), androgen receptor (AR), and glucocorticoid receptor (GR) were performed by using tissue microarray analysis of 358 EOC tissues, and the data were compared with clinic pathological variables, including survival. We also assessed proportions of CD4+, CD8+, CD3+, and FoxP3+ from 138 EOC tissues by immunohistochemistry.

**Results:** Expressions of AR, GR, and PR were reduced drastically in ovarian cancer tissues ($P < 0.001$), while ERα and ERβ increased significantly in ovarian cancer tissues ($P < 0.001$ and $P = 0.034$, respectively) compared to normal epithelium. By clustering analysis, the subgroup expressing all receptors showed poor disease-free survival (DFS) ($P < 0.023$). The Cox proportional hazards model demonstrated that hormone receptor expression was an independent prognostic factor for DFS ($HR = 3.89$, 95% CI 1.35–11.19, $P = 0.012$). Also, we evaluated the relationship between the proportion of CD4+, CD8+, CD3+, or FoxP3+ TILs and the status of hormone receptor expression. The ratio of CD3+ to FoxP3+ TILs was significantly decreased in all hormone receptor-positive groups compared to others ($P < 0.021$). Notably, the differential composition of TILs was related to FIGO stage, cell type, tumor grades, and elevation of CA-125.

**Conclusion:** Hormone receptors were expressed in the majority of ovarian cancers, and clustering analysis revealed that ovarian cancer expressing all 5 hormone receptors showed poor DFS. By incorporating analyses of immune response, the inverse relationship between the ratio of CD3+ to FoxP3+ TILs and hormone receptor expression allowed us to hypothesize the inhibitory effect of the immune microenvironment via hormones.

238 - Poster Session  
**Predictive value of CIRS severity index on survival in elderly women (>= 70 years) with advanced epithelial ovarian cancer**  
aPusan National University Yangsan Hospital, Yangsan-si, South Korea, bH. Lee Moffitt Cancer Center & Research Institute, Tampa, FL, USA, cJames Graham Brown Cancer Center, University of Louisville, Louisville, KY, USA

**Objective:** This study assessed the predictive value of age and Cumulative Illness Rating Scale (CIRS) severity index on the management of advanced-stage epithelial ovarian cancer (EOC) patients 70 years or older.

**Method:** A retrospective chart review was performed in elderly women (≥70 years) with advanced EOC cancer at a Moffitt Cancer Center between January 2007 and April 2016. Exclusion criteria included nonepithelial histology, stage less than IIIC, low grade, or incomplete medical records. Clinical data were analyzed according to the following age group categories: group 1, 70–74 years; group 2, 75–79 years; and group 3, older than 79 years.

**Results:** One hundred twenty-seven patients were identified (66 patients in age group 1, 35 in group 2, and 26 in group 3). There were no differences in clinicopathologic data between the 3 age groups. Optimal debulking rate (77.2% in age group 1, 82.8% in group 2, and 76.9% in group 3, $P = 0.78$), completeness of adjuvant chemotherapy (80.3% in age group 1, 82.8% in group 2, and 65.3% in group 3, $P = 0.21$), platinum sensitivity, and the utilization of growth factor were similar among groups. Multivariate analyses demonstrated that only the pretreatment assessment of CIRS severity index was an independent prognostic factor for OS in elderly women (>70 years) with advanced EOC (HR = 0.52, $P = 0.02$). Older age (≥75 years vs 70–74 years) was not associated with decreased OS in this cohort.

**Conclusion:** High CIRS severity index could be a predictor of poor survival in elderly women (≥70 years) with advanced EOC.

239 - Poster Session  
**Shorter interval to subsequent therapy following a PARP inhibitor is associated with poor tolerance of the subsequent therapy (post-PARPi therapy)**  

**Objective:** The purpose of this study was to determine whether time to initiation of subsequent therapy after discontinuation of a PARP inhibitor (PARPi) has an impact on tolerance of the subsequent therapy (post-PARPi therapy) and whether tolerance of post-PARPi therapy has an impact on clinical outcomes.

**Method:** We queried our specialty pharmacy database for ovarian cancer patients who received PARPi and then post-PARPi therapy from January 2016 to August 2019. Poor tolerance of post-PARPi therapy was defined as either a treatment-related hospitalization or delay in treatment due to cytopenia. We calculated number of days between last dose of PARPi and first dose of post-PARPi therapy.
Progression-free survival (PFS) was calculated from first day of post-PARPi therapy to progression. Descriptive statistics as well as the Mann Whitney U test, Kaplan-Meier curves with log rank test, and logistic regression were utilized.

**Results:** Thirty-nine patients met inclusion criteria: 16 (41%), 13 (33%), and 10 (26%) patients were treated with rucaparib, niraparib, and olaparib, respectively. Post-PARPi therapy included platinum doublets (46%), single-agent therapies (44%), or clinical trials (10%). There were 22 patients (56%) who had tolerance of post-PARPi therapy and 17 (44%) who had poor tolerance. Patients received a median of 3 lines of therapy prior to PARPi (range 1–10), which did not differ among groups ($P = 0.18$). The most common adverse event was bone marrow suppression (41%). The median number of days between discontinuing PARPi and starting post-PARPi therapy was 16 (range 6–28) for those with poor tolerance versus 47 (range 13–142) for those with tolerance ($P < 0.01$). There was no significant difference in median PFS on post-PARPi therapy between groups (4.0 vs 4.1 months, HR = 1.16, 95% CI 0.57–2.39). Patients received a median of 2 lines of therapy after PARPi (range 1–7), which did not differ among groups ($P = 0.73$). The odds of tolerating post-PARPi therapy increased by 14% for each additional day prior to starting post-PARPi therapy (OR = 1.14, 95% CI 1.05–1.24).

**Conclusion:** Longer time between discontinuation of PARPi and post-PARPi therapy was associated with better tolerance of post-PARPi therapy and did not have a negative impact on number of subsequent lines of therapy or PFS on post-PARPi therapy.

---

**240 - Poster Session**

**Utilization of maintenance therapy for platinum-sensitive recurrent ovarian cancer**


**Objective:** Maintenance therapy can extend progression-free survival (PFS) in platinum-sensitive recurrent ovarian cancer. Patients with a somatic or germline *BRCA* mutation have greater clinical benefit with maintenance PARP inhibitor (PARPi) than those with wildtype. Roughly 50% of patients eligible for maintenance therapy do not receive it, and variation in prescribed therapy (bevacizumab [BEV] vs PARPi) exists. Our objective was to analyze institutional utilization of maintenance therapy in platinum-sensitive recurrent ovarian cancer.

**Method:** This retrospective cohort study evaluated platinum-sensitive recurrent ovarian cancer patients from September 2018 to July 2019 completing second-line or greater platinum-based chemotherapy for 3–8 cycles after March 27, 2017 (date of FDA approval for PARPi maintenance). Percentage of patients and type of maintenance received after platinum-based therapy was assessed. We calculated PFS in patients recurring on maintenance as date of initiation of platinum-based chemotherapy until disease progression or death regardless of whether they were on maintenance (PFS definition in BEV maintenance phase III clinical trials). Patients were excluded if maintenance was stopped because of adverse reactions. Difference in *BRCA* status between groups was evaluated.

**Results:** Eighty-one platinum-sensitive recurrent ovarian cancer patients met inclusion criteria: 16 (41%), 13 (33%), and 10 (26%) patients were treated with rucaparib, niraparib, and olaparib, respectively. Post-PARPi therapy included platinum doublets (46%), single-agent therapies (44%), or clinical trials (10%). There were 22 patients (56%) who had tolerance of post-PARPi therapy and 17 (44%) who had poor tolerance. Patients received a median of 3 lines of therapy prior to PARPi (range 1–10), which did not differ among groups ($P = 0.18$). The most common adverse event was bone marrow suppression (41%). The median number of days between discontinuing PARPi and starting post-PARPi therapy was 16 (range 6–28) for those with poor tolerance versus 47 (range 13–142) for those with tolerance ($P < 0.01$). There was no significant difference in median PFS on post-PARPi therapy between groups (4.0 vs 4.1 months, HR = 1.16, 95% CI 0.57–2.39). Patients received a median of 2 lines of therapy after PARPi (range 1–7), which did not differ among groups ($P = 0.73$). The odds of tolerating post-PARPi therapy increased by 14% for each additional day prior to starting post-PARPi therapy (OR = 1.14, 95% CI 1.05–1.24).

**Conclusion:** Consistent with randomized control trials, maintenance therapy prolonged PFS in platinum-sensitive recurrent ovarian cancer patients. At our institution, >75% of patients eligible for maintenance therapy received it. While 23% of patients did not receive maintenance, this could have been based on a multitude of factors, including physician/patient combined decision making.

---

**241 - Poster Session**

**Low-grade serous ovarian cancer: Prognostic impact of initial tumor load--A GINECO group and TMRG network study**

I.L. Ray-Coquard, a, b, F. Lecuru, c, d and H. Bonsang-Kitzis, c, d. aCentre Léon Bérard and University Claude Bernard and Groupe d’Investigateurs Nationaux pour l’Etude des Cancers Ovariens (GINECO), Lyon, France, bCentre Leon Berard, Lyon, France, cARCAGY-GINECO, Paris, France, dHôpital Européen Georges-Pompidou, Paris, France

**Objective:** Complete resection of disease is the most important prognostic factor for patients with low-grade serous ovarian carcinoma (LGSOC). However, the implication of peritoneal carcinomatosis distribution and implant size according to their location is poorly investigated. Our objective was to assess the impact of peritoneal carcinomatosis quantitative and qualitative localizations on progression-free survival (PFS) and overall survival (OS) in patients with LGSOC after complete cytoreductive surgery.

---
Method: We performed a retrospective analysis of a prospective nationwide registry (TMRG–GINECO). Between January 2010 and July 2017, we included patients with stage III–IV LGSOC without residual disease (CC0 score) after primary debulking surgery (PDS) or after interval debulking surgery (IDS) following neoadjuvant chemotherapy (NACT). Peritoneal carcinomatosis was assessed according to qualitative criteria (anatomical distribution, embryological origin, areas rich in adipocytes, gastrointestinal involvement) and quantitative criteria (size of carcinomatosis implants according to PCI). Primary endpoint was PFS in the whole population. Secondary endpoints included OS in the whole population and PFS in the two subgroups, PDS and IDS.

Results: Eighty-four patients were included. At 60 months, PFS was 37.1% (25.4%–54.2%), and OS was 75.3% (63.8%-89.0%). On the whole population, bowel resection and involvement of adipocytes-enriched areas were significantly associated with a decreased PFS and OS, respectively. No location was associated with PFS or OS in the PDS subgroup. In the IDS subgroup, lesser omentum involvement was associated with a decreased OS, and greater omentum involvement tended to be associated with a decreased PFS.

Conclusion: Adipocytes-enriched areas and bowel involvement were associated with poor prognosis (PFS and OS) in patients receiving PDS. Larger scale studies are needed to confirm whether initial tumor load has a prognostic impact after complete cytoreductive surgery and to identify a potentially different impact on the PDS or IDS groups.

242 - Poster Session
Investigating the impact of neuropilin-1 on the interaction of carcinoma-associated mesenchymal stem cells and the immune tumor microenvironment in ovarian cancer
C.K. Chandler, L. Coffman and T.C. Bruno. Magee-Womens Hospital of UPMC, Pittsburgh, PA, USA

Objective: Ovarian cancer exists within a complex tumor microenvironment critical to supporting tumor survival, growth, and metastasis. Within the tumor microenvironment, tumor-stromal-immune cell interactions create an immunosuppressive environment and facilitate treatment resistance. Antitumor T cells are associated with improved patient survival, while immunosuppressive cells T regulatory cells (Tregs) are associated with decreased survival. Previous data demonstrate that Tregs within ovarian cancers have increased neuropilin-1 (NRP-1), a cell surface protein that enhances Treg function and stability. Carcinoma-associated mesenchymal stem cells (CAMSCs) are important protumorigenic cells that exert their effects through direct interaction with tumor cells. Further, CAMSCs also express NRP-1, which potentially homodimerizes with NRP-1 on Tregs, facilitating direct CAMSC–Treg interactions. We hypothesize that CAMSCs are recruiters of intratumoral NRP-1 + Tregs, which increase immunosuppression within the tumor microenvironment, and that CAMSCs directly interact with Tregs through NRP-1 mediated binding.

Method: Through in vitro adhesion assays from patient-derived samples, we demonstrate CAMSCs bind Tregs in a NRP-1 dependent manner.

Results: Work from patient-derived samples demonstrates CAMSCs preferentially form heterocellular complexes with tumor cells and immune cells in human ascites. In addition, through in vitro adhesion assays it is clear that Tregs enriched for NRP-1 expression bind at a higher rate to CAMSCs, and this can be blocked with specific NRP-1 directed antibodies. We also demonstrate CAMSCs enhance Treg proliferation and immunosuppressive functions using an in vitro microsuppression assay. Isolation of heterocellular complexes from ascites from women with high-grade serous ovarian cancer confirms CAMSC tumor cells complexes are enriched with Tregs.

Conclusion: Collectively, this work indicates a novel role of CAMSCs in the ovarian tumor microenvironment, facilitating immune suppression via NRP-1 mediated Treg interactions. NRP-1 blocking agents are currently in phase 1 trials and may represent a future avenue for attempts at directed immune therapy in ovarian cancer.

243 - Poster Session
Oncologic outcomes and morbidity following heated intraperitoneal chemotherapy at cytoreductive surgery for primary epithelial ovarian cancer: A systematic review and meta-analysis
G. Bouchard-Fortier, M.C. Cusimano, R. Fazelzadeh, K. Sajewycz, L. Lu, S.E. Ferguson and T. May. Princess Margaret Cancer Centre, University Health Network, Toronto, ON, Canada, University of Toronto, Toronto, ON, Canada, Princess Margaret Cancer Centre, University of Toronto, Toronto, ON, Canada, Queen’s University, Kingston, ON, Canada

Objective: The addition of heated intraperitoneal chemotherapy (HIPEC) to interval cytoreductive surgery in the treatment of primary epithelial ovarian cancer (EOC) was associated with a 12-month overall survival (OS) benefit in a landmark randomized trial. There remains uncertainty in the literature about the clinical value and safety of HIPEC in ovarian cancer. The aim of this systematic review and meta-analysis was to assess oncologic outcomes and perioperative morbidity following HIPEC among patients with primary EOC.

Method: We searched MEDLINE, EMBASE, the Cochrane Central Register of Controlled Trials, and the Cochrane Database of Systematic Reviews, from inception to August 2, 2019, for observational and randomized studies of primary EOC patients undergoing HIPEC at the
time of cytoreductive surgery. We assessed risk of bias using the Institute of Health Economics Quality Appraisal Checklist for single-arm cohort studies, Newcastle-Ottawa Quality Scale for double-arm cohort studies, and Cochrane Collaboration’s Tool for Assessing Risk of Bias for randomized trials. We qualitatively summarized survival outcomes and calculated the pooled proportion of 30-day grade III–IV morbidity and postoperative death.

**Results:** We identified 34 articles including 1,928 patients with primary EOC, including only 1 randomized trial. The timing, temperature, and chemotherapeutic agents used for HIPEC differed across studies. Reported OS following HIPEC at cytoreductive surgery was also highly variable (3-year OS range 48%-77%); 3 comparative studies demonstrated a significant survival benefit associated with HIPEC, while 2 did not. Thirteen articles were included in a meta-analysis to evaluate the perioperative outcomes following HIPEC. The pooled proportions for grade III–IV morbidity and postoperative death at 30 days were 34.0% (95% CI 17.0–56.0) and 3.0% (95% CI 1.0–5.0), respectively.

**Conclusion:** There is significant heterogeneity in current literature on HIPEC for primary EOC, with respect to an appropriate regimen as well as both short- and long-term outcomes. HIPEC in conjunction with cytoreductive surgery is associated with significant morbidity, but few studies compared the combination to surgery alone. High-quality prospective randomized controlled trials are urgently needed to establish the role of HIPEC at cytoreductive surgery in the first-line treatment of primary EOC.

---

**244 - Poster Session**  
**Immune and genomic profiling of small cell carcinomas of the ovary hypercalcemic type**  

**Objective:** Small cell carcinomas of the ovary hypercalcemic type (SCCOHT) are rare but aggressive cancers characterized by inactivating mutations in *SMARCA4*. We sought to investigate the mutational and immunologic landscape of SCCOHTs to gain insight into evolution of the tumor and tumor microenvironment with standard chemotherapy or immune checkpoint blockade (ICB).

**Method:** DNA from 7 SCCOHTs and matched normals were subjected to whole exome sequencing. Three patients were treated with ICB. Somatic mutations, copy number alterations, mutational signatures, and clonal decomposition were determined using validated bioinformatics methods. Representative tissue sections from 9 cases were subjected to multiplex immunofluorescence (IF) microscopy, and specific leukocyte subsets were quantified using the HALO software.

**Results:** All patients had somatic (6) or germline (1) loss-of-function *SMARCA4* mutations. The median number of somatic mutations identified in the primary SCCOHTs was 51 (12–105), of which 35 (9–66) were nonsynonymous. No amplifications or homozygous deletions were found. Of the 5 cases with recurrence, 3 were post-ICB and 2 were post-chemotherapy. We noted that the recurrences of 2 SCCOHTs after ICB had acquired a large number of mutations (55 and 44), which was not observed in a tumor that recurred post-chemotherapy alone. Multiplex IF analysis revealed heterogeneity in tumor immune infiltration, with PD-L1 positivity in the majority of cases. Interestingly, tumor recurrence after ICB was associated with an increase in CD8+Ki67+, Tregs, and CD68+PDL1+ cells, which was not observed in a tumor that recurred post-chemotherapy alone.

**Conclusion:** While patients with SCCOHT frequently benefit from ICB, recurrent tumors demonstrate genetic and tumor microenvironment evolution, paradoxically characterized by increase in mutational burden and immune infiltration in some cases. Understanding of the mechanisms of immune recognition and escape in SCCOHT will be essential for patient selection for ICB and development of combination therapies.

---

**245 - Poster Session**  
**Antibiotic use during chemotherapy negatively impacts outcomes in women with advanced epithelial ovarian cancer: Is an intact microbiome essential for optimal platinum chemotherapy response?**  
aThe Cleveland Clinic Foundation, Cleveland, OH, USA, bCleveland Clinic, Cleveland, OH, USA

**Objective:** Decreased response to platinum chemotherapy has been reported in animals treated with antibiotics targeted against gram-positive bacteria. The objective was to identify whether antibiotics, including those targeting gram-positive bacteria, during primary platinum chemotherapy have an impact on oncologic outcomes in women with advanced epithelial ovarian cancer (EOC).

**Method:** This study was a single-institution retrospective analysis of women with stage III–IV EOC diagnosed from 2009 to 2015 who underwent surgery and platinum chemotherapy. Patient and oncologic variables were recorded, including antibiotic use during primary platinum chemotherapy; gram-positive antibiotics were defined as Vancomycin, Daptomycin, and Linezolid. Kaplan-Meier analysis for
progression-free survival (PFS) and overall survival (OS) were performed from time of first treatment to progression and/or death. Cox proportional hazards regression multivariate models for gram-positive antibiotics were built based on backward selection.

**Results:** Of 382 eligible women, 131 (34.3%) were treated with antibiotics, and 42 (11.0%) received anti-gram-positive antibiotics during platinum chemotherapy. There was no difference in age ($P = 0.45$), neoadjuvant platinum chemotherapy ($P = 0.39$), stage ($P = 0.57$), histology ($P = 0.93$), and optimal cytoreduction ($P = 0.19$). With a median follow-up of 50.4 months, antibiotics resulted in worse PFS (17.4 vs 23.3 months) and 3-year recurrence-free survival (RFS) (19.3% vs 3.76%, HR = 1.51, 95% CI 1.19–1.91, $P < 0.001$) than no antibiotics. Similarly, patients who received antibiotics had worse OS (45.7 vs 66.4 months) and 3-year OS (58.8% vs 71.3%, HR = 1.65, 95% CI 1.27–2.15, $P < 0.001$). When stratified to consider only gram-positive antibiotics, those patients had a worse PFS (16.5 vs 21.6 months) and 3-year RFS (9.9% vs 33.7%, HR = 1.77, 95% CI 1.27–2.48, $P < 0.001$) than those who did not. Similarly, women who received gram-positive antibiotics had worse OS (35.0 vs 60.9 months) and 3-year OS (47.6 vs 69.5 months, HR = 2.12, 95% CI 1.48–3.02, $P < 0.001$). On multivariate analysis controlling for confounders, gram-positive antibiotics were significantly associated with increased risk of recurrence (HR = 1.86, $P = 0.004$) and cancer-specific death (HR = 2.12, $P < 0.001$).

**Conclusion:** Our results demonstrate that antibiotics, especially those targeted against gram-positive bacteria, during primary platinum chemotherapy are associated with decreased PFS and OS in women with EOC. This provides support that antibiotics during platinum chemotherapy worsen outcomes and this may be due to gut microbiome changes. Further study is needed to understand the mechanism of how antibiotics and the microbiome affect platinum chemotherapy response.

---

**246 - Poster Session**

**Doxorubicin-loaded oligonucleotide conjugated gold nanoparticles: A promising drug delivery system for ovarian cancer**

S. Jeon and H. Jeon. Soonchunhyang Cheonan Hospital, Cheonan, South Korea

**Objective:** Major cause of failure in the treatment of advanced ovarian cancer is chemoresistance. Gold nanoparticles (AuNPs) are promising drug delivery systems for overcoming chemoresistance. Doxorubicin (DOX) is one of the representative cancer chemotherapeutic agents and is widely used by many researchers as a chemotherapy agent in the drug delivery system; however, there have been limited data on ovarian cancer research. The aim of our study was to compare cytotoxic effect between DOX and DOX-loaded oligonucleotides (ONTs) attached to gold nanoparticles (AuNPs), called DOA, on ovarian cancer cell lines.

**Method:** We propose DOX-loaded ONTs attached to AuNPs (DOA) as a drug delivery system for cancer chemotherapy. We utilized AuNPs as the drug delivery vehicle, which were synthesized by chemical reduction to 13 nm in diameter. ONT AuNPs present numerous binding sites for DOX, facilitating the delivery of DOX to cancer cells. Transmission electron microscope (TEM) and fluorescence spectrometer were utilized for characterization of DOA. To compare drug efficacy of DOA with that of DOX, in vitro cytotoxicity and in vivo tumor growth inhibition were evaluated.

**Results:** We characterized DOA using TEM imaging of AuNPs. About 70% of DOX in solution could be bound to ONTs on AuNPs to become DOA, and about 28% of loaded DOX was released from the as-prepared DOA (Figure 1A). In MTT assay, significant reduction in the cell viability was detected in DOA-treated ovarian cancer cells (SKOV3, A2780, Hey A8) compared to DOX-treated cells ($P < 0.05$) (Figure 1B). Significant reduction of tumor volume was identified in tumor-bearing mice treated with DOA compared to those treated with DOX (Figure 1C).

**Conclusion:** Our results suggest that DOA is an effective drug delivery system for patients with ovarian cancer.

![Fig. 1](image-url) Analyses of in vivo mouse xenografts bearing tumor from SKOV3-GFP cell line. (A) Illustration of tumor regions in the mouse. (B) Differential tumor volume between control (PBS)-, DOX-, and DOA-treated mice. (C) Change in body weight during the course of the experiment in control (PBS)-, DOX-, and DOA-treated mice.
Factors associated with declining adjuvant chemotherapy in women with advanced ovarian cancer who accepted initial intervention: A National Cancer Database (NCDB) study

B.J. Matthews\textsuperscript{a}, M.M. Qureshi\textsuperscript{a,\textit{b}}, C.C. Nitschmann\textsuperscript{a}, S. Fiascone\textsuperscript{a,\textit{b}} and M.A. Dyer\textsuperscript{a,\textit{b}}.

\textit{a}Boston Medical Center, Boston, MA, USA, \textit{b}Boston University School of Medicine, Boston, MA, USA, \textit{c}Beth Israel Lahey Health, Burlington, MA, USA

Objective: The aim of this study was to identify factors predicting chemotherapy nonacceptance in women with advanced ovarian cancer who accepted primary surgery. A prior National Cancer Data Base (NCDB) analysis identified factors associated with chemotherapy refusal across all ovarian cancer cases, but the population who accept initial surgery and then decline recommended chemotherapy is not well studied.

Method: This retrospective cohort study identified ovarian cancer patients from 2004 to 2015 in the NCDB. Patients were included if they had a diagnosis of stage II–III ovarian cancer, had primary surgery, were recommended for adjuvant chemotherapy, and had sufficient data for factors in our core model (age, stage, comorbidity score, facility type, insurance status, race, Hispanic identity, education, postoperative hospital stay, and readmission). Multivariate logistic regression analyses evaluated factors associated with the NCDB code identifying that chemotherapy was recommended but "refused by the patient, a patient's family member, or the patient's guardian." Overall survival was assessed with Kaplan-Meier analysis. Adjusted hazard ratios (aHR) were computed using Cox regression modeling.

Results: Of 38,243 women who met inclusion criteria, 974 (2.5\%) declined adjuvant chemotherapy after primary surgery. Women declining chemotherapy were more likely to be age \(\geq70\) years (aOR = 2.76, \(P < 0.0001\)), to have stage II disease (aOR = 2.06, \(P < 0.0001\)), to have a comorbidity score of 2 or higher (aOR = 1.39, \(P = 0.022\)), to identify as Hispanic (aOR = 1.49, \(P = 0.004\)), or to have public insurance or no insurance (Table 1). Those who declined chemotherapy were less likely to be treated at academic or integrated cancer care programs (Table 1). Unplanned readmission, black race, and community education level were not significant factors. Declining chemotherapy was significantly associated with decreased median survival: 46 versus 131 months if stage II (aHR = 2.31, \(P < 0.0001\)) and 18 versus 48 months if stage III (aHR = 2.33, \(P < 0.0001\)).

Conclusion: Declining adjuvant chemotherapy after primary surgery for advanced ovarian cancer is associated with modifiable and unmodifiable variables. Further research in groups more likely to decline (e.g., women with stage II cancer, Hispanic women) could clarify reasons for not choosing chemotherapy.

| Table 1. Univariate and multivariate logistic regression model for odds of not getting chemotherapy due to the patient or patient family refusal. |

<table>
<thead>
<tr>
<th></th>
<th>Crude</th>
<th>Adjusted Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Events (%)</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-&lt;50</td>
<td>5,749</td>
<td>99 (1.7)</td>
</tr>
<tr>
<td>50-&lt;70</td>
<td>22,715</td>
<td>384 (1.7)</td>
</tr>
<tr>
<td>70 or older</td>
<td>9,779</td>
<td>491 (5.0)</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>34,177</td>
<td>853 (2.5)</td>
</tr>
<tr>
<td>Black</td>
<td>2,468</td>
<td>71 (2.9)</td>
</tr>
<tr>
<td>Other</td>
<td>1,598</td>
<td>58 (3.1)</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Hispanics</td>
<td>36,402</td>
<td>910 (2.5)</td>
</tr>
<tr>
<td>Hispanics</td>
<td>1,841</td>
<td>64 (3.5)</td>
</tr>
<tr>
<td><strong>Insurance status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private</td>
<td>20,094</td>
<td>307 (1.5)</td>
</tr>
<tr>
<td>Medicare/Other Govt.</td>
<td>14,730</td>
<td>563 (3.8)</td>
</tr>
<tr>
<td>Medicaid/Uninsured</td>
<td>3,419</td>
<td>104 (3.0)</td>
</tr>
<tr>
<td>% with no HS degree</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\geq21)</td>
<td>5,261</td>
<td>138 (2.6)</td>
</tr>
<tr>
<td>13-20.9</td>
<td>9,194</td>
<td>267 (2.9)</td>
</tr>
<tr>
<td>7-12.9</td>
<td>12,935</td>
<td>326 (2.5)</td>
</tr>
<tr>
<td>(&lt;7)</td>
<td>10,853</td>
<td>243 (2.2)</td>
</tr>
<tr>
<td><strong>Facility type</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(p\) values indicate statistical significance.
<table>
<thead>
<tr>
<th>Community program (CP)</th>
<th>1,122</th>
<th>44 (3.9)</th>
<th>Ref</th>
<th>Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehensive CP</td>
<td>13,822</td>
<td>396 (2.9)</td>
<td>0.72 (0.53-0.93)</td>
<td>0.045</td>
</tr>
<tr>
<td>Academic/Research</td>
<td>17,407</td>
<td>396 (2.9)</td>
<td>0.57 (0.41-0.72)</td>
<td>0.001</td>
</tr>
<tr>
<td>Integrated Network</td>
<td>5,892</td>
<td>140 (2.4)</td>
<td>0.60 (0.42-0.81)</td>
<td>0.003</td>
</tr>
<tr>
<td>Cancer Program</td>
<td>Ref</td>
<td>Ref</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Charlson-Deyo score</th>
<th>30,989</th>
<th>743 (2.4)</th>
<th>Ref</th>
<th>Ref</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>5,950</td>
<td>175 (2.9)</td>
<td>1.23 (1.04-1.43)</td>
<td>0.014</td>
</tr>
<tr>
<td>1</td>
<td>1,304</td>
<td>56 (4.3)</td>
<td>1.83 (1.38-2.43)</td>
<td>&lt;0.000</td>
</tr>
<tr>
<td>2 or more</td>
<td>Ref</td>
<td>Ref</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| AJCC stage              | 7,628  | 313 (4.1) | 1.94 (1.69-2.24) | <0.000 | 2.06 (1.74-2.45) |
|-------------------------| 30,615 | 661 (2.2) | Ref | Ref |

| Hospital readmission    | 35,938 | 925 (2.6) | Ref | Ref |
|-------------------------| 2,305  | 49 (2.1)  | 0.82 (0.62-1.08) | 0.187 | 0.81 (0.60-1.10) |
| Surgical inpatient stay (days) | 38,243 | 974 (2.5) | 1.01 (1.00-1.02) | 0.013 | 1.01 (1.00-1.01) | 0.042 |

Abbreviations: OR = ratio; aOR = adjusted odds ratio; CI = confidence interval; Ref = referent.
Adjusted model includes age, race, ethnicity, insurance status, education, facility type, Charlson-Deyo score, stage, readmission, and surgical inpatient stay.

---

**248 - Poster Session**

**HO-3867 rescues p53 repression of PLAC1 expression in ovarian cancer cells**

E. Devor\textsuperscript{a}, J. Lapierre\textsuperscript{a} and K.K. Leslie\textsuperscript{b}. \textsuperscript{a}University of Iowa Carver College of Medicine, Iowa City, IA, USA, \textsuperscript{b}University of Iowa Hospitals and Clinics, Iowa City, IA, USA

**Objective:** The cysteine thiol group binding agent HO-3867 has been shown to recover normal p53 protein function in cancers containing mutant TP53. Such recovery was demonstrated through the reinstatement of transcription of downstream p53 client genes. We hypothesize that reinstatement of transcriptional repression is an equally likely event.

**Method:** We chose to focus on the high-grade serous ovarian cancer model cell line OVCAR-3, which contains a classic TP53 gain-of-function mutation, R248Q. We treated OVCAR-3 cells with 2 μM and 5 μM HO-3867 for 24 hours and 48 hours. Treated cells and vehicle-only control cells were recovered, and whole cell RNA was purified using the mirVana RNA isolation kit (Thermo-Fisher). RNAs were then reverse transcribed, and PLAC1 expression was assessed via SYBR Green qPCR.

**Results:** PLAC1 expression did not change significantly with exposure to 2 μM HO-3867 at either 24 hours or 48 hours, but at 5 μM exposure expression at 24 hours decreased 1.9-fold \((P < 0.05)\) and at 48 hours it decreased 1.5-fold \((P < 0.01)\). We also observed evidence that these changes were being driven by significant increases \((P < 0.01)\) in p53 binding to the distal, or cancer, PLAC1 promoter.

**Conclusion:** Exposure of OVCAR-3 ovarian cancer cells to the cysteine thiol group binding agent HO-3867 does rescue p53 repression of PLAC1 expression. This is the first demonstration that HO-3867 treatment not only rescues p53-mediated transcription of downstream client genes but also reinstates p53-mediated transcriptional repression.

---

**249 - Poster Session**

**Calorie restriction for ovarian cancer reduction**

R. Rattan\textsuperscript{ab}, L. Dimitrova\textsuperscript{a}, M.P. Udumula\textsuperscript{a}, T.E. Buekers\textsuperscript{a} and S. Giria. \textsuperscript{a}Henry Ford Health System, Detroit, MI, USA, \textsuperscript{b}Wayne State University School of Medicine, Detroit, MI, USA

**Objective:** Dietary interventions are attractive as inexpensive supportive anticancer therapies. Calorie restriction is an established tumor preventive regimen, reducing systemic inflammation and growth factor signaling, as well as improving metabolic markers in the tumor. The aim of our study was to determine the effect of calorie restriction on ovarian cancer outcome.

**Method:** Female B6 mice were fed either ad libitum or underwent a 30% calorie restriction. After 5 weeks, mouse epithelial ovarian cancer (EOC) ID8 cells (5 million cells) were injected intraperitoneally. Tumor growth was monitored by in situ luciferases guided
imaging, followed by pathological determination of tumors at 8 weeks. Changes in growth factors/cytokines were determined by ELISA, and immune response was measured by flow cytometry analysis.

**Results:** The mice on calorie restriction displayed decreased EOC burden in contrast to mice fed ad libitum ($P < 0.01$). The mice on calorie restriction exhibited increased survival (median survival 100 days) in contrast to mice fed ad libitum (median survival 70 days, $P < 0.01$). The calorie-restricted mice showed a significant reduction in levels of insulin, leptin, MCP-1, VEGF, and IL-6 ($P$ ranging from 0.5 to 0.01). In addition, calorie-restricted mice had increased frequency of T cells (CD4, CD8, and NKT cells) and decreased frequency of macrophages ($P < 0.05$).

**Conclusion:** Our study suggests that calorie restriction can suppress ovarian cancer growth and is associated with modulation of inflammatory and immune microenvironment, suggesting the promise of calorie restriction and its mimetics as supportive anticancer therapies.

250 - Poster Session

**Intratumoral XBP1s expression and its association with T cell infiltration and patient outcomes in ovarian carcinoma**


**Objective:** Ovarian cancer can evade immune responses by inducing endoplasmic reticulum stress in intratumoral leukocytes. In the ovarian tumor microenvironment, the endoplasmic reticulum stress-activated transcription factor X-box binding protein 1 (XBP1s) causes immune cell dysfunction and facilitates malignant progression. However, the clinical significance of XBP1s expression in ovarian cancer remains elusive. We sought to evaluate the association between intratumoral XBP1s levels and ovarian cancer patient outcomes.

**Method:** Patients diagnosed with ovarian carcinoma at a single institution between 2007 and 2017 were identified. Immunohistochemical (IHC) staining for XBP1s expression and tumor-infiltrating CD3+ or CD8+ lymphocytes (TILs) was performed on tumor sections. TILs were quantified using HALO™ imaging software. XBP1s staining was evaluated by 2 independent pathologists blinded to clinical outcome. XBP1s grading was based on intensity of staining and H-scores ([(1*weak] + [2*moderate] + [3*strong]).

**Results:** Seventy-nine patients with high-grade serous ovarian carcinoma were identified. The average age was 66.1 years (range 40–95 years). The median XBP1s H-score was 1.44 (mean 1.27, SD 0.77). Patients who were platinum sensitive were more likely to have a low H-score (42.3%) than a high H-score (7.7%). Among stage III–IV patients who underwent primary surgery, high XBP1s (H-scores >2) revealed worse median progression-free survival (14.9 months) than low (H-score<1) and moderate (H-score 1–2) staining (21.5 months and 29.3 months, respectively). Five-year overall survival was greater among low XBP1s staining (86%) than among high-staining (80%). Using whole tumor staining, CD3+ TILs expression was significantly greater in patients with low XBP1s (H-scores <0.72) than in patients with high XBP1s (H-scores >0.72, $P = 0.0263$). Similarly, greater levels of CD8+ TILs expression were associated with low XBP1s (H-scores <0.50) versus high XBP1s (H-scores >0.50) (Figure 1).

**Conclusion:** This is a novel study investigating the clinical significance of XBP1s levels in ovarian cancer. Our results indicate that high XBP1s staining is associated with worse PFS and OS. In addition, tumors with low XBP1s levels were shown to have greater numbers of CD3+ and CD8+ TILs correlating with improved outcomes through higher immune responses. Further studies are needed to determine whether XBP1s can be used as a biomarker for identifying populations for targeted immunotherapies.
**Fig. 1.** Violin plot of mean tumor infiltrating lymphocyte (TIL) levels based on XBP1 H-Score. For CD3+: XBP1s low staining (H-scores <0.72) mean = 177,133 versus high staining (H-scores >0.72) mean = 95,849 (unpaired t-test with Welch's correction one tail p=0.0263). For CD9+: XBP1s low staining (H-scores <0.50) mean = 98,933 versus high staining (H-scores >0.50) mean = 60,200 (unpaired t-test with Welch's correction one-tail p=0.0820).

---

**251 - Poster Session**

**Interim results of the non-interventional C-PATROL study: Real-world treatment data from patients who switched from olaparib capsules to tablets**


*a*University Medical Centre Mannheim, Medical Faculty Mannheim, Heidelberg University, Mannheim, Mannheim, Germany, *b*Mammazentrum Hamburg, Hamburg, Germany, *c*Medical Office for Hemato-oncology, Aschaffenburg, Germany, *d*Universitätsklinikum Charite, Berlin, Germany, *e*Goethe University Frankfurt, Frankfurt, Germany, *f*University Hospital of Tuebingen, Tuebingen, Germany, *g*AstraZeneca GmbH, Wedel, Germany, *h*Charite Universitätsmedizin Berlin, Berlin, Germany

**Objective:** Olaparib (50-mg hard capsules) has been approved in the European Union since December 2014 as monotherapy for maintenance treatment of adult patients with platinum-sensitive relapsed BRCA-mutated ovarian cancer (PSR-OC) who are in response to platinum-based chemotherapy. Subsequently, film-coated tablets (100/150 mg) were approved in the European Union in May 2018, but regardless of BRCA status. So far, no real-world olaparib treatment data from patients who switched from olaparib hard capsules to film-coated tablets (switcher) are available.

**Method:** The German prospective noninterventional study C-PATROL (NCT02503436) collects routine clinical and patient-reported outcome data of BRCA-mutated PSR-OC patients treated according to label. The third interim analysis (cut-off date, April 1, 2019) centers on treatment- and safety-related data of patients who switched from olaparib hard capsule to film-coated tablet formulation using descriptive statistics. The therapy with olaparib film-coated tablets can be documented since August 2018 in this study.

**Results:** A total of 177 patients were solely treated with olaparib hard capsules, 28 patients were initiated with film-coated tablets, and 47 patients started hard capsules and switched to film-coated tablet formulation during maintenance treatment. Of patients treated with hard capsules, 85% started maintenance treatment with a daily dose of 800 mg, and 89% of patients treated with film-coated tablets started maintenance treatment with a daily dose of 600 mg according to label. At switch from hard capsule to film-coated tablet formulation, more than two-thirds started with a film-coated tablet daily dose of 600 mg. In the 3 subgroups, the median treatment duration was 9 (hard capsules), 2.9 (film-coated tablets), and 17.4 (switcher) months. The proportion of patients with dose modifications, therapy interruptions, and adverse events grade ≤3 according to subgroup as well as for the switcher subgroup prior to the switch (hard capsule maintenance treatment) and after the switch (film-coated tablet maintenance treatment) are shown in **Table 1**. Adverse events resulted in discontinuation of olaparib maintenance treatment in 11% (hard capsules), 7% (film-coated tablets), and 0% (switcher).

**Conclusion:** The third interim analysis provides the first real-world data for patients switching from olaparib capsule to tablet formulation. The data indicate that switching was well tolerated by patients under routine conditions. The observed toxicity profile was in line with data from clinical trials and prior interim analyses of this study with olaparib as maintenance treatment in PSR-OC and primary advanced ovarian cancer.

**Table 1.** Therapy modifications and adverse events according to subgroup under olaparib mtx.

<table>
<thead>
<tr>
<th>Subgroup</th>
<th>Dose modification</th>
<th>Therapy interruption</th>
<th>AE ≥ grade 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>HC subgroup (n=177)</td>
<td>42%</td>
<td>38%</td>
<td>38%</td>
</tr>
<tr>
<td>FT subgroup (n=28)</td>
<td>39%</td>
<td>36%</td>
<td>18%</td>
</tr>
<tr>
<td>Switcher subgroup (n=47)</td>
<td>49%</td>
<td>40%</td>
<td>32%</td>
</tr>
<tr>
<td>Before switch (HC mtx)</td>
<td>38%</td>
<td>36%</td>
<td>26%</td>
</tr>
<tr>
<td>After switch (FT mtx)</td>
<td>17%</td>
<td>11%</td>
<td>6%</td>
</tr>
</tbody>
</table>

---

**252 - Poster Session**

**Stability and preclinical efficacy of patient-derived xenograft (PDX) models in endometrial cancer and uterine sarcoma**


*a*Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, South Korea, *b*Samsung Medical Center, Seoul, South Korea
**Objective:** In precision medicine, the concept of individually treating cancer patients has been recently emphasized. In trying to find treatments, patient-derived tumor xenografts (PDX) models have been used. We identified the stability of PDXs of uterine cancer and the preclinical efficacy for targeted treatment in specific uterine cancers.

**Method:** We established PDXs with subrenal capsule transplantation of cancer tissue obtained from 58 uterine cancer patients into immunosuppressed mice. Progression-free survival and overall survival of uterine cancer patients according to the engraftment status of their PDXs was calculated with Kaplan-Meier curves. Hematoxylin and eosin (H&E) staining, short tandem repeat (STR) analysis, and CancerScan showed histopathological and genetic similarity between PDXs and primary patient tissues. Also, the target therapy for the gene mutation identified in the gene analysis, CancerScan, was applied to the PDXs. Two models with PIK3 mutation, EM-13 (clear cell carcinoma) and EM-19 (serous adenocarcinoma), were selected and compared with control and treatment groups (PI3K inhibitor, AZD8835).

**Results:** The successful rate of PDXs in uterine cancer was 56.9% (33/58); in endometrial cancer, 50% (22/44); and in nonendometrial cancer, 78.6% (11/14). Patients whose tumors were successfully engrafted in mice had a trend of both inferior progression-free survival and overall survival ($P = 0.219$ and $P = 0.470$, respectively). Also, the result of H&E staining and genetic analysis with STR analysis and CancerScan showed the similarity of primary cancer tissues and PDX. In therapy experiments of PI3K inhibitor, tumor weight significantly decreased in all 2 PDXs compared with the control ($P = 0.049$ and $P = 0.003$ of EM-13 and EM-19).

**Conclusion:** PDXs of uterine cancer, established by subrenal capsule implantation, had histopathological and genetic similarity and stability. In addition, this technique is useful in identifying and applying suitable targeted therapies in specific uterine cancer groups.

---

253 - Poster Session
**Platinum-based chemotherapy and bevacizumab-induced mitochondrial damage in human epithelial ovarian cancers via different pathways**


**Objective:** Ovarian cancer remains the principal cause of gynecologic cancer death worldwide. The standard chemotherapeutic approaches to this cancer are platinum-based chemotherapy (carboplatin and paclitaxel) and bevacizumab (BEV). However, the effects of both platinum-based chemotherapy and BEV on mitochondrial damage in isolated mitochondria from human epithelial ovarian cancers have not yet been investigated. Therefore, the present study aimed to test the hypothesis that platinum-based chemotherapy and BEV equally damage the mitochondria from human epithelial ovarian cancers via increased mitochondrial dysfunction, mitophagy, and mitochondrial apoptosis.

**Method:** Mitochondria were isolated from human epithelial ovarian cancers ($n = 16$). Each isolated mitochondria was treated with either combined carboplatin (10 µM) and paclitaxel (5 µM) or BEV (2 mg/mL) for 60 minutes. Following the treatment, mitochondrial function, ROS (reactive oxygen species) production and swelling, as well as mitophagy (PINK1, Parkin) and mitochondrial apoptosis (Bax, Bcl2), were determined.

**Results:** Platinum-based chemotherapy increased mitochondrial ROS production and swelling in isolated mitochondria from human epithelial ovarian cancers, while the expression of mitophagy proteins and pro-apoptotic protein was increased in isolated mitochondria from human epithelial ovarian cancers treated with BEV (as shown in Figure 1).

**Conclusions:** These findings suggest that human epithelial ovarian cancers treated with platinum-based chemotherapy and BEV cause mitochondrial damage through different mechanisms.
The effects of platinum-based chemotherapy (carboplatin and paclitaxel) and bevacizumab on mitochondria isolated from human epithelial ovarian cancers. Abbreviations: Mito+C+P = mitochondria treated with carboplatin and paclitaxel; Mito+B = mitochondria treated with bevacizumab.

**Objective:** Pressurized intraperitoneal aerosol chemotherapy (PIPAC) has been introduced for treating solid tumors including ovarian cancer with peritoneal carcinomatosis. However, PIPAC has some limitations, such as unclear distribution, penetration depth, and tissue concentration of aerosolized drugs in different areas of the peritoneal cavity. Thus, we developed rotational injection of pressurized intraperitoneal aerosol chemotherapy (RIPAC) to improve drug delivery and treat peritoneal carcinomatosis more effectively.

**Method:** First, we developed the PIPAC system, composed of a nozzle with a mean diameter of 35 μm, releasing aerosol at a pressure of 7 bars (100 psi) at a constant rate of 30 ml/minute with the help of a high-pressure syringe pump. Then we developed a conical pendulum motion device, thereby building a RIPAC system. After inserting two 10-mm trochars via the abdomen of a swine of about 50 kg, we performed PIPAC and RIPAC on 2 pigs. We used methylene blue solution to compare the distribution between early postoperative intraperitoneal chemotherapy (EIPAC), PIPAC, and RIPAC and used 3.5 mg of doxorubicin mixed with 50 ml of 0.9% NaCl as aerosol at room temperature (23°C) to compare the penetration depth and tissue concentration between PIPAC and RIPAC. After we injected aerosols of methylene blue and doxorubicin, captoperitoneum was maintained at 12 mm Hg for 30 minutes, after which the pigs were sacrificed.

**Results:** In terms of distribution, RIPAC showed wider spread of methylene blue than either EIPAC or PIPAC (Figure 1A). Depth of concentrated diffusion (DCD) and depth of maximum diffusion (DMD) were also greater in RIPAC than in PIPAC (Figure 1B). Tissue concentration was also higher in RIPAC than in PIPAC (Figure 1C).
**Conclusion:** The newly developed RIPAC may show enhanced distribution, penetration depth, and tissue concentration of intraperitoneal drugs compared to PIPAC, yielding promising results in improving treatment of ovarian cancer with peritoneal carcinomatosis.

**Figure 1A**

![Image of whole abdomen, diaphragm, and pelvis for EIPAC, PIPAC, and RIPAC]

**Figure 1B**

![Graphs comparing distribution of methylene blue and depth of concentrated diffusion (DCD) and depth of maximum diffusion (DMD) of doxorubicin between PIPAC and RIPAC]

**Figure 1C**

![Graph comparing tissue concentration of doxorubicin between PIPAC and RIPAC]

**Fig. 1.** Comparison of the efficacy between pressurized intraperitoneal aerosol chemotherapy (PIPAC) and rotational injection of pressurized intraperitoneal aerosol chemotherapy (RIPAC). (A) Comparison of the distribution of methylene blue in EIPAC, PIPAC and RIPAC. (B) Comparison of depth of concentrated diffusion (DCD) and depth of maximum diffusion (DMD) of doxorubicin between PIPAC and RIPAC. (C) Comparison of tissue concentration of doxorubicin between PIPAC and RIPAC.

---

**255 - Poster Session**

Does timing of intraperitoneal chemotherapy initiation following bowel resection in patients with newly diagnosed advanced ovarian cancer impact short- and long-term outcomes?
Objective: The primary objective of this study was to determine whether early administration of intraperitoneal chemotherapy (IPC) and intraoperative insertion of an intraperitoneal (IP) port are associated with increased complications in patients who undergo a bowel resection procedure as part of primary cytoreductive surgery. Secondary outcomes included the impact of patient and surgical factors on progression-free survival (PFS) in this population, and measuring the association between the mode of delivery of chemotherapy and the time to chemotherapy.

Method: This was a multicenter retrospective cohort study at 2 high-volume institutions. An exploratory multivariate Cox proportional hazards model with stepwise backward variable selection and bootstrap validation was constructed to study PFS. Multivariate linear regression analysis was used to determine the effect of the route of chemotherapy administration on the time to chemotherapy.

Results: The majority of patients had stage III–IV disease (86.2%) and high-grade serous histology (91.6%). Median PFS was 20.5 months. Compared to patients who received their first cycle of chemotherapy intravenously (IV), patients who started with IPC were not at increased risk of infections (1.8% vs 1.3%, \( P = 0.8 \)), IP port-related complications (19.6% vs 20%, \( P = 0.96 \)), or anastomotic leak (3.6% vs 2.7%, \( P = 0.8 \)). The rates of anastomotic leak (5.6% vs 3.3%, \( P = 0.62 \)), intra-abdominal infection (16.7% vs 6.7%, \( P = 0.17 \)), and IP port-related complications (24.1% vs 13.3%, \( P = 0.21 \)) were not statistically different in patients who had intraoperative IP port insertion compared to those who had delayed postoperative insertion. PFS was not significantly different in patients who received IPC during the first cycle (\( P = 0.7 \)) from those who had intraoperative port insertion (\( P = 0.21 \)). Patient age, mode of chemotherapy delivery, fecal diversion, or surgical complications were not predictors of the time to chemotherapy. See Figure 1 and Figure 2.

Conclusion: IPC during the first cycle and intraoperative IP port insertion after bowel resection are not associated with increased postoperative complications and are not predictive of PFS. After accounting for hospital-level clustering, we did not find any patient or treatment factors associated with a significant increase in the time to starting chemotherapy.

Figure 1. PFS (months) based on the type of chemotherapy administered during the first cycle (0=IV 1=IP)

![Figure 1](image1)

\( p = 0.70 \)

Figure 2. PFS (months) based on the timing of IP port insertion (0=post-operatively 1=intra-operatively)

![Figure 2](image2)

\( p = 0.21 \)

Fig. 1.

256 - Poster Session

Hur inhibition is a novel approach to treatment of chemotherapy-resistant low-grade serous ovarian carcinomas

M. Dandulakis\textsuperscript{a}, J. Reader\textsuperscript{b}, P. Smith\textsuperscript{b}, C. Fan\textsuperscript{b}, M.S. Carey\textsuperscript{b}, J. Lin\textsuperscript{c}, L. Xu\textsuperscript{c}, T. Legesse\textsuperscript{a}, G.G. Rao\textsuperscript{a}, A. Fulton\textsuperscript{a} and D.M. Roque\textsuperscript{a}. \textsuperscript{a}The University of Maryland School of Medicine, Baltimore, MD, USA, \textsuperscript{b}University of British Columbia, Vancouver, BC, Canada, \textsuperscript{c}The University of Kansas, Lawrence, KS, USA
**Objective:** Low-grade serous ovarian carcinoma (LGSO) is a subtype of ovarian cancer that affects women at a younger age and is associated with a more indolent course than high-grade serous ovarian cancer. It is generally poorly responsive to cytotoxic chemotherapy given slow doubling times and other molecular factors. Human antigen R (HuR) is an RNA-binding protein that binds to adenine- and uridine-rich elements (ARE) located in the 3′- or 5′-untranslated region of target mRNAs. HuR promotes the translation of several target mRNAs encoding proteins involved in treatment resistance, including class III β-tubulin (Figure 1a). Cytoplasmic HuR has also been linked to cyclooxygenase (COX) over-expression, which promotes chemoresistance though prostaglandin E2 (PGE2). Recently, a potent, selective, and structurally validated HuR inhibitor, KH3, has been discovered. We tested the hypothesis that HuR inhibition may be a novel therapeutic approach to the treatment of LGSO, alone or in combination with paclitaxel or COX pathway modulators (EP4 inhibitors).

**Method:** LGSO cell lines (VOA-4627, VOA-1056, VOA-3723) and formalin-fixed paraffin-embedded tissues were characterized by immunohistochemistry (IHC), Western blot, and polymerase chain reaction (PCR). Cell lines were treated with KH3, paclitaxel, and different EP inhibitors (A or B) and analyzed for viability over 3 days.

**Results:** LGSO tissues universally (100%) demonstrated strong (3+) nuclear IHC staining for HuR (Figure 1b and Figure 1c), as did high-grade serous ovarian cancer/normal ovary (not shown); cytoplasmic staining was negligible. In cell lines, HuR predominantly localized to the nuclear fraction, but cytoplasmic protein was present (Figure 1d). LGSO cell lines upregulated HuR mRNA (Figure 1e). All LGSO cell lines demonstrated paclitaxel resistance, particularly those with slow growth rates (Figure 1f). Pretreatment of cells with EP4 inhibitor for 1 day sensitized cells to paclitaxel, but this was insufficient to fully overcome paclitaxel resistance. All LGSO cell lines were exquisitely sensitive to HuR inhibitor. Pretreatment with EP4 inhibitor enhanced response to KH3.

**Conclusion:** In this pilot study, we have shown that HuR is a relevant target for LGSO. HuR inhibition may represent a novel approach to treatment of chemotherapy-resistant LGSO. Comodulation of the COX pathway may provide synergism. Larger studies are warranted.

---

**257 - Poster Session**

**Neoadjuvant chemotherapy in advanced epithelial ovarian cancer: Is the number of preoperative cycles important?**


**Instituto Nacional de Cancerología de México, México, DF, Mexico, Instituto Nacional de Perinatología, Mexico, DF, Mexico, Hospital General de Saltillo, Saltillo, CU, Mexico**

**Objective:** The aim of this study was to evaluate neoadjuvant chemotherapy (NACT) 3–4 cycles versus 6 or more courses followed by debulking surgery in advanced epithelial ovarian cancer (EOC), and compare it with primary surgery followed by NACT.
**Method:** A retrospective analysis from records of patients with advanced EOC from 2011 to 2016 who underwent NACT was performed to compare complete cytoreduction (R0), surgical complications (SC), progression-free survival (PFS), and OS in relation to the number of NACT cycles.

**Results:** Of 247 patients identified with EOC stages III–IV, 48 (19.4%) had initial surgery followed by NACT (group 1), 114 (46.2%) had debulking surgery after 3 or 4 cycles of NACT (group 2), and 85 (34.4%) had cytoreductive surgery after 5 or more cycles of NACT (group 3); 19 (7.7%) had unresectable disease and were excluded from the analysis. Group 1 had more surgical and postoperative complications (14.6% vs 4.8% and 5.3% for groups 2 and 3) \( (P = 0.049) \), and the rate of reintervention during 30 days after debulking surgery was 6.3% in the primary surgery group versus 1.9% of interval debulking surgery \( (P < 0.001) \). Complete cytoreduction (R0) was achieved in 87.5%, 92.4%, and 92% of groups 1, 2, and 3, respectively; suboptimal cytoreduction (>1 cm) was achieved in 8.9% in the group of primary debulking, versus 7.6% and 6.7% in groups 2 and 3 \( (P = NS) \). Mean PFS was 24, 14, and 13 months and mean OS was 87.6, 79.9, and 71.6 months for groups 1, 2, and 3, respectively, with no significance after adjusted by clinical stage \( (P = NS) \).

**Conclusion:** Debulking surgery continues to be preponderant for tumor control, our study demonstrates that timing for debulking surgery does not have an impact in terms of PFS and OS. In those patients with poor response to initial treatment, completing 6 cycles of chemotherapy could be an option, but a randomized clinical trial is imperative to confirm our results.

---

**258 - Poster Session**

**Inhibition of the integrin-linked kinase (ILK) pathway represents a novel target in ovarian cancer treatment**

M.A. Ulma, S. Ponnusamyb, A.C. ElNaggara, T. Tillmannsa and R. Narayana{a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z}

**Objective:** The aim of this study was to identify and validate the integrin-linked kinase (ILK) pathway as a novel therapeutic target in ovarian cancer.

**Method:** Ovarian cancer specimens from the Collaborative Human Tissue Network with normal adjacent tissue (NAT) specimen were identified for analysis. Next-generation expression profiling of tumor tissue and NAT specimens was performed using Human Transcriptome Array (HT2.0). The gene candidate list from the differential expression data was loaded to Ingenuity Pathway Analysis to determine a target pathway for further analysis. ILK expression in SKOV3 and OV90 cell lines was determined using Western blot. SKOV3 cells were transfected with siRNA directed against ILK and nontargeted siRNA. Expression from siRNA-transfected cells was determined by RT-PCR and cellular proliferation using a microplate cellular proliferation assay. SKOV3 and OV90 cells were incubated with CP-22, a highly selective inhibitor of ILK activity. Downstream activity was assessed using Western blot against phosphorylated ILK and Akt. Incucyte live cell imager was used to assess cellular proliferation of SKOV3 and OV90 cell lines after incubation with CP-22 measured over 72 hours.

**Results:** A total of 24 ovarian cancer specimens were identified for analysis. A significant upregulation of the ILK pathway was identified using Ingenuity Pathway Analysis in 22 of the 24 cancer specimens relative to the NAT specimens. Similar upregulation was seen in SKOV3 and OV90 ovarian cancer cell lines. Reduced expression and cellular proliferation of ILK in SKOV3 cell lines was demonstrated following siRNA transfection and incubation. CP22 effectively eliminated phosphorylation of Akt by ILK. CP22 effectively inhibited cellular proliferation of SKOV3 and OV90 in a dose-dependent fashion relative to controls (Figure 1). Taken together, CP22 inhibits ILK-mediated phosphorylation of Akt, a serine/threonine-specific kinase involved in the inhibition of apoptosis.

**Conclusion:** Our results highlight the role of ILK in ovarian cancer, being differentially expressed relative to NAT. The effect of CP22 on cellular proliferation and downregulation of Akt suggests a new target for the development of therapeutic strategies against drug-resistant cancer cells. CP22 may be a promising compound that warrants further study in ovarian cancer.
259 - Poster Session
Should we abandon systematic pelvic and paraaortic lymphadenectomy in low-grade serous ovarian cancer? A GINECO group and TMRG network study.

Objective: Low-grade serous ovarian carcinoma (LGSOC) is a rare disease that accounts for 5% of all ovarian cancers. Complete resection of the carcinosis is an important prognostic factor in this disease. To date, the prognostic value of pelvic and paraaortic lymphadenectomy remains unclear.

Method: This retrospective cohort of patients with a diagnosis of LGSOC was registered in the Tumeurs Malignes Rares Gynécologiques (TMRG) national network, between January 2000 and July 2017, in 25 centers. All LGSOC were confirmed after pathological review and operated by primary debulking surgery (PDS) or interval debulking surgery after neoadjuvant chemotherapy (NACT-IDS). Primary endpoints were overall survival (OS) and progression-free survival (PFS). We compared the survival of patients with or without pelvic paraaortic lymphadenectomy.

Results: A total of 126 patients were included; 86.1% were stage III–IV and 74.6% had lymph node dissection (LND). According to the Completeness of Cancer Resection (CCR) score, 83.7% had a complete resection. Median OS was 130 months, and median PFS was 41
months. Pelvic and paraaortic LND had no significant impact on OS (\(P = 0.78\)) or on DFS (\(P = 0.93\)), and it was confirmed in subgroups (advanced stages FIGO III–IV, CCR score 0/1 or 2/3, and timing of surgery PDS or NACT-IDS). Histological positive paraaortic lymph nodes had a significant pejorative impact on PFS in whole population (HR = 2.21, CI 1.18–4.39, \(P = 0.02\)) and in CC0/CC1 population (HR = 2.28, CI 1.13–4.59, \(P = 0.02\)).

**Conclusion:** Systematic pelvic and para-aortic LND in patients with LGSOC improves neither OS nor PFS. A prospective trial is urgently required to confirm these results.

---

### 260 - Poster Session
**Omega-3 lipid metabolites as mediators of metformin's anti-proliferative effect in ovarian cancer**

M.P. Udumula\(^a\), I. Dimitrova\(^a\), S. Sakr\(^b,c\), T.E. Buekers\(^d\), S. Girid\(^d\) and R. Rattan\(^b,d\). \(^a\)Henry Ford Hospital, Detroit, MI, USA, \(^b\)Wayne State University School of Medicine, Detroit, MI, USA, \(^c\)Karmanos Cancer Center/Wayne State University, Detroit, MI, USA, \(^d\)Henry Ford Health System, Detroit, MI, USA

**Objective:** Metformin is being repurposed for treatment of gynecologic malignancies and other cancers. It is known to alter the cancer cell metabolism, primarily the energy metabolism. Our aim was to identify and test the preclinical efficacy of the prominent metabolite changes occurring in response to metformin treatment in ovarian cancer cell lines.

**Method:** Three human ovarian cancer cell lines (\(A2780, C200\), and \(SKOV3\)) treated with metformin (10 mM) for 48 hours were subjected to untargeted global metabolomics by ultra-high-performance liquid chromatography and gas chromatography mass spectroscopy. Statistical and bioinformatics analyses were performed. Five ovarian cancer cell lines (\(A2780, C200, SKOV3\), \(ID8\), and \(OVCA5\)) with different genetic makeup and characteristics were treated with varying doses of omega-3 metabolites (eicosapentaenoic acid [EPA] and docosahexaenoic acid [DHA]) (12.5–200 uM) with or without carboplatin. Cell survival was assayed by MTT and clonogenic assay (12.5–100 uM). \(SKOV3\) and \(Cav3\) xenograft models were used for testing the preclinical efficacy of DHA and EPA.

**Results:** Under metformin treatment, the 3 cell lines revealed 57 common altered metabolites, of which 30 had consistent direction change. The enrichment analysis of the commonly upregulated metabolites indicated a universal increase of the omega-3 biosynthetic pathway, including alpha-linolenic and linoleic acid metabolism (\(P < 0.001\)). Treatments with EPA or DHA, the most common lipids from the pathway, resulted in a significant dose-dependent inhibition of proliferation in all 5 cell lines (\(P < 0.001\)). EPA and DHA potentiated carboplatin cytotoxicity in all cell lines (\(P < 0.05\)). Significant inhibition of colony formation was also noted with EPA and DHA (\(P < 0.01\)). Treatment with EPA and DHA significantly improved the survival of mice bearing \(SKOV3\) and \(Cav3\) xenograft tumors (\(P < 0.01\)).

**Conclusion:** Metformin treatment resulted in increase of omega-3 fatty acid metabolism. Both EPA and DHA, metabolites of the pathway, inhibited ovarian cancer cell proliferation alone and in combination with carboplatin, as well as increased survival in ovarian cancer mouse models. Thus, the cytotoxic effect of metformin may be partially mediated through upregulation of omega-3 lipids.

---

### 261 - Poster Session
**Surgical outcomes of adnexal masses classified by IOTA simple rules: Identifying opportunities to reduce surgical morbidity**

E.V. Carballo, Z. Li, E. Sadowski and L.M. Barroilhet. University of Wisconsin School of Medicine and Public Health, Madison, WI, USA

**Objective:** Effective methods to screen for ovarian cancer have eluded researchers. Patients at risk for ovarian cancer often undergo surgery for benign disease. The IOTA (International Ovarian Tumor Analysis) simple rules classify adnexal masses as benign, malignant, or indeterminate based on ultrasound features. We seek to identify characteristics associated with increased surgical morbidity and propose appropriate triage of IOTA indeterminate masses.

**Method:** Using a retrospective cohort of sonographically detected adnexal masses (\(n = 530\)), we analyzed the imaging and patient characteristics of those who underwent surgery (\(n = 170\)) and lesions classified as IOTA indeterminate (\(n = 33\)). Surgical patients were categorized based on pathology and compared using \(X^2\) and \(t\) test for categorical and continuous variables, respectively. IOTA indeterminate masses were compared based on surgical disposition in a similar fashion. A logistical regression was used to predict characteristics with an impact on disposition.

**Results:** Of 22 lesions classified as malignant by IOTA, 12 were malignant on pathology (55%), and 2 were physiologic cysts (9%) (\(P < 0.001\)). No lesions categorized as benign by IOTA were ultimately malignant. Of IOTA indeterminate masses, 22 were surgically removed, 4 of which were physiologic. Five were malignant, making up 23% of all indeterminate imaging (\(P = 0.087\)), 80% of which went directly to surgery. Looking at variables including patient age, menstrual status, imaging findings, and CA-125, only number of nodules was statistically significant in predicting disposition to surgery or further imaging (OR = 0.56, CI 0.32–0.98, \(P = 0.04\)). Surgically induced menopause for physiologic lesions occurred in 7 individuals (1.7% of premenopausal patients). Short-term surgical complications were
seen in 3 of the 170 surgically managed patients (1.7%), and 9 cases (5.3%) were laparoscopic cases converted to laparotomy. The majority (11/12) of events occurred in surgeries for benign lesions.

**Conclusion:** The sensitivity of IOTA effectively identifies malignancies but, if used in isolation, may lead to unnecessary surgery, premature menopause, and increased morbidity for benign disease. Multiple nodules, even in the presence of reassuring features, is predictive of malignancy more than any other clinical factors.

---

**262 - Poster Session**

**Chemotherapy choice and impact on survival of patients with carcinosarcoma of the ovary: A retrospective review**


Yale University School of Medicine, New Haven, CT, USA, Stanford Women’s Cancer Center, Palo Alto, CA, USA, Stanford University School of Medicine, Stanford, CA, USA

**Objectives:** Ovarian carcinosarcomas (OCS) are rare aggressive malignancies treated with chemotherapy regimens extrapolated from uterine carcinosarcomas (UCS) experiences. For UCS, the National Comprehensive Cancer Network (NCCN) recommends ifosfamide/paclitaxel or cisplatin/ifosfamide; however, recent data suggest carboplatin-based regimens are non-inferior. This OCS study compares the overall survival (OS) of patients treated with either platinum-based or non-platinum-based regimens.

**Method:** This is a retrospective study of OCS patients from 1995 to 2016 across 2 academic institutions treated with primary cytoreductive surgery followed by adjuvant chemotherapy. Patients were divided into platinum-based or non-platinum-based groups depending on initial chemotherapy regimens. The primary objective was to compare OS. Demographic data were collected. The groups were compared by Kruskal–Wallis and Fisher exact tests. OS was determined using Kaplan-Meier curves, and multivariate analyses were performed.

**Results:** Forty-nine patients were included, with 80% of patients receiving optimal cytoreduction. The baseline demographics between the platinum-based (n = 37) and the non-platinum-based (n = 12) groups are presented in Figure 1. No statistically significant differences were seen between age, BMI, race, percentage of advanced disease, or positive lymph nodes. Median OS for all patients was 38.3 months. Patients who received platinum-based versus non-platinum-based regimens had a median OS of 59.79 versus 35.25 months, respectively, with a HR of 0.246 in favor of platinum-based (CI 0.078–0.7667) (Figure 1). In a subgroup analysis of advanced-versus early-stage disease, we found that platinum-based still imparted an OS advantage in advanced disease, 58.80 versus 36.05 months (HR = 0.315, CI 0.104–0.94). Platinum-based also improved OS in early-stage disease (147 vs 42.5 months), but statistical significance was lost due to limited patients in the non-platinum-based group.

**Conclusion:** This study demonstrates an OS benefit for patients with OCS treated with platinum-based versus non-platinum-based chemotherapy regimens. The OS benefit was notable in both advanced-stage and early-stage disease, suggesting that a platinum-based regimen should be considered first-line therapy for all stage OCS. The platinum-based group did not include ifosfamide, thereby supporting the use of platinum combinations in OCS without ifosfamide. This finding is congruent with the recent results of the NRG UCS study.
Objectives: A majority of women diagnosed with ovarian cancer will relapse after treatment, and these cancers will become resistant to standard therapies. To better understand the mechanisms of chemotherapy resistance, we have initiated a study to analyze the
molecular characteristics of tumor samples taken during primary debulking, during interval debulking, and at recurrence. Our goal is to define molecular characteristics that are prognostic and predictive for chemotherapy resistance.

**Method:** We have enrolled more than 60 women and completed single-cell RNA sequencing (scRNAseq). Five of these patients received neoadjuvant chemotherapy; we performed scRNAseq on samples taken from initial, prechemotherapy specimens, and also from subsequent interval debulkings. ScRNAseq was performed using the 10X genomics platform, and we obtained data on an average of 3,000 cells per sample. We used multiple bioinformatics methods, including ccFindR, Seurat, SC3, ClusterExperiment, and CIDR, to analyze cell populations present in the samples.

**Results:** Comparison of the pre- and postchemotherapy scRNAseq datasets revealed differences in cancer epithelial cell types detected in the postchemotherapy samples compared to the prechemotherapy samples. The immune and stromal composition, including T and B cell frequencies and types also changed significantly when samples were compared. Based on the gene expression patterns in these cell clusters, we have identified specific signaling pathways and cell types that suggest possible mechanisms used within the tumor microenvironment to develop resistance to chemotherapy.

**Conclusion:** ScRNAseq provides novel information regarding the processes taking place within the tumor microenvironment as the tumor progresses from chemotherapy-sensitive to -resistant. We are correlating scRNAseq results with DNA mutations and chromosomal copy number variants detected in the bulk exome and targeted germline data we also have collected. We will follow the disease course in these women and further determine differences in cell composition between those who are sensitive, resistant, and refractory to therapy in order to develop better treatment strategies to improve patient outcomes.

**264 - Poster Session**

**Characterization of isogenic ovarian cancer cell line models of acquired resistance to the clinical ATR inhibitor AZD6738**

W. Ao\(^{a}\), D. Tommarello\(^{a}\), K.A. Conrads\(^{a}\), P.N. Teng\(^{a}\), N.T. Phippen\(^{b}\), K.M. Darcy\(^{a,c}\), C.A. Hamilton\(^{a}\), Y. Casablanca\(^{a,c}\), C.J. Bakkenist\(^{d}\), J.I. Risinger\(^{e}\), G.L. Maxwell\(^{a,c}\), T.P. Conrads\(^{a,c}\) and N.W. Bateman\(^{a,c}\).

\(^{a}\)Gynecologic Cancer Center of Excellence, Bethesda, MD, USA, \(^{b}\)San Antonio Military Medical Center, Fort Sam Houston, TX, USA, \(^{c}\)John P. Murtha Cancer Center, Bethesda, MD, USA, \(^{d}\)University of Pittsburgh, Pittsburgh, PA, USA, \(^{e}\)Michigan State University, Grand Rapids, MI, USA, \(^{f}\)Inova Fairfax Hospital, Falls Church, VA, USA

**Objective:** Clinical ATR kinase inhibitors (ATRi) are an emerging class of therapeutics being used to treat diverse solid tumor malignancies, including ovarian cancer. This study is focused on improving our understanding of ATRi resistance through characterizing isogenic ovarian cancer cell line models of acquired resistance to the clinical ATR inhibitor AZD6738.

**Method:** Established isogenic models of ATRi-resistant OVCAR3 and OV90 ovarian cancer cells by metronomic treatment with the ATR inhibitor AZD6738 (Astra Zeneca). Characterized sensitivity of models to ATRi as well as inhibitors of checkpoint kinase 1 (Chk1, LY2606368), ataxia-telangiectasia mutated (ATM, KU55933) poly (ADP-ribose) polymerase (PARP, BMN-673 and MK-4827) and combination with cisplatin (CDDP) and a cyclin D kinase 4/6 inhibitor (PD-0332991). In addition, we assessed the impact of ATRi treatment on cell cycle, expression of G1/S phase cell cycle regulators, and tumorigenicity of ATRi-resistant OV90 cells in athymic nude FOXN1 mice.

**Results:** Metronomic treatment of ovarian cancer cells with ATRi induced resistance to ATRi and Chk1i, but not ATMi or PARPi. Combination treatment of cells with CDDP and ATRi showed both parental and ATRi-resistant cells were sensitized to CDDP by equivalent doses of ATRi. Cell cycle analyses showed that ATRi-sensitive cells arrest in S-phase, whereas ATRi-resistant cells arrest in G1-phase following ATRi treatment. Combination treatment with ATRi and PD-0332991 underscored that cell cycle arrest in G1 increases resistance to ATRi. Further investigation revealed alterations in G1/S regulatory proteins accompanied an ATRi-resistant phenotype, including loss of CDC25A expression in ATRi-resistant OV90 cells and that ATRi-sensitive and -resistant OV90 cells form tumors at equivalent rates.

**Conclusion:** We find that metronomic treatment of ovarian cancer cells with ATRi induces resistance to ATRi and Chk1i. ATRi-resistant cells remain sensitive to PARPi and are sensitized to CDDP when combined with ATRi. ATRi-resistant cells further exhibit a G1-phase cell cycle arrest response to ATRi and alterations in G1/S phase proteins, including loss of CDC25A. Our findings provide insight into the impact of prolonged treatment of ovarian cancer cells with a clinical ATR inhibitor.

**265 - Poster Session**

**Chemopreventive effect of progestin and vitamin D in the mogp-TAG ovarian cancer mouse model**

O.L. Nelson\(^{a,b}\), J. Turbov\(^{a}\), R. Rosales\(^{a}\), L.G. Thae\(^{a,b}\), M. Cline\(^{a}\) and G.C. Rodriguez\(^{a,b}\).

\(^{a}\)NorthShore University Health System, Evanston, IL, USA, \(^{b}\)The University of Chicago Medicine, Chicago, IL, USA, \(^{c}\)Wake Forest School of Medicine, Winston-Salem, NC, USA
Objective: Growing evidence suggests the fallopian tube epithelium harbors the precursor for high-grade serous ovarian cancer, creating opportunities for targeting the fallopian tube for effective chemoprevention. Animal and human evidence has shown that progestins confer potent cancer preventive effects in the gynecologic tract by activating molecular pathways that clear genetically damaged cells. In addition, it has been shown in vitro that the potency of progestins can be enhanced with vitamin D. The genetically engineered mogp-TAg mouse develops p53 signatures and cancers in the fallopian tube, mimicking human serous fallopian and ovarian carcinoma. Here we investigated the chemopreventive effect of a progestin and vitamin D in the mogp-TAg mouse model.

Method: Mogp-TAg mice (10 per group) were treated at 5 weeks of age with vehicle, the progestin depo-medroxyprogesterone acetate (DMPA, 1 mg/mouse), the vitamin D analogue (EB1089, 0.15 µg/kg/day), and the DMPA/EB1089 combination. Mice were euthanized at 8 weeks, and the fallopian tube, uterine horn, ovary, and vagina were examined via H&E staining. Immunohistochemistry and immunofluorescence were used to characterize p53 expression.

Results: Fallopian tube volume (P = 0.00005) was significantly reduced in the mice treated with DMPA and the DMPA/EB1089 combination but not EB1089 alone. Histologically, the fallopian tube of the vehicle-treated mice developed adenocarcinoma and/or epithelial/smooth muscle hyperplasia in all cases; in comparison, 30% of the mice in the EB1089 group had no significant lesions (P = 0.08). Only 1 of the mice in the DMPA and none in the DMPA/EB1089 combination-treated groups had any significant lesions in the fallopian tube (P < 0.00005). Accumulation of p53 in the fallopian tube was significantly reduced in all groups: DMPA (P < 0.00005), EB1089 (P < 0.0005), and DMPA/EB1089 (P < 0.000005) combination.

Conclusion: DMPA and DMPA/EB1089 combination treatments significantly reduced the tumor burden and aberrant p53 expression in the fallopian tube of mice compared to vehicle-treated animals. EB1089-treated animals showed a significant reduction in the accumulation of p53 but to a lesser extent than that observed in DMPA and EB1089/DMPA groups. These data provide evidence supporting the hypothesis that progestin alone or in combination with vitamin D may be used for prevention of ovarian cancer.

266 - Poster Session
Targeting ovarian and breast cancers through phosphatase inhibition
M. Siemon, M.P. Schlumbrecht and B. Slomovitz. University of Miami, Sylvester Comprehensive Cancer Center, Miami, FL, USA

Objective: The purpose of this study was to evaluate the sensitivity of ovarian and breast cancers to the phosphatase inhibitor phendione and to correlate this with the concentration of the target protein, protein phosphatase 2A-catalytic subunit (PP2Ac), as well as to evaluate the interaction between phendione and olaparib (PARP).

Method: Three ovarian cancer cell lines (PEO1, PEO4, and A2780) and 2 breast cancer cell lines (MCF7 and HCC1937) were evaluated. Cell viability experiments were performed to measure IC50 for carboplatin, PARP, and phendione. Quantitative immunoblotting was used to measure the concentration of PP2Ac and normalize it to the housekeeping protein Beta-Actin. Student t test, ANOVA, and linear regression analysis were used where indicated. Drug interaction was assessed using the Loewe Additivity model.

Results: The relative platinum resistance between the high-grade serous ovarian cancer (HGSOC) cell lines (PEO4 and PEO1) was measured (IC50 of 45.0 uM vs 14.2 uM for carboplatin, respectively, P < 0.001). HCC1937 was more platinum-sensitive than MCF7 (IC50 of 104.1 uM vs 337.6 uM for carboplatin, respectively, P < 0.001). Sensitivity to phendione varied significantly among all 5 cell lines (F(4,715) = 609.07, P < 0.001); however, there was no difference between the HGSOC lines (IC50 of 0.438 uM vs 0.448 uM for PEO4 and PEO1, respectively, P = 0.9995). HCC1937 was less sensitive to phendione than MCF7 (IC50 of 3.587 uM vs 2.524 uM, respectively, P = 0.02), and this was not correlated to platinum sensitivity. On quantitative immunoblot, normalized PP2Ac was directly proportional to the IC50 of phendione for all cell lines, with a regression equation of y = 0.016x + 0.038, R2 = 0.926, F(1,3) = 37.76, P = 0.009 (Figure 1). No difference in sensitivity to PARP was identified between the HGSOC cell lines (IC50 of 2.082 uM vs 2.015 uM for PEO4 and PEO1, respectively, P = 0.843). Using the Loewe Additivity model to evaluate the interaction between PARP and phendione in the HGSOC lines, a synergistic interaction was identified with combination indices of 0.692, 95% CI 0.386–0.996, P < 0.01, and 0.445, 95% CI 0.296–0.594, P < 0.01, for PEO4 and PEO1, respectively.

Conclusion: Ovarian and breast cancers demonstrate sensitivity to phendione, and this is not related to their platinum sensitivity. Sensitivity to phendione is inversely proportional to the quantity of PP2Ac present. Phendione acts synergistically with PARP in HGSOC.
Objective: Traditionally, the management of large suspicious ovarian tumors includes a mid-line laparotomy. Minimally invasive surgery (MIS) has been proven to be a safe alternative for the management of endometrial cancer, early ovarian cancer, and small ovarian lesions. MIS is associated with shorter hospital stay, less pain, and quicker recovery. The data supporting MIS for the management of large ovarian tumors are scarce. The objectives of this study were to compare recurrence and complications of laparoscopy versus laparotomy for the management of large ovarian tumors requiring surgery by a gynecologic oncologist.

Method: This is a retrospective, single institute study. All women who had surgery by a gynecologic oncologist for the management of ovarian lesions of at least 14 cm in size between April 2013 and December 2017 were included. Patients with evidence of metastatic disease were excluded. Demographics, surgical approach (MIS vs laparotomy), complications, histology, and recurrences were collected for the entire cohort using medians, ranges, and interquartile ranges for continuous variables, and frequencies and proportions for categorical variables.

Results: One hundred and eighteen patients were included; 62 underwent laparotomy and 56 MIS. Mean age and BMI were similar (49.9 ± 13.6 vs 51.7 ± 15; 29.2 ± 6.7 vs 29 ± 6.9) between the MIS and laparotomy groups, respectively. The mean mass size was 20 cm versus 21 cm in the MIS versus laparotomy groups. Benign lesion was the most common diagnosis in both groups (51% vs 53%), followed by malignancy (26% vs 34%) and borderline tumors (23% vs 13%). The MIS group had significant shorter hospital stay (0.8 vs 6.7 days) and fewer grade 3–5 complications (0 vs 8%). Mean follow-up was 14 versus 21 months in the MIS versus laparotomy groups. Rates of recurrence were low in both groups (4 patients, 7%, vs 5 patients, 8%, MIS, laparotomy).

Conclusion: Our data suggest that MIS is feasible and safe for the management of very large ovarian tumors requiring surgery by a gynecologic oncologist. MIS is associated with shorter hospital stay and less severe postoperative complications.

Cost-minimization analysis of germline and somatic testing strategies for BRCA mutations in women with newly diagnosed epithelial ovarian cancer
C.A. Penn, M.S. Wong, J. Lee and C. Walsh. Cedars-Sinai Medical Center, Los Angeles, CA, USA

Objective: The SOLO1 trial made it a priority to identify BRCA germline and somatic mutations in women with newly diagnosed epithelial ovarian cancer in order to determine candidates for olaparib maintenance. It is also important to differentiate between
germline and somatic mutations because of the potential for cascade testing in relatives. Three testing strategies can be employed: (1) test all patients for germline mutations with reflex somatic testing if germline testing is negative; (2) test all tumors for somatic mutations with reflex germline testing if somatic testing is positive; or (3) perform simultaneous germline and somatic testing. Little is known about the costs incurred to the health care system with these approaches. We aimed to determine the least costly strategy.

**Method:** We assumed all strategies were equally effective and thus performed a cost-minimization analysis. Base case analysis was performed assuming 20 BRCA mutations per 100 ovarian cancer cases (17 germline, 3 somatic based on The Cancer Genome Atlas data). Costs were based on commercially available tests and obtained from previously published sources or via telephone. We performed probabilistic sensitivity analysis using Monte Carlo microsimulation and 1-way sensitivity analysis.

**Results:** Paired testing upfront was the least costly option per cancer case. Based on probabilistic sensitivity analysis, testing for the 22,240 new ovarian cancer cases in the United States per annum would cost $136,310,231 for upfront paired testing, less than the germline, reflex somatic ($217,755,000) or somatic, reflex germline ($151,133,409) strategies. Paired testing remained the least costly option when priced at less than $6,794 per test (Figure 1). Priced greater than this, the somatic, reflex germline strategy became the least costly.

**Conclusion:** Simultaneous germline and somatic testing is currently the least costly option to identify germline and somatic BRCA mutation carriers among women with newly diagnosed ovarian cancer.

---

**Fig. 1.** Sensitivity analysis of optimal strategy by cost of combination testing.

---

269 - Poster Session
Toxicity and survival associated with IV/IP chemotherapy following neoadjuvant chemotherapy and interval debulking surgery for epithelial ovarian, fallopian tube, and primary peritoneal cancer
E. Rios-Dorina, M. Pezzilloa, M.A. Ulmb and T. Tillmannsb. aUniversity of Tennessee Health Science Center, Memphis, TN, USA, bUniversity of Tennessee West Cancer Center, Memphis, TN, USA

**Objective:** The aim of this study was to evaluate the feasibility and outcomes of a planned 6 cycles of intravenous/intraperitoneal (IV/IP) chemotherapy regimen following neoadjuvant chemotherapy (NACT) and interval debulking surgery (IDS), and to compare them with existing data on IV/IP therapy.

**Method:** Patients with stage III or IV epithelial ovarian, fallopian tube, or primary peritoneal cancer treated at a single institution with a plan for 6 cycles of IV/IP paclitaxel and cisplatin chemotherapy following NACT and IDS were included for analysis. Toxicity, tolerance, and survival of patients with planned 6 cycles of IV/IP chemotherapy following IDS were analyzed. The National Cancer Institute Common Terminology Criteria for Adverse Effects v5.0 was utilized to categorize adverse events.
**Results:** Thirty-three patients were identified. After the debulking surgery, 15 patients were reduced to no residual disease (45.5%); 16 patients were optimally debulked to less than 1 cm (48.5%); and 2 patients were suboptimally debulked (6%). A total of 161 cycles of adjuvant chemotherapy was given, 16 patients (48%) completing all 6 cycles of IV/IP therapy. The median number of cycles completed was 5. Reasons for not completing the planned treatment include adverse effects (3 patients, 9%) and patient refusal (5 patients, 15%). A total of 18 patients had disease recurrence (55%). The most common grade 3–4 complication was infections (5 patients, 15%) of which 3 were IP catheter related, followed by abdominal pain (3 patients, 9%), acute kidney injury (2 patients, 6%), and fatigue (1 patient, 3%). Less than 15% of patients had neutropenia, febrile neutropenia, or neuropathy (5 patients total). Reoperation was required for a total of 3 patients (9%) for wound dehiscence or small bowel obstruction. The median progression free survival (PFS) was 20 months, and the median overall survival (OS) was 59 months. See **Figure 1**.

**Conclusion:** Six cycles of IV/IP chemotherapy following NACT and IDS is well tolerated and associated with acceptable survival outcomes. IV/IP chemotherapy following NACT and IDS warrants further evaluation.
Clinical trial enrollment is associated with improved survival in recurrent ovarian cancer patients


aCedars-Sinai Medical Center, Los Angeles, CA, USA, bClearity Foundation, San Diego, CA, USA, cAnne Arundel Medical Center, Annapolis, MD, USA

Fig. 1.
Objective: Clinical trial participation is required for cancer therapy advances. Participation in trials requires patients and health care systems to commit more time and effort for therapies that may not be beneficial. The objective of this study was to examine whether participation in clinical trials was associated with an overall survival (OS) benefit in patients with high-grade serous ovarian cancer.

Method: High-grade serous ovarian carcinoma patients with recurrent disease included in the Clearity Foundation repository were evaluated. This database includes a cohort of patients who have consented to undergo next-generation tumor sequencing and provide clinical records. Following sequencing, participants were provided with options for treatment including standard of care and available clinical trials to return to their treating physicians. Data were abstracted for age, stage, survival, primary platinum sensitivity, and clinical trial enrollment. Censoring was performed at the date of last contact for alive patients. Cox regression was performed, and hazard rate ratios (HRR) were calculated.

Results: Of 369 included patients, 129 (35%) patients enrolled onto a total of 119 clinical trials. These included phase 1 (41%), phase 2 (46%), and phase 3 (14%) trials. Patients enrolled onto clinical trials versus nonenrolled patients were similar in age (mean 57.0 vs 58.2 years), stage (74.2% vs 75.3% stage 3), and platinum sensitivity (68.8% vs 68.0%). Patients who enrolled in clinical trials had an improved OS HRR of 0.642 for death compared to nonenrollers (95% CI 0.437–0.943, \(P = 0.024\)). Increasing age was also associated with increased risk of death (HRR = 1.025 per year, 95% CI 1.004–1.046, \(P = 0.017\)). Stage at diagnosis and primary platinum resistance were not predictive of benefit from clinical trial enrollment. See Figure 1.

Conclusion: Clinical trial enrollment among high-grade serous ovarian cancer patients was associated with direct clinical benefit in the form of improved OS. Further research is required to evaluate whether this benefit is a result of concordance between study drug and molecular profile. Enrollment to clinical trials for women with high-grade serous ovarian cancer should be encouraged.

Fig. 1. Survival by enrollment in clinical trial.
**Objective:** Hallmarks of *BRCA1* or *BRCA2*-associated ovarian cancer include platinum sensitivity and improved survival. However, therapeutic impact of other homologous recombination repair (HRR) gene mutations is limited, especially in Chinese populations. This study will display therapeutic implications of *BRCA1* or *BRCA2* and other HRR genes mutations in Chinese ovarian cancer patients.

**Method:** We prospectively enrolled 328 patients who underwent primary surgery for ovarian cancer between January 2016 and December 2018 at our institution. None of these patients received neoadjuvant chemotherapy. Paired blood and FFPE tumor samples were tested for genetic and somatic variations in *BRCA1* or *BRCA2* and 33 other HRR genes. As of March 2019, 274 patients have been followed up over 1 year and were included in the analyses. The median follow-up time was 15 months, and 163 paired tumor samples have been tested.

**Results:** Seventy (25.5%) patients carried germline and/or somatic *BRCA1* or *BRCA2* mutations. Another 32 patients had other HRR gene mutations. A larger proportion of patients with *BRCA1* or *BRCA2* mutations were platinum sensitive compared with wildtype patients (81.4% vs 70.3%, *P* = 0.053), while there was a small difference between HRR gene-mutated and wildtype groups (71.9% vs 70.3%, *P* = 0.174). Compared with wildtype patients, patients with *BRCA1* or *BRCA2* mutations had strikingly improved progression-free survival (median PFS, NR vs 20 months, HR = 0.54, CI 0.36–0.80, *P* = 0.007). Patients with mutations of HRR genes did not show prolonged PFS (*P* = 0.56). See Figure 1.

**Conclusion:** Germline and/or somatic *BRCA1* or *BRCA2* mutations potentially indicated platinum sensitivity rates and favored short-term outcome for Chinese ovarian cancer patients, while other HRR gene mutations failed to have similar positive impact in our population.

---

**272 - Poster Session**

**The effect of time to chemotherapy interval on low-grade serous ovarian cancer in aspect of progression free survival and overall survival**

J.H. Kang, C.H. Choi, J.W. Lee, T.J. Kim, E.S. Paik, S.Y. Jeong, M.S. Kim, B.G. Kim, D.S. Bae and Y.Y. Lee. Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, South Korea

**Objective:** The aim of this study was to evaluate the effect of time to chemotherapy (TTC) interval on progression-free survival (PFS) and overall survival (OS) of low-grade serous ovarian cancer.

**Method:** Data for 73 patients with low-grade (grade I) serous ovarian cancer (FIGO stage I–IV) from Korea (*n* = 55) and Taiwan (*n* = 18) were analyzed retrospectively. All patients were underwent primary surgery followed by platinum-based chemotherapy or platinum-based neoadjuvant chemotherapy followed by interval surgery. TTC interval was divided into 2 groups according to the median time. Multivariate Cox regression analysis was used to evaluate the independent effect of TTC interval after surgery on PFS and OS.
**Results:** Of 73 patients, 70 underwent primary debulking surgery and 3 interval debulking surgery. Median TTC interval was 12 days (range 9–19 days). There were no significant differences between the TTC interval <12 days group (n = 35) and the TTC interval ≥12 days group (n = 38) in age, stage, residual disease after surgery, and treatment modality (P > 0.05). Residual disease ≥1 cm (HR = 2.37, 95% CI 1.01–7.07, P = 0.047) and FIGO stage IV (HR = 11.75, 95% CI 3.04–45.40, P < 0.001) were significant prognostic factors for PFS in multivariate analysis. However, TTC interval <12 days versus ≥12 days (HR = 1.05, 95% CI 0.52–2.13, P = 0.88) was not associated with PFS in multivariate analysis. There were no significant prognostic factors including TTC interval <12 days versus ≥12 days (HR = 2.69, 95% CI 0.49–14.74, P = 0.254), FIGO stage, and residual disease for OS in multivariate analysis.

**Conclusion:** Our study found that delayed initiation of chemotherapy after surgery is not a significant prognostic factor in patients with low-grade serous ovarian cancer. So we have to consider the fast start of chemotherapy is not the best way to manage low-grade serous ovarian cancer, and we need to give patients enough time for recovery after surgery.

---

**273 - Poster Session**

**Landscape of germline and somatic alterations of HRR and MMR genes in 328 Chinese patients with primary epithelial ovarian cancer (EOC)**

H. Wen\(^a\), Z. Feng\(^a\), C. Zhu\(^b\), N. An\(^b\) and X. Wu\(^a\), \(^a\)Fudan University Shanghai Cancer Center, Shanghai, China, \(^b\)BGI Shenzhen, Shenzhen, China

**Objective:** Alterations of homologous recombination (HRR) and mismatch repair (MMR) pathways in epithelial ovarian cancer (EOC) have both hereditary and therapeutic implications. The aim of this study was to explore the germline and somatic landscape of genetic variations of HRR and MMR genes simultaneously in Chinese EOC patients.

**Methods:** All consecutive nonselective patients diagnosed with EOC pathologically and receiving primary surgery between January 2016 and December 2018 at our institution were prospectively recruited. Those who had undergone neoadjuvant chemotherapy were ineligible. Informed consent and peripheral blood were obtained from 328 patients and sent for germline testing. Of these, 192 paired FFPE tumor samples were also tested for somatic variations. HRR and MMR genes were captured and sequenced by MGI-seq 2000 platform.

**Results:** Most patients (84.4%) were high-grade serous ovarian cancer (HGSOC), and 227 (69.2%) patients reported a family history of any type of cancer. In total, 106 (32.3%) patients carried 116 germline (likely) pathogenic variations of HRR and/or MMR genes, including 10 patients (3%) with comutations. *BRCA1* or *BRCA2* and other HRR genes and MMR gene mutations were observed in 22% (n = 73), 10.9% (n = 36), and 1% (n = 4) patients, respectively. For patients with paired FFPE tumor samples tested, 51.6% (99/192) carried somatic and/or germline mutations in *BRCA1* or *BRCA2*, HRR, or MMR genes. Somatic mutations of *BRCA1* or *BRCA2* and other HRR genes were found in 13 (6.8%) and 17 (8.8%) patients. Genetically, “double-hit” was identified in 28 patients. See Figure 1.

**Conclusion:** Both germline and somatic testing with multigene panel including HRR and MMR genes is practical in EOC. And somatic testing may provide more information on therapeutic decision, especially for PARPi therapy.
Elucidating the immune responsiveness of small cell carcinoma of the ovary, hypercalcemic type


**Objective:** A recent case series described favorable response of small cell carcinoma of the ovary, hypercalcemic type (SCCOHT) to antiprogrammed death-1 (PD-1) immune checkpoint therapy in 4 patients. In this study, we aimed to examine patterns of immunohistochemical (IHC) expression of PD-L1 in SCCOHT and correlate these with available clinical response to immunotherapy.

**Method:** Clinical and pathological data were available for 4 patients with SCCOHT, including 3 treated with anti-PD-1 immunotherapy. PD-L1 IHC was performed in an additional 4 patients. SMARCA4 genetic testing was completed in all patients. PD-L1 positivity by IHC was quantitatively assessed using either the combined positive score (CPS) or tumor proportion score (TPS).

**Results:** PD-L1 staining in this case series demonstrated distinct staining patterns (Figure 1). Patients 1 and 2 had minimal PD-L1 staining (CPS <1 and CPS = 0, respectively). Patient 3 demonstrated CPS = 15 primarily in tumor cells, while patient 4 had CPS = 30 primarily in immune cells. Pathology alone was available for 4 additional cases of SCCOHT. Three were negative for PD-L1 (CPS = 0), and 1 was low positive (TPS = 1). All 8 patients were found to have a SMARCA4 mutation. Patients 1–4 were treated with surgery and cytotoxic adjuvant chemotherapy. Patients 1, 2, and 3 went on to receive immunotherapy. Patients 1 and 2 received 2 and 3 cycles of pembrolizumab, respectively, with progression of disease. Patient 3 received ipilimumab/nivolumab (IPI/NIVO) following palliative radiation to oligometastatic progressive disease and had a complete response after 4 cycles. She was briefly placed on NIVO monotherapy and then subsequently restarted IPI/NIVO for progressive disease. Patient 4 was lost to follow-up after completion of adjuvant chemotherapy.

**Conclusion:** These preliminary data suggest that SCCOHT differentially expresses PD-L1, which may correlate with patient clinical response to immune checkpoint therapy.
Fig. 1. PD-L1 staining in SCCOHT patients. PD-L1 staining in this patient cohort demonstrates three distinct staining patterns: minimal, tumor predominant, and immune predominant. Patients 1-3 received immunotherapy. Only patient 3 with tumor predominant PD-L1 staining demonstrated clinical response to PD-1 immune checkpoint therapy.

275 - Poster Session
Surgical approach for interval debulking after neoadjuvant chemotherapy for treatment of advanced ovarian cancer: A single-institution retrospective cohort study
E.M. Webster², K.B. Dugan³, B. McNamara¹, L. Lu⁴, M. Azodi⁵, E.S. Ratner⁶, P.E. Schwartz⁷ and G. Menderès⁸,⁹, aYale University School of Medicine, New Haven, CT, USA, bJohns Hopkins School of Medicine, Baltimore, MD, USA, cUniversity of California, San Francisco, San Francisco, CA, USA, dYale School of Public Health, New Haven, CT, USA, eSmilow Cancer Hospital at Yale and Yale University, New Haven, CT, USA, fYale New Haven Health System - Bridgeport Hospital, Bridgeport, CT, USA, gYale New Haven Health System, New Haven, CT, USA

Objective: This study aims to compare oncological outcomes following minimally invasive surgery (MIS) versus laparotomy (open) for interval debulking (IDS) in advanced epithelial ovarian cancer (EOC).

Methods: This is an updated, matched retrospective cohort study of patients who underwent IDS from 2013 to 2019. MIS and open cases were identified through an institutional tumor registry, and data were obtained by chart review. Open controls were matched to MIS cases by an investigator blinded to the outcome. Patients were matched on 6 covariates: age, surgeon, tumor histology, tumor stage, cycles of neoadjuvant chemotherapy (NACT), and performance status. Kaplan-Meier survival curves were modeled using SAS v9.4.

Results: Thirty-eight MIS cases were matched to 38 open controls. The median surgical date was earlier for open cases (May 18, 2015, vs May 8, 2016); however, median follow-up time for disease-free patients was similar (20.6 vs 16.6 months, \( P = 0.33 \)). Median CA-125 at diagnosis was higher, but not statistically significant, for open cases (1268 vs 830, \( P = 0.3 \)) and at the time of IDS (24.9 vs 17.7, \( P = 0.18 \)). There was no difference in number of BRCA mutation carriers (4 vs 7, \( P = 0.28 \)). Open cases were more likely to have residual disease preoperatively (87% vs 66%, \( P = 0.03 \)). Of these, there was an equal likelihood of R0 resection (85% vs 84%, \( P = 0.93 \)). There was no
The difference between median progression-free survival (PFS) (17.3 vs 15.5 months, \( P = 0.44 \)), cancer-specific survival (42.1 vs 37.3 months, \( P = 0.59 \)), and overall survival (42.1 vs 33.1 months, \( p = 0.39 \)) following an open versus MIS approach. Mean time to initiation of adjuvant chemotherapy was the same (35.6 vs 34.8 days, \( P = 0.4 \)). See Figure 1.

**Conclusion:** This study showed similar oncological outcomes in women with advanced EOC when IDS was performed using MIS and open approaches. We previously presented preliminary data that suggested a trend toward improved PFS with open IDS. However, new data with expanded sample size and longer follow-up time refute this trend. It is possible that a surgical learning curve of laparoscopic technique also contributes to these findings. This study adds to the limited body of evidence of the efficacy of MIS IDS. Prospective data are needed to further evaluate the role of surgical approach for IDS in women with advanced EOC.

![Fig. 1. Progression-free survival curve for MIS and open approaches. Median open PFS 17.3 months (95% confidence interval [CI], 9.3 - 35.0 months). Median MIS PFS 15.5 months (95% CI, 11.9 - 23.2 months).](image)

**276 - Poster Session**

**Germline mutations of SMARCA4 in small cell carcinoma of the ovary, hypercalcemic type and in SMARCA4-deficient undifferentiated uterine sarcoma: Clinical features of a single family and comparison of large cohorts**


**Objective:** Small cell carcinoma of the ovary, hypercalcemic type (SCCOHT) and SMARCA4-deficient undifferentiated uterine sarcoma (SMARCA4-DUS) are rare and aggressive tumors, primarily affecting pre- and perimenopausal women. Inactivating SMARCA4 mutations are thought to be the driving molecular events in the majority of these tumors. Here, we report the clinical course of a family with germline SMARCA4 mutation and compare large cohorts of these rare tumor types.

**Method:** We extracted clinicopathological medical record data for the family with germline SMARCA4 mutation. Clinicogenomic data from SCCOHT and SMARCA4-DUS cohorts were retrospectively extracted from the archives of a large CLIA-certified reference molecular laboratory.

**Results:** We identified a single family with an inherited germline SMARCA4 mutation, in which two different family members developed either SCCOHT or SMARCA4-DUS, both of whom died within 1 year of diagnosis, despite aggressive surgical, chemotherapy, and immunotherapy treatment. Retrospective comparative analysis of large SCCOHT (\( n = 48 \)) and SMARCA4-DUS (\( n = 17 \)) cohorts revealed that SCCOHT patients were younger (median age 28.5 vs 49.0 years) and more likely to have germline SMARCA4 alterations (37.5% vs 11.8%) than SMARCA4-DUS patients.

**Conclusion:** Growing understanding of the role SMARCA4 plays in the pathogenesis of these rare cancers may inform recommended genetic testing and counseling in families with these tumor types.
The predictive value of homologous recombination deficiency (HRD) status for progression free survival (PFS) after first-line platinum-based chemotherapy in advanced ovarian cancer

Y. Xu, A. Saverimuthu, A. Jadhav, R. Bhuiyan, J. Yio and V. Kumar.

Maimonides Medical Center, New York, NY, USA, Brigham and Women’s Hospital and Harvard Medical School, Boston, MA, USA

Objective: Platinum-sensitive recurrent ovarian cancers harboring homologous recombination deficiency (HRD) derive benefit from maintenance therapy with poly(adenosine diphosphate–ribose) polymerase (PARP) inhibitors. Ovarian cancers with HRD may also have a better response to platinum-based chemotherapy, which exerts lethal killing by creating DNA damage. A list of genes selected for quantifying HRD, or loss of heterozygosity (LOH) score, has been developed by Foundation Medicine, Inc, and used in the ARIEL 2 study. This retrospective study aims to correlate HRD status with PFS, platinum-free duration, and overall survival (OS).

Method: All ovarian cancer patients in Maimonides Medical Center who had tumor FoundationOne test results from its inception to August 31, 2019, were eligible. HRD+ status was defined as a score of LOH ≥ 16%. PFS is from the initial diagnosis to the first recurrence. Platinum-free duration is from the last day of first-line (adjuvant) platinum treatment to the first recurrence.

Results: We identified 39 patients, and LOH score was available in 35 patients, who were included in the analysis. Twenty-nine patients had stage III–IV disease at initial diagnosis. All received platinum-based chemotherapy; 13 also received intraperitoneal cisplatin; and 3 did not have debulking surgery. Thirty-two patients had tumor recurrence. Table 1 summarizes the tumor characteristics. Fifteen patients had HRD+ status (group A), and 20 patients had HRD− (group B). Three patients from group A had germline mutations on BRCA1, RAD51C, and BRIP1. Comparing group A with B, the PFS was 18.53 months (95% CI 10.8–22.63) versus 20.47 months (95% CI 10.67–25.33, P = 0.46); the platinum-free duration was 11.2 months (95% CI 4.7–15.83) versus 12.73 months (95% CI 4.3–17.77, P = 0.38); and the OS was 73.9 months (95% CI 52.12–87.8) versus 63.33 months (95% CI 34.2–95.4, P = 0.15), respectively.

Conclusion: Ovarian cancer with HRD+ status was more likely to have intermediate levels of TMB and germline mutations. Mucinous and clear cell cancer had HRD− status. However, HRD+ status was not associated with more favorable outcome after platinum treatment or OS.

Table 1

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Median age</th>
<th>Stage III/IV</th>
<th>IP chemo</th>
<th>Tumor mutation burden (TMB), intermediate</th>
<th>Genetic mutation</th>
<th>Histology other than serous</th>
</tr>
</thead>
<tbody>
<tr>
<td>HRD+, Group A</td>
<td>15</td>
<td>61</td>
<td>13 (86.7%)</td>
<td>6</td>
<td>5 (33.3%)</td>
<td>3</td>
<td>Adenocarcinoma: 1</td>
</tr>
<tr>
<td>HRD- Group B</td>
<td>20</td>
<td>57.5</td>
<td>16 (80%)</td>
<td>7</td>
<td>1 (5%)</td>
<td>0</td>
<td>Small cell: 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mucinous: 3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Clear cell: 1</td>
</tr>
</tbody>
</table>

Robotic-assisted laparoscopic splenectomy in recurrent ovarian cancer: A case series with clinical outcomes

T.A. Paterniti, S. Ahmad and R.W. Holloway.

Augusta University Medical Center, Augusta, GA, USA, AdventHealth Cancer Institute, Orlando, FL, USA

Objective: The aim of this study was to review clinical outcomes of a series of patients who underwent robot-assisted laparoscopic splenectomy (RALS) for cytoreduction of recurrent ovarian cancer.

Method: Chart review from patients who underwent RALS for splenic recurrence of platinum-sensitive ovarian cancer (PSOC) between April 2012 and May 2019 was performed. The extent of disease was confirmed by PET-CT preoperatively, and platinum-doublet chemotherapy was initiated postoperatively. Peri- and postoperative outcomes were assessed.

Results: Ten patients underwent RALS as part of a secondary or tertiary cytoreduction. Disease was limited to the spleen in 7 patients, while 3 had evidence of omental or diaphragmatic metastases on preoperative imaging. The median operative time was 176 minutes (range 114–420 minutes), and resection to no visible disease was achieved in each patient. One patient developed a pleural effusion postoperatively; however, there were no transfusions, returns to the operating room, abscesses, or pseudocysts, and each patient was cleared to begin adjuvant chemotherapy within 21 days postoperatively. After a median follow-up of 47 months (range 6–92 months), 5 patients remain disease-free, while 5 have experienced a recurrence of disease (2 deaths, 3 alive with disease). The median disease-free interval was 15 months (range 6–92 months), and the median overall survival was 47 months (range 6–92 months).
Conclusion: RALS is feasible with low morbidity in select patients with a splenic recurrence of PSOC.

279 - Poster Session
Neoadjuvant chemotherapy for stage III ovarian cancer: A single-institution experience
Zucker School of Medicine at Hofstra/Northwell, New Hyde Park, NY, USA, Hofstra - North Shore Long Island Jewish School of Medicine, Manhasset, NY, USA

Objective: There has been much debate regarding the utility of neoadjuvant chemotherapy (NACT) for advanced-stage ovarian cancer. Differences in the utilization of NACT have been observed based on location and institutional volume. We wanted to evaluate the outcomes of our institutional experience with NACT.

Method: An Institutional Review Board-approved study identified all our patients with stage III ovarian cancer between January 2011 and May 2018. Demographics and outcome measures were abstracted from medical records and the tumor registry. Cox proportional hazard models, log rank tests, and comparisons of means were used to calculate significance ($P < 0.05$).

Results: One hundred sixty patients were identified during the study period. One hundred and ten (71%) presented with serous carcinoma. Five (3%) patients refused chemotherapy. One hundred fifteen (70.1%) received adjuvant therapy as intravenous or intravenous/intraperitoneal platinum-based chemotherapy. Forty (25%) patients received NACT. Seventy-seven percent of tumors were platinum-sensitive. The utilization of NACT did not significantly change during the study period ($P > 0.05$). Median progression-free survival (PFS) was 18 months (IQR 8.5–33) in the adjuvant group and 17 months (IQR 6.3–28.5) in the NACT group ($P > 0.05$, Figure 1). Median overall survival (OS) was 36 months (21.5–58.5 months) in the adjuvant group and 29 months 24.3–51.5 months) in the NACT ($P > 0.05$). Increasing substage was an independent risk factor for worse PFS and OS ($P < 0.05$).

Conclusion: Our cohort showed no significant difference in PFS or OS in patients with stage III ovarian cancer. Twenty-five percent of our patients received NACT, which remained constant throughout the study period. Data regarding the optimal treatment for advanced-stage ovarian cancer have yet to be determined. Our data support that NACT is a reasonable treatment option in our cohort.

Fig. 1.

280 - Poster Session
Molecular tumor testing rates for women with ovarian cancer: Results from a national claims database
C.R. Gamble, Y. Huang, J.D. Wright and J.Y. Hou.
New York-Presbyterian/Columbia University Medical Center, New York, NY, USA, Columbia University College of Physicians and Surgeons, New York, NY, USA

Objective: Precision medicine technologies increasingly demonstrate potential in the management of gynecologic cancers. However the real world uptake of molecular tumor testing has not been extensively explored. We sought to determine the frequency of molecular tests for patients who have ovarian cancer, examining trends over time and geographic variation.

Method: The nationwide insurance claims database MarketScan was used to identify commercially insured women with a diagnosis of ovarian cancer who underwent oophorectomy between 2011 and 2017. The frequency of claims for BRCA1 or BRCA2 limited and full sequencing, multigene sequencing, single gene analysis, microsatellite instability (MSI)/immunohistochemistry (IHC) testing for proteins associated with Lynch genes, other non-Lynch IHC testing, and fluorescence in situ hybridization (FISH) was examined. Descriptive statistics were calculated for each test, and trends stratified by year of diagnosis, geographic region, and age analyzed.
**Results:** There were 24,087 patients with ovarian cancer who underwent surgery during the study period. From 2011 to 2017, claims for BRCA-limited testing increased from 0.15% to 14%; BRCA1 or BRCA2 full gene sequencing increased from 0.26% to 24.78%; and multigene panel testing increased from 0% to 0.35%. Claims increased for Lynch-associated MSI/IHC testing (0% to 3.16%) and non-Lynch IHC (42.6% to 58.7%), whereas they decreased for FISH (4.6% to 1.4%). For women <40 years, BRCA1 or BRCA2 limited and full sequencing was 6.4% and 8.6%, respectively. Rates of BRCA1 or BRCA2 limited and full sequencing were highest in women age 50–59 years (10.2% and 13.9%, \( P < 0.001 \)). Geographically, there were higher rates of BRCA1 or BRCA2 testing in the West (\( P = 0.004 \)), and single-gene testing in the South (\( P = 0.01 \)). Multigene sequencing did not vary with age or geography (\( P > 0.05 \) for both). See Table 1.

**Conclusion:** The rates of molecular tumor testing for women with ovarian cancer are increasing. There remains significant room for improvement within this insured patient cohort, specifically as it relates to BRCA tumor testing for young patients <40 years.

**Table 1.**

<table>
<thead>
<tr>
<th>Year</th>
<th>BRCA 1/2 gene only, limited analysis</th>
<th>BRCA1/2 gene only, full sequencing</th>
<th>Multi-gene sequencing</th>
<th>Single gene analysis (non-BRCA/Lynch)</th>
<th>MSI/IHC Lynch</th>
<th>IHC non-Lynch</th>
<th>FISH</th>
<th>Ancillary Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>0.15</td>
<td>0.26</td>
<td>0</td>
<td>0.02</td>
<td>0</td>
<td>42.56</td>
<td>4.63</td>
<td>9.11</td>
</tr>
<tr>
<td>2012</td>
<td>3.67</td>
<td>7.45</td>
<td>0</td>
<td>0.41</td>
<td>0.1</td>
<td>46.2</td>
<td>4.56</td>
<td>10.71</td>
</tr>
<tr>
<td>2013</td>
<td>10.51</td>
<td>12.82</td>
<td>0</td>
<td>5.72</td>
<td>0.72</td>
<td>49.28</td>
<td>4.76</td>
<td>7.86</td>
</tr>
<tr>
<td>2014</td>
<td>13.55</td>
<td>15.12</td>
<td>0</td>
<td>6.72</td>
<td>0.69</td>
<td>42.21</td>
<td>4</td>
<td>8.17</td>
</tr>
<tr>
<td>2015</td>
<td>14.94</td>
<td>18.53</td>
<td>0.08</td>
<td>9.17</td>
<td>1.3</td>
<td>55.18</td>
<td>1.38</td>
<td>7.91</td>
</tr>
<tr>
<td>2016</td>
<td>13.32</td>
<td>18.53</td>
<td>0.69</td>
<td>7.67</td>
<td>1.13</td>
<td>56.64</td>
<td>0.73</td>
<td>6.74</td>
</tr>
<tr>
<td>2017</td>
<td>14.24</td>
<td>24.78</td>
<td>0.35</td>
<td>7.21</td>
<td>3.16</td>
<td>58.7</td>
<td>1.41</td>
<td>7.73</td>
</tr>
</tbody>
</table>

\( P\)-value: <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001 <0.0001

**Geographic Region**

<table>
<thead>
<tr>
<th>Geographic Region</th>
<th>BRCA 1/2 gene only, limited analysis</th>
<th>BRCA1/2 gene only, full sequencing</th>
<th>Multi-gene sequencing</th>
<th>Single gene analysis (non-BRCA/Lynch)</th>
<th>MSI/IHC Lynch</th>
<th>IHC non-Lynch</th>
<th>FISH</th>
<th>Ancillary Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>North East</td>
<td>8</td>
<td>9.94</td>
<td>0.12</td>
<td>3.98</td>
<td>0.45</td>
<td>46.82</td>
<td>2.96</td>
<td>7.98</td>
</tr>
<tr>
<td>North Central</td>
<td>7.2</td>
<td>10.07</td>
<td>0.06</td>
<td>3.72</td>
<td>0.51</td>
<td>48.86</td>
<td>2.56</td>
<td>7.26</td>
</tr>
<tr>
<td>South</td>
<td>8.41</td>
<td>11.81</td>
<td>0.1</td>
<td>5.03</td>
<td>0.96</td>
<td>49.38</td>
<td>4.79</td>
<td>10.01</td>
</tr>
<tr>
<td>West</td>
<td>9.36</td>
<td>12.49</td>
<td>0.12</td>
<td>3.42</td>
<td>0.55</td>
<td>46.07</td>
<td>3.46</td>
<td>8.65</td>
</tr>
<tr>
<td>Unknown</td>
<td>8.42</td>
<td>8.91</td>
<td>0</td>
<td>2.97</td>
<td>0</td>
<td>44.8</td>
<td>5.2</td>
<td>7.18</td>
</tr>
</tbody>
</table>

\( P\)-value: 0.0044 <0.0001 0.7982 <0.0001 0.0003 0.0007 <0.0001 <0.0001

**Age**

<table>
<thead>
<tr>
<th>Age</th>
<th>BRCA 1/2 gene only, limited analysis</th>
<th>BRCA1/2 gene only, full sequencing</th>
<th>Multi-gene sequencing</th>
<th>Single gene analysis (non-BRCA/Lynch)</th>
<th>MSI/IHC Lynch</th>
<th>IHC non-Lynch</th>
<th>FISH</th>
<th>Ancillary Procedures</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;40</td>
<td>6.42</td>
<td>8.65</td>
<td>0.04</td>
<td>3.3</td>
<td>2.78</td>
<td>39.76</td>
<td>2.34</td>
<td>7.83</td>
</tr>
<tr>
<td>40-49</td>
<td>9.6</td>
<td>12.68</td>
<td>0.07</td>
<td>4.13</td>
<td>3.37</td>
<td>41.18</td>
<td>3.1</td>
<td>9.23</td>
</tr>
<tr>
<td>50-59</td>
<td>10.2</td>
<td>13.87</td>
<td>0.12</td>
<td>4.7</td>
<td>3.62</td>
<td>49.7</td>
<td>3.82</td>
<td>8.99</td>
</tr>
<tr>
<td>&gt;=60</td>
<td>6.41</td>
<td>8.6</td>
<td>0.11</td>
<td>4.02</td>
<td>1.93</td>
<td>52.16</td>
<td>4.13</td>
<td>8.29</td>
</tr>
</tbody>
</table>

\( P\)-value: <0.0001 <0.0001 0.6162 0.0118 <0.0001 <0.0001 <0.0001 <0.0001

---

**281 - Poster Session**

**Disparate care in primary treatment of advanced ovarian cancer: Do we maintain equipoise?**

A.D. Craig\(^a\), P.N. Peters\(^b\), E. Garcia\(^b\), L.M. Chen\(^c\) and J.S. Chapman\(^b\).

\(^a\)Fox Chase Cancer Center, Philadelphia, PA, USA, \(^b\)University of California, San Francisco, San Francisco, CA, USA, \(^c\)UCSF Helen Diller Family Comprehensive Cancer Center, San Francisco, CA, USA

**Objective:** Multiple randomized trials have demonstrated equivalent survival with fewer adverse outcomes following neoadjuvant chemotherapy (NACT) compared to primary cytoreductive surgery (PCS) for women with advanced-stage ovarian cancer. A larger proportion of women are undergoing neoadjuvant chemotherapy, yet little is known about the characteristics of these women. The aim of this project was to evaluate whether treatment approach was associated with socioeconomic status, race/ethnicity, or geographic distance from an academic medical center.
**Method:** This was a retrospective chart review of women with stage III or IV ovarian, fallopian tube, or peritoneal cancer receiving treatment at an urban academic medical center from 2011 to 2016. Descriptive analyses were performed using $X^2$, student $t$ test, or Wilcoxon log rank tests, and recurrence data were analyzed using Kaplan-Meier and Cox proportional hazards ratio.

**Results:** Complete data were available for 176 women. Seventy-two women (41%) received NACT, while 104 women (59%) underwent PCS. Ten percent of women never consulted with a gynecologic oncologist prior to initiating treatment. Women receiving NACT were older (median age 64 vs 59 years, $P = 0.013$) and more likely to have public funded insurance (68% vs 49%, $P = 0.024$) and to live closer to an academic teaching center (48 vs 168 miles, $P = 0.0396$). Adjuvant chemotherapy after cytoreductive surgery varied by initial treatment choice, with those receiving NACT more likely to receive carboplatin/paclitaxel every 3 weeks (55% vs 31%) or dose dense chemotherapy (22% vs 17%), whereas the PCS group more frequently received IV/IP chemotherapy (5% vs 24%) or enrolled in a clinical trial (0 vs 7%, $P < 0.0001$). There was no statistically significant difference in disease recurrence by initial treatment choice. See Figure 1.

**Conclusion:** We identified disparities in selection of primary and adjuvant treatment for ovarian cancer. When there are practice changes in a field of medicine, there is the possibility for differential care, especially in underserved populations. Future work should focus on the significance of decision making in the community, how differences in treatment may affect ovarian cancer outcomes, and identification of interventions that may reduce disparate care.

![Kaplan-Meier survival estimates](image)

**Fig. 1.** Kaplan-Meier survival curve for ovarian cancer recurrence.

---

**282 - Poster Session**

**Ovarian cancer risk score predicts the chemo-response and outcome of epithelial ovarian carcinoma patients**

W.F. Cheng. National Taiwan University Hospital, Taipei, Taiwan

**Objective:** The purpose of this study was to develop an ovarian cancer risk score (OVRS) by 10 ovarian cancer-related genes panel to predict the chemoresponse and outcome of epithelial ovarian carcinoma (EOC) patients.

**Method:** We studied 149 women with EOC including 75 chemo-sensitive and 74 chemo-resistant patients. The gene expressions of 10 ovarian cancer-related genes were determined by quantitative real-time polymerase chain reaction. We analyzed the correlations between OVRS and chemoresponse, progression-free survival, and overall survival of ovarian cancer patients. We also validated the OVRS by analyzing the patients from The Cancer Genome Atlas (TCGA) database.

**Results:** The median expression levels of the 10 respective ovarian cancer-related genes were significantly higher in chemo-resistant patients than in chemo-sensitive patients. The chemo-sensitive group had lower OVRS than the chemo-resistant group (5 vs 15, $P < 0.001$, Mann-Whitney U test). Patients with disease relapse (13 vs 5, $P < 0.001$) or disease-related death (13.5 vs 6, $P < 0.001$) had higher OVRS than those without. The OVRS $\geq 9$ (HR = 5.02, 95% CI 2.75-9.18, $P < 0.001$) was the only poor prognostic factor for the
Conclusion: The ovarian cancer risk score can be a good biomarker system to predict the chemoresponse and outcome of EOC patients.
Is there any utility in performing lymphadenectomy for early-stage mucinous ovarian carcinoma?


**Objective:** The aim of this study was to investigate the prevalence of regional lymph node metastasis among patients with clinical stage I and II mucinous ovarian carcinoma (MOC).

**Method:** The National Cancer Data Base was accessed (2004–2015), and patients with clinical stage I and II MOC and known tumor grade who did not have a personal history of another tumor and underwent surgical treatment were identified. Performance of lymph node dissection (LND) and status of lymph nodes were assessed. Variables associated with the receipt of LND were evaluated by binary logistic regression.

**Results:** A total of 4,867 patients with clinical stage I and II MOC were identified; 4,453 had stage I disease, while 414 had stage II disease. A total of 3,117 (70.0%) patients with stage I and 280 (67.6%) patients with stage II MOC underwent LND. Patients who received LND were more likely to have their surgery in an academic facility (63.5%, \( P < 0.001 \)), be >50 years (57.5%, \( P = 0.009 \)), have grade 1 tumors (46% vs 42.3% grade 2 and 12.6% grade 3, \( P = 0.040 \)), be within stage IA–IB (65.6% vs 25.1% stage IC and 8.2% stage II, \( P < 0.001 \)), have tumors ≥10 cm (63.9%, \( P < 0.001 \)), and have no medical comorbid conditions (70.8%, \( P < 0.001 \)). The prevalence of lymph node metastasis was 1.5% and 7.2% among patients with stage 1 and 2 disease, respectively (\( P < 0.001 \)). Among those with stage I disease, 1.3% with stage IA–IB, and 1.6% with stage IC disease had lymph node metastasis (\( P < 0.001 \)). The prevalence of lymph node metastasis was 0.6% in those with grade 1 tumors, 1.5% in grade 2 tumors, and 7.9% in grade 3 tumors (\( P < 0.001 \)). In stage I, the rate of lymph node metastasis was not associated with tumor size (\( P = 0.42 \)).

**Conclusion:** In MOC, the prevalence of lymph node metastasis is significantly higher in grade 3 tumors and stage II disease. The prevalence of lymph node metastasis in stage I, grade 1, and grade 2 tumors is low, indicating that these patients could potentially be spared from LND during staging procedures.

Cytoreductive surgery for advanced-stage ovarian cancer with upper abdominal disease performed by gynecologic oncologists alone versus multiple surgical specialties: Is there a difference in outcomes?

N.A. Latif\(^a\), S. Gysler\(^b\), A.F. Haggerty\(^b\), R.L. Giuntoli II\(^b\), E.M. Ko\(^b\) and L. Cory\(^b\). \(^a\)University of Pennsylvania, Philadelphia, PA, USA, \(^b\)University of Pennsylvania Health System, Philadelphia, PA, USA, \(^c\)Penn Medicine, University of Pennsylvania, Philadelphia, PA, USA
Objective: The purpose of this study was to evaluate the perioperative surgical outcomes of cytoreductive surgery that included upper abdominal disease in advanced-stage ovarian cancer performed by gynecologic oncologists alone versus those with other surgical specialties (other than gynecologic oncologists).

Method: We identified women who underwent cytoreductive surgery that included upper abdominal disease (defined as disease involving the liver, spleen or diaphragm) in stage III and IV ovarian cancer in the National Surgical Quality Improvement Program database from 2014 to 2017. Data collected included residual disease (<1 cm or ≥1 cm), operative time, blood transfusions, length of stay, and serious postoperative complications. Univariate and bivariate statistics were performed.

Results: A total of 881 women underwent surgical intervention for stage III and IV ovarian cancer with upper abdominal disease between 2014 and 2017. Of those surgeries, 83.2% (n = 733) were performed by gynecologic oncologists alone compared to 16.7% (n = 148) performed with other surgical specialties. The total cohort had a median age of 62.0 years (IQR 54.0–70.0) and median BMI of 26.6 kg/m² (IQR 23.2–31.4), and the majority were Caucasian (75%, n = 669). Surgeries performed by other surgical specialties had longer operative times (median 298 vs 198 minutes, P < 0.01) and more blood transfusions (54.7% vs 37%, P < 0.01) compared to surgeries performed by gynecologic oncologists alone. Women who underwent cytoreductive surgeries performed by gynecologic oncologists alone were more likely to have longer length of stay (7 vs 5 days, P < 0.01) and thromboembolism (10% vs 4.5%, P < 0.01). There were no differences in postoperative deaths, readmission, and need for reoperation between gynecologic oncologists alone versus other surgical specialties. However, gross residual disease ≥1 cm was higher in cytoreductive surgery performed by gynecologic oncologists alone versus other surgical specialties (11% vs 6%, P < 0.03).

Conclusion: Ovarian cancer patients with upper abdominal disease who underwent cytoreductive surgery performed by gynecologic oncologists were more likely to have better intraoperative and postoperative outcomes but higher rates of suboptimal cytoreduction compared to surgeries performed by other surgical specialists. Further studies are warranted to optimize the outcomes of cytoreductive surgery for advanced-stage ovarian cancer with upper abdominal disease.

---

286 - Poster Session

Projection of long-term overall survival among patients with newly diagnosed advanced ovarian cancer and a BRCA1/2 mutation

D. R. G. Mustona, M. J. Monbergb, K. McLaurinc, A. Sackeyfiod, R. Hettled, J. Signorovitche, E. Swallowf, W. Goae, S. Zhangg, I. Kalemaje and K. N. Moorei. aMerck & Co., Inc., Whitehouse Station, NJ, USA, bMerck & Co., Inc., Kenilworth, NJ, USA, cAstraZeneca, Gaithersburg, MD, USA, dAstraZeneca, Cambridge, United Kingdom, eAnalysis Group, Inc., Boston, MA, USA, fThe University of Oklahoma Stephenson Cancer Center, Oklahoma City, OK, USA

Objective: Understanding the long-term survival rate of patients with newly diagnosed advanced ovarian cancer is critical to the clinical and economic appraisal of new treatments, disease management, and patient counseling. A phase 3 clinical trial (SOLO1) demonstrated that maintenance olaparib provided substantial benefit in progression-free survival (PFS) in BRCA1 or BRCA2 patients with newly diagnosed advanced ovarian cancer. Overall survival (OS) from SOLO1 is currently immature. This study aimed to explore the external validity of 4 methods to extrapolate OS for placebo in SOLO1.

Method: Four methods were evaluated by comparing their projected 10-year OS for the placebo arm of SOLO1 with observed OS in SEER cancer registry data for patients with stage III or IV ovarian cancer (BRCA1 or BRCA2 status unavailable). All methods used observed data for the first 24 months, the duration of maintenance treatment in SOLO1. From this point, method 1 used a Weibull parametric model (best-fitting distribution) from placebo arm data; method 2 used the same distribution from olaparib arm data with an assumed treatment effect for placebo; method 3 projected OS by applying an acceleration factor to PFS; and method 4 instead applied a constant HR to the hazard of disease progression. The acceleration factor and the HR were estimated from SEER-Medicare data.

Results: At year 10, the estimated OS for placebo was 60.3%, 18.4%, 45.0%, and 44.0% for methods 1–4, respectively. The estimate from method 2 was the closest to the reported 10-year OS from SEER (15.0%).

Conclusion: The 3 methods produced widely divergent survival results. Compared to real-world data, method 2 provided the most externally valid projection of long-term OS in patients with advanced ovarian cancer; and this may inform future modeling for cost-effectiveness, service demand, and patient counseling. Future validation against extended follow-up of trial populations, with and without olaparib or subsequent PARP inhibitor treatment, will provide additional evidence to inform long-term survival for patients with BRCA1 or BRCA2 mutations and ovarian cancer.

---

287 - Poster Session

Inherited mutations in Chinese women with epithelial ovarian cancer

H. Wena, Z. Fengb, C. Zhub and X. Wu. aFudan University Shanghai Cancer Center, Shanghai, China, bBGI Shenzhen, Shenzhen, China
Objective: Genetic predisposition to epithelial ovarian cancer (EOC) is well documented. However, little is known about inherited mutations in Chinese EOC patients. We report the frequency of pathogenic variants identified among Chinese women with EOC using a multigene panel.

Method: All consecutive nonselective patients diagnosed with EOC and receiving surgery without neoadjuvant therapy between January 2016 and December 2018 at our institution were prospectively recruited into a cohort study. Informed consent and peripheral blood were obtained from 328 patients and sent for germline testing of HRR and MMR genes. Pathogenic variants of 13 EOC-related inherited susceptibility genes were analyzed.

Results: Positive yield was 27.7% (91/328) with comutations in 3 patients. BRCA1 or BRCA2 were most frequently altered with a frequency of 22.3% (73/328). Mutations of other HHR genes and MMR genes were seen in 17 (5.2%) and 4 (1.2%) patients, respectively. No mutation was detected in clear cell, LGSC, and mucinous cases. The tendency of early onset was observed in cases with BRCA1 and MMR mutations. Women with a family history of breast, ovarian, prostate, and pancreatic cancer, or HGSC subtype, advanced stage (III and IV), were most likely to harbor BRCA mutations, while women with family histories of colorectal cancer or endometrial cancer sought to harbor MMR mutations. See Figure 1.

Conclusion: Our results demonstrate the genetic heterogeneity of ovarian cancer and benefits of multigene panels for patients with personal history of ovarian cancer regardless of age at diagnosis, family history, or histologic subtype, providing evidence for testing beyond BRCA1 or BRCA2 and the Lynch syndrome genes.

288 - Poster Session
Impact of subcutaneous negative pressure drain for surgical wound healing in ovarian cancer
Y.S. Chung and J.Y. Lee. Yonsei University College of Medicine, Seoul, South Korea

Objective: The purpose of this study was to assess the effects of a subcutaneous negative pressure drain on wound healing after abdominal surgery for ovarian cancer.
**Method:** A retrospective study was performed on patients who underwent abdominal surgery for ovarian cancer between July 2006 and May 2019. Patients were divided into 2 groups according to the presence (group 1, $n = 99$) or absence (group 2, $n = 213$) of subcutaneous negative pressure drains.

**Results:** A higher rate of clear wound healing (82.8% vs 71.8%, $P = 0.036$) and a lower rate of wound seroma (6.1% vs 16.0%, $P = 0.015$) were observed in group 1. In multivariate analysis, subcutaneous wound drain was an independent prognostic factor for preventing surgical wound complications (OR = 0.426, 95% CI 0.208–0.874, $P = 0.020$). BMI ≥25 kg/m$^2$ (OR = 2.800, 95% CI 1.499–5.229, $P = 0.001$), lysis of adhesion (OR = 2.529, 95% CI 1.348–4.744, $P = 0.004$), and bowel surgery (OR = 2.144, 95% CI 1.129–4.069, $P = 0.020$) were also associated with higher rates of wound complications. Kaplan-Meier analysis showed no significant differences in progression-free or overall survival between the 2 groups ($P = 0.353$ and 0.827, respectively).

**Conclusion:** Use of a subcutaneous negative pressure drain after abdominal surgery significantly reduces the rate of wound complication in ovarian cancer.

---

**289 - Poster Session**

**Inhibition of PARG sensitizes ovarian cancer cells to PARP inhibitors and DNA damaging agents**


Jewish General Hospital, McGill University, Montreal, QC, Canada, Center Hospitalier de l’Universite de Montreal, Montreal, QC, Canada

**Objective:** Poly(ADP-ribose) glycohydrolase (PARG) is responsible for PAR catabolism. The aim of this study was to evaluate the effect of a PARG inhibitor on epithelial ovarian cancer cell lines, alone and in combination with a poly(ADP-ribose) polymerase inhibitor (PARPi) and/or cisplatin.

**Method:** PARG protein levels were assessed in 74 snap-frozen ovarian cancer specimens from our biobank by Western blot and immuno-histochemistry (IHC), in the ONCOMINE database, which includes The Cancer Genome Atlas (TCGA) dataset (586 cases), and in the Hendrix dataset (41 case). In vitro cell migration, proliferation assays, and colony formation assays were performed on established BRCA-mutated and wildtype cell lines. PARG knockdown cell lines were subjected to cell cycle and apoptosis analysis in the absence and presence of PARPi and cisplatin.

**Results:** PARG protein was highly expressed in 33.7% of high-grade serous ovarian tumors, and low expression was found in another 9.75%. Similarly, Hendrix and TCGA databases showed a significant upregulation in PARG mRNA expression in ovarian cancer patients compared to normal tissue ($P = 0.001$ and $P = 0.005$, respectively). PARG inhibitor slows the migration in a time- and concentration-dependent manner. In clonogenic assays, we found decreased survival of cells with combination treatment compared to PARG inhibitor, PARPi, and cisplatin alone (Figure 1). PARG knockdowns had significant G2/M cell cycle arrest and apoptosis induction in the presence of PARPi and cisplatin.

**Conclusion:** PARG inhibition appears as a complementary strategy to PARP inhibition in the treatment of ovarian cancer, especially the homologous recombination-deficient type.
Objective: We have published findings that high receptor tyrosine kinase (AXL) is associated with poor response to chemotherapy and poor survival. Our objective was to determine whether GAS6/AXL inhibition with AVB500 (AVB) can increase platinum and poly(ADP-ribose) polymerase inhibitor (PARPi) response through inducing “BRCAness” in sporadic high-grade serous ovarian cancer (HGSC) models and identify the ligand GAS6 as a marker for poor response to platinum.

Method: AVB was supplied by Aravive Biologics. Four HGSC cell lines were used (OVCAR8, COV362, CAOV3, and OVCAR3-TPmes) for all experiments. Cell viability and clonogenics were performed. Immunofluorescence (IF) was performed for γH2AX for DNA damage; RAD51, BRCA1, BRCA2 for homologous recombination (HR); and 53BP1 for nonhomologous end joining (NHEJ). Flow cytometry was used to evaluate cell cycle. Synergism was analyzed using Combenefit software. Patient-derived xenograft (PDX) and OVCAR5 intraperitoneal (IP) mouse models were used to determine response to carboplatin, paclitaxel, and AVB (C+P+A) as well as olaparib and AVB (O+A). in addition, tumors pre- and post-neoadjuvant chemotherapy (NACT) with C+P were obtained. GAS6 expression was measured by tissue immunohistochemistry (IHC) and serum ELISA.

Results: The addition of AVB to carboplatin resulted in decreased cell viability and fewer colonies than C alone (P < 0.05). This led to an increase in γH2AX foci with C+A, and an induction of BRCAness with a decrease in RAD51 (P < 0.001), BRCA1 (P < 0.001), and BRCA2 foci (P < 0.001) compared to C alone. Cells treated with C+A showed an increase in foci for 53BP1 (P < 0.05) compared to C alone. Cell cycle was similar among all groups. A Loewe analysis demonstrated C+A treatment was synergistic. IP models treated with C+P+A had significantly fewer tumors than those treated with C+P alone (50 mg vs 357 mg, P = 0.003). In addition, mice treated with O+A had significantly fewer tumors than those treated with olaparib alone (76 mg vs 171 mg, P = 0.03). We found that patients with poor response to NACT had high pretreatment GAS6 by IHC (>85%) or serum GAS6 (>25 ng/mL) compared to those with low GAS6 by IHC (<45%) (P = 0.010) or low serum GAS6 (<15 ng/mL) (P = 0.002).

Conclusion: Inhibition of this GAS6/AXL pathway with AVB induces BRCAness in sporadic HGSC, which leads to an improved sensitivity to carboplatin and olaparib. In addition, high levels of GAS6 can identify patients who have worse response to platinum-based chemotherapy and may benefit from this novel GAS6/AXL inhibitor.
Acute normovolemic hemodilution in patients undergoing primary cytoreductive surgery for advanced ovarian cancer: Experience of clinical outcome in a prospective trial

Objective: Our objective was to describe the oncologic outcome after use of acute normovolemic hemodilution (ANH) to reduce the requirement for allogenic red blood cell (RBC) transfusions in patients undergoing primary cytoreduction (PDS) for advanced ovarian cancer.

Method: We previously reported the short-term results of a prospective trial investigating the safety and feasibility of ANH in women submitted to PDS for advanced ovarian cancer at time of surgery. Here we report the long-term outcomes of this trial as a post-hoc analysis. Intraoperative blood withdrawal was performed to a target hemoglobin of 8.0 g/dL. A standardized transfusion protocol first using autologous then allogenic blood was applied intraoperatively and throughout hospitalization according to institutional guidelines. Demographic, perioperative, and outcomes data were collected and groups compared using standard statistical tests. Progression-free survival (PFS) and overall survival (OS) were evaluated using Kaplan-Meier method.

Results: Forty-one patients consented to participate, of whom 39 were eligible for analysis. Two patients with stage I–II ovarian cancer were excluded. Twenty-four patients had stage III (61.5%) and 15 (38.5%) stage IV disease. The majority of patients had high-grade serous ovarian cancer (n = 33, 84.5%), followed by low-grade serous carcinoma (n = 3, 8%), clear cell carcinoma (n = 2, 5%), and endometroid type ovarian cancer (n = 1, 2.5%). Median blood withdrawn during ANH was 1,600 mL (range 700–3,000 mL). Cytoreductive outcomes were as follows: 0 mm, 28 (72%); 1–10 mm, 9 (23%); and >10 mm, 2 (5%) residual disease. Estimated blood loss was 1,000 mL (range 150–2,700). Fourteen patients (36%) received allogenic RBC transfusions intra- or postoperatively, a lower number compared to our previous reported rate of 50%. Median PFS and OS of the entire cohort was 28.5 months and 68.8 months, respectively.

Conclusion: ANH represents an innovative approach in intraoperative management that maximizes success in achieving complete gross resection rate and associated benefit in oncologic outcomes.

Targeting glutaminase 1 to sensitize platinum-resistant BRCAwt ovarian cancer to PARP inhibitors

Objective: In the past 5 years, there have been several FDA approvals for utilization of PARPi in ovarian cancer, although the usage is still limited to either patients with BRCA mutations or those with platinum-sensitive disease. However, 80% of patients with ovarian cancer do not have a BRCA mutation, and the vast majority will eventually become platinum-resistant. The objective of this study was to investigate whether the usage of poly(ADP-ribose) polymerase inhibitor (PARPi) could be expanded to BRCAwt platinum-resistant patients by using a synergistic combination approach that exploits metabolic vulnerability present in ovarian cancer. Our hypothesis is that the inhibition of glutaminase 1 (GLS1) will deplete cells from nucleotides and lead to DNA breaks that will sensitize cells to PARPi.

Method: RNA sequencing was performed on microdissected ovarian cancer tumors and ovarian cancer-derived cell lines (both high-grade serous, HGSC, and clear cell tumors). Gene ontology and pathway analysis were performed to interrogate the gene expression profiles. Cell lines were treated with the glutaminase1 (GLS1) inhibitor CB-839 and the combination of CB-839 and olaparib (PARPi).

Results: Pathways involved in hypoxic cell growth, angiogenesis, and metabolism, which are pathways regulated by the hypoxia inducible transcription factors 1a and/or 2a (HIF1a and HIF2a), were upregulated in HGSC and clear cell. There was a high expression of HIF1a and HIF2a target genes in HGSC and clear cell tumors. Treatment of HGSC and clear cell cells with CB-839 resulted in growth arrest and death. CB-839 induced genomic instability in HIF1/HIF2 hyperactivated clear cell ovarian cancer cells and sensitized these tumors to treatment with olaparib.

Conclusion: A hallmark of cancer is formation of hypoxic regions, and cancer cells react to this stress by inducing the transcription of HIF1a and HIF2a, which upregulate the expression of intermediary metabolism enzymes, which in turn reprogram cancer cell metabolism and induce anaerobic glycolysis. Given the dependence on glutamine, targeting GLS1, which converts glutamine to glutamate, could have therapeutic implications in ovarian cancer. Based on our preclinical data, we have an ongoing investigator-initiated phase 1 trial combining CB-839 with the PARPi, niraparib.
**Objective:** The purpose of this study was to report the epidemiological and histological features of ovarian tumors in Lebanon.

**Method:** This is a retrospective study evaluating the characteristics of borderline and malignant ovarian tumors diagnosed in 20 years (from 1997 to 2017) at the Hôtel Dieu de France, University Hospital of Saint Joseph University, in Beirut, Lebanon. The data were extracted from the computerized registers of the hospital’s pathology laboratory. Statistical analysis was performed using SPSS v24.0.

**Results:** A total of 1,137 ovarian lesions were reported, of which 695 (61.12%) were benign, 50 (4.4%) borderline, 361 (31.75%) malignant, and 31 (2.73%) unspecified. Of the 361 malignant lesions, 54 (4.75%) were metastases from another extra-ovarian primitive. Of the 652 benign neoplastic ovarian tumors, epithelial tumors, stromal and sex cords tumors, germ cell tumors, and tumors from the dermoid cyst were 306 (46.93%), 70 (10.73%), 268 (41.1%), and 8 (1.24%), respectively. The most common benign neoplastic tumor was mature cystic teratoma representing 268 cases (41.1%), followed by 170 (26.07%) serous cystadenomas and 80 (12.2%) mucinous cystadenomas. Of the 361 malignant ovarian tumors, 246 (68.1%) were malignant surface epithelial tumors. Germ cell malignancies, stromal tumor and sex cords, and metastatic carcinoma were 25 (6.9%), 22 (6.1%), and 54 (15%), respectively. High-grade serous cystadenocarcinoma was the most common malignant tumor with 147 cases (40.7%).

**Conclusion:** The epidemiological characteristics of ovarian tumors in Lebanon are compatible with those published in Western countries and in Asia. This study is the first of its kind in Lebanon and is a database for further research.
Objective: The purpose of this study was to review the surgical outcomes of cytoreductive surgery for ovarian cancer in a single institution.

Method: We reviewed all patients with ovarian cancer who received cytoreductive surgery between January 2005 and December 2018 at Hôtel-Dieu de France University Hospital, Beirut, Lebanon.

Results: A total of 161 patients were included. Mean age at surgery was 54 years (range 16–83 years). Cytoreductive surgery was performed in 4 settings: upfront surgery (40%), interval surgery post neoadjuvant chemotherapy (42%), post recurrence (7%), and post incomplete primary surgery (11%). Of operated patients, 67% were stage III. Surgical resection included bowel resection (48%), diaphragmatic peritoneal resection (25%), and splenectomy (15%). Eighty-nine percent of patients received a pelvic and paraaortic lymphadenectomy. Node involvement was noted in 48% of patients. No recurrence was seen in 56% of patients, and the mean interval of recurrence was estimated at 21 months with 78% of recurrences occurring 12 months after surgery. Overall survival was estimated at 40 months (range 2–165 months). No impact on survival was detected whether the patient benefited from an upfront surgery or an interval one post neoadjuvant chemotherapy: 36 months versus 30 months, respectively ($P = 0.39$). Better survival was encountered when only 1 lymph node was involved (85 months vs 42 months, $P = 0.037$). Patients with LNR $\leq 0.03$ had a survival of 50 months versus 27 months in patients with LNR $> 0.03$.

Conclusion: Huge efforts including extensive cytoreductive surgeries are being performed at institutions in developing countries in order to improve survival and lower recurrence in ovarian cancer patients.

<table>
<thead>
<tr>
<th>Correlation</th>
<th>myChoice HRD</th>
<th>LOH</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOH</td>
<td>0.864</td>
<td></td>
</tr>
<tr>
<td>%LOH</td>
<td>0.845</td>
<td>0.940</td>
</tr>
<tr>
<td>PPA</td>
<td>myChoice HRD (≥42)</td>
<td>LOH (≥8)</td>
</tr>
<tr>
<td>LOH (≥8)</td>
<td>86.70%</td>
<td></td>
</tr>
<tr>
<td>%LOH (≥16%)</td>
<td>67.71%</td>
<td>62.97%</td>
</tr>
<tr>
<td>PPA</td>
<td>myChoice HRD (≥33)</td>
<td></td>
</tr>
<tr>
<td>%LOH (≥16%)</td>
<td>53.45%</td>
<td></td>
</tr>
</tbody>
</table>
Objective: The aim of this study was to demonstrate whether exposure to talcum powder induces malignant transformation in human primary normal ovarian epithelial cells and human primary normal peritoneal fibroblasts. Epidemiological and molecular studies have linked perineal use of talcum powder to increased risk of ovarian cancer. Exposure to talcum powder was shown to induce specific point mutations in key redox enzymes that altered their activities in both normal and epithelial ovarian cancer cells.

Method: Talcum baby powder (Johnson & Johnson, NJ, #30027477, Lot#13717RA) or titanium dioxide (TiO₂, Fischer Scientific) were suspended in PBS (stock solution of 50 mg/ml) and sonicated 3 times for 1 minute each. Human primary normal ovarian epithelial cells (Cell Biologics) and human primary peritoneal fibroblasts were treated in triplicate with 100 and 500 ug/ml of talcum powder or TiO₂ as a control for 72 hours before assessment with cell transformation assay (Abcam), according to the manufacturer protocol. This assay was chosen because it is faster, stable, and more sensitive than the traditional Soft-Agar Assay.

Results: Anchorage-independent growth is a hallmark of cancer cells. Treatment with talcum powder resulted in formation of colonies, indicating cell malignant transformation in a dose-dependent manner. There were no colonies formed in untreated ovarian cells or control ovarian cells at either dose. Interestingly, there were no colonies formed in normal fibroblasts treated with talcum powder (Figure 1). Treatment with talcum powder significantly increased number of transformed ovarian cells by 11% and 20% in the 100 and 500 ug/ml doses, respectively ($P < 0.05$). There were no detectible transformed cells when treated with TiO₂. Data were analyzed with paired $t$ tests.

Conclusion: Exposure to talcum powder induces malignant transformation in normal ovarian epithelial cells but not in normal peritoneal fibroblasts. This finding represents a direct causation mechanism of talcum powder exposure specific to normal ovarian cells and further supports previous studies of the association of genital use of talcum powder and increased risk of ovarian cancer.

Fig. 1.
Objective: A phase 3 clinical trial (SOLO1) demonstrated that olaparib as maintenance provided significant improvement in progression-free survival (PFS) in patients with newly diagnosed advanced ovarian cancer and a germline or somatic BRCA mutation. This study evaluates the cost-effectiveness of olaparib as a first-line maintenance therapy versus routine surveillance from a U.S. third-party payer perspective.

Method: A 3-state (progression free, progressed disease, and death) partitioned survival model with a 1-month cycle was developed to estimate the costs and effectiveness of olaparib versus routine surveillance over a 50-year lifetime horizon. Piecewise models were applied to data from SOLO1 to extrapolate overall survival (OS) and PFS. Rates of death were constrained to be at least as high as natural mortality rates in the United States. Health state utilities and disutilities associated with adverse events were obtained from the literature and SOLO1. Treatment costs, adverse event costs, and medical costs associated with health states were obtained from publicly available databases, SOLO1, and real-world data. Time on treatment was estimated from SOLO1. All costs were inflated to 2018 US dollars. Incremental costs per quality-adjusted life-year (QALY) and life-year (LY) gained were estimated (discounted at 3.0% per annum). One-way deterministic and probabilistic sensitivity (PSA) analyses were conducted.

Results: Over a lifetime horizon, olaparib was associated with an additional 3.63 LYs and 2.93 QALYs, and an incremental total cost of $152,545 versus routine surveillance. Incremental cost per LY gained and per QALY gained for olaparib was $42,032 and $51,986, respectively. The incremental cost-effectiveness ratios remained below $100,000 across a range of inputs and scenarios. In the PSA, the probability of olaparib being cost-effective at an $100,000 per QALY threshold was 99%.

Conclusion: Compared to routine surveillance, olaparib is predicted to increase both the LYs and QALYs of patients with advanced ovarian cancer, at an overall cost that yields incremental cost-effectiveness ratios below a $100,000 threshold. Olaparib offers a cost-effective maintenance strategy for patients with newly diagnosed advanced ovarian cancer and with a germline or somatic BRCA mutation from a U.S. third-party payer perspective.

Objective: The mainstay of therapy for high-grade serous ovarian cancer (HGSC) is primary cytoreductive surgery with postoperative chemotherapy. However, optimal surgical outcomes with <1 cm of residual disease are achieved in only a portion of surgical patients. Thus, methods that would objectively select patients for optimal surgical outcomes are needed. Our objective was to create models that will identify HGSC patients who will have optimal surgical outcomes using radiologic images analyzed with artificial intelligence (AI).

Method: Optimal surgical outcomes were defined as (1) residual disease of less than 1 cm, (2) with no mortality within 90 days after surgery, and (3) administration of chemotherapy within 2 months after surgery. Two approaches were used to create prediction models with CT images. One was the image recognition approach, which used the whole image for recognition of intraabdominal disease, used known frameworks for image recognition, like Caffe, then trained images with NVIDIA application DIGITS, and tested models with TensorFlow. The second approach was the segmentation approach, with selection of cancer in CT images, creation of a novel 2-dimensional segmentation network with 24 layers and 278 million features, then selection of the best features for the model (with lasso), and finally testing of the model in an independent set of patients.

Results: The imaging recognition approach involved 178 patients, 122 with optimal outcomes and 44,520 available images, and 56 patients with suboptimal outcomes and 17,363 images. Initial imaging analysis with this approach resulted in models with an accuracy of more than 99%. However, when the model was tested in an independent set of 102 patients, performance of the validation was poor, with an AUC of 51%. The segmentation approach built a new network and trained a model with more layers and features. The accuracy of this model was more than 95%, and the validation improved accuracy from 68.8% to 87.5%.

Conclusion: Prediction models of surgical outcomes using AI with imaging recognition approaches tend to overfit the data, with very poor validation. Prediction models based on segmentation of images had better validation results in an independent set of patients. More work is needed to improve the accuracy of AI models before they can be applied in the clinic.
300 - Poster Session
Methylation as epigenetic regulation in ovarian cancer
D. Russo, A.M. Newton, N.D. Cardillo, H.D. Reyes, Y.A. Lyons, E. Devor, M.J. Goodheart and J. Gonzalez Bosquet. University of Iowa Hospitals and Clinics, Iowa City, IA, USA

Objective: Epigenetic mechanisms contribute to differential gene regulation via histone modification and DNA methylation. DNA methylation has long been associated with carcinogenesis. Our objective was to assess differences of DNA methylation between high-grade serous ovarian cancer (HGSC) and normal tube epithelium. Then we assessed how these differences affected whole-genome expression.

Method: We conducted a retrospective study of HGSC patients and controls with no personal or family history of HGSC. We extracted DNA from tumors of 99 patients with HGSC and from 12 normal tubes from controls. The Illumina Infinium MethylationEPIC 850K BeadChip was used for the whole-genome DNA methylation analysis. Data resulting from these arrays were imported, processed, normalized, and log 2-transformed for analysis using the Minfi R package. Also, RNA was extracted and sequenced for the same samples using the Illumina HiSeq 4000 sequencing platform. RNA-sequencing analysis was performed using Galaxy suite of programs. The Cancer Genome Atlas (TCGA) data were used for validation of results. Pathway enrichment analysis was performed to assess biological processes involved in DNA methylation.

Results: In total, 5,852 probes revealed significantly different methylation between HGSC samples and tubal samples, with $P < 10^{-7}$ and >2-fold change. These 5,852 differentially methylated probes represented 4,593 unique genes of which 725 were hypomethylated and 3,868 hypermethylated. We observed that 175 hypomethylated genes also had higher gene expression, and 1,173 hypermethylated genes had lower expression. Thus a quarter of differentially methylated genes showed an inverse relationship between methylation and gene expression. Pathway analysis of differentially methylated genes showed over-representation of neurological signaling pathways.

Conclusion: There are numerous differences between methylation in HGSC and normal tubal epithelium that underscores alteration of epigenetic regulation in HGSC. These differences also correlate with gene expression changes in some of the genes. But there are other regulatory elements affecting gene expression. Signaling neurological pathways seem to be most affected by dysregulation of methylation in HGSC.

301 - Poster Session
Appendectomy at time of surgery for ovarian malignancy: An ACS-NSQIP propensity score-stratified analysis
L. Bernard and T. Le. University of Ottawa, Ottawa, ON, Canada

Objective: Despite evidence that routine elective appendectomy at the time of staging surgery for ovarian malignancy is not warranted, it remains common practice in gynecologic oncology. The objective of this study was to compare the surgical complication rates of staging operations for suspected ovarian malignancy that included an appendectomy with those without an associated appendectomy.

Method: All women from the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) 2010–2017 datasets who underwent staging operations for suspected ovarian malignancies were compared for patient demographics and comorbidity. Women with preoperative ascites or disseminated cancer or who underwent concurrent bowel surgery or debulking surgery were excluded. Thirty-day postoperative complications were evaluated. Multivariate logistic regression and propensity score stratification were used to assess risk factors for complications.

Results: Three hundred and fifty-five out of 1,758 women (16.8%) underwent a concurrent appendectomy at time of surgery. The rate of postoperative infection was 6.1%. The odds ratio (OR) of postoperative infection after staging surgery was 2-fold higher in women undergoing a concurrent appendectomy (CI 1.24–3.23) after controlling for risk factors, including age, BMI, diabetes, COPD, smoking, steroid, weight loss, functional status, ASA score, work relative value unit, and estimated probabilities of mortality and morbidity. After propensity score stratification, the increased risk remained significant (OR = 1.89, CI 1.19–3). Length of hospital stay, rate of readmission, return to the operating room, or postoperative death did not correlate with concurrent appendectomy.

Conclusion: Appendectomy at time of staging surgery for suspected ovarian malignancy is associated with 1.89 times the odds of postoperative infection. Unless there is clinical suspicion for involvement, routine appendectomy should be reevaluated in clinical practice.

302 - Poster Session
Differential immune landscapes in high-grade serous ovarian tumors of high-risk patients seen by imaging mass cytometry
H. Cuna, S. Ferri-Borgogno, R. Cheng, J.H. Kimb, G.H. Hanb, K.H. Lua and S.C. Moka. aThe University of Texas MD Anderson Cancer Center, Houston, TX, USA, bGangnam Severance Hospital, Seoul, South Korea
Objective: The aim of this study was to generate and compare immune landscapes in advanced-stage high-grade serous ovarian tumors (HGSC) with BRCA1 or BRCA2 mutations and against wildtype BRCA1 and BRCA2 utilizing imaging mass cytometry (IMC).

Method: A total of 40 advanced-stage HGSC tumors were collected under an Institutional Review Board-approved protocol, 20 patients with known BRCA1 or BRCA2 mutations and 20 wildtype patients. Formalin-fixed paraffin embedded (FFPE) tissue sections of 10 µm thickness were stained with 34 metal-tagged antibodies to detect various cell-specific and immune-related markers using the Fluidigm protocol. IMC data were obtained by the Fluidigm Helios CyTOF instrument utilizing the Hyperion Imaging System laser ablation module. Images from a 1-mm² area of each tissue section were processed and converted to tiff files using MCD Viewer (Fluidigm). Tumor tissue was identified by positive pan-Keratin and cytokeratin 8/18 activity. Stroma was noted by positive smooth muscle actin activity. Images were then analyzed for various immune marker activity including CD8, CD4, Granzyme B, CD20, CD68, PDL1, and FoxP3. Statistical analysis was performed using unpaired t test.

Results: HGSCs with BRCA1 mutations had a significantly higher number of intratumoral CD8+ cells (32 vs 7 cells/mm², P = 0.02) than those with BRCA2 mutations. A markedly higher number of intratumoral CD20+ cells and CD4+ cells were also observed in HGSCs with BRCA1 than those with BRCA2 mutations, although the difference did not reach significance (6.7 vs 1.3 cells/mm², P = 0.09; 93 v. 28 cells/mm², P = 0.08). Compared to wildtype, BRCA1- or BRCA2-mutated tumors had a significantly higher number of CD20+ cells in the tumor aspect and in the whole tissue (4 vs 0.2 cells/mm², P = 0.03; 9 vs 1 cells/mm², P = 0.05). Furthermore, BRCA1- and BRCA2-mutated tumors also had a higher number of stromal and total CD4+ than wildtype patients (28 vs 14 cells/mm², P = 0.07; 63 vs 24 cells/mm², P = 0.7). See Figure 1.

Conclusion: In this cohort, we found that HGSC tumors with BRCA1 mutations had an increase in immune cells compared to those with BRCA2 mutations, including intratumoral CD8+, CD20+, and CD4+ cells. BRCA mutant tumors also had increased CD20 and CD4 cells compared to BRCA wildtype. These immune phenotypes suggest an increased immune response in tumors with BRCA mutations, particularly BRCA1. We plan to use a larger cohort to further validate potential immunological differences in these patient populations.

Fig. 1. Immune landscape of high grade serous ovarian cancer in high risk patients. BRCA1 (a) mutation demonstrates an increased number of CD20+ and CD8+ cells within the tumor as compared to BRCA2 (b).

303 - Poster Session
Targeting septins controls ovarian tumor growth

Objective: Septins are GTP-binding cytoskeletal proteins that participate in cytokinesis, cell migration, chromosomal dynamics, and protein secretion. Malignancies exhibit altered septin expression and mutations. Pharmacologic tools to curb septin-orchestrated malignancies are needed. However, the oligomeric structures of septins mount considerable challenges in designing targeted therapies, and thus the small molecule modulators of septins remain unavailable. As a part of an ongoing study, we have identified a small molecule, UR214-9, that causes septin catastrophe and controls tumor growth. In this study the pharmacologic characterization and antitumor effects of UR214-9 in ovarian cancer models are described.

Method: R2 Genomics Analysis and Visualization platform was used to establish the correlation of septin expression with survival rate among epithelial ovarian cancer (EOC) patients. Relative septin over-expression in normal ovarian, benign, and serous EOC tissues was validated by fluorescence histochemistry. UR214-9 was designed by structure-activity relationship guided optimization of forchlorfenuron (FCF). Structural changes in the septin filamental structures in EOC cells after UR214-9 treatment were imaged by confocal microscopy. In silico docking studies using septin-2/septin-2 dimer complex structure were conducted to inform the GRD...
binding interactions elicited by UR214-9. Cell viability of EOC cells treated with UR214-9 was estimated by MTS assay. Antitumor efficacy of UR214-9 was determined by measuring the tumor size of SKOV-3 derived xenografts in immune compromised NSG mice.

**Results:** Septin-2 gene enrichment correlated with poor survival in EOC. UR214-9 treatment (1 μM) caused cytoskeletal catastrophe in EOC cells. In silico studies showed that UR214-9 occupies the same domain as FCF does but displaces the guanine carbonyl oxygen from the GDP binding domain. UR214-9 treatment reduced proliferation of EOC cells in vitro and controlled the growth of SKOV-3 cell derived xenografts in NSG mice (*Figure 1*).

**Conclusion:** Septin-2 gene over-expression correlated with poor prognosis in EOC patients. UR214-9 is a novel septin filamental modulator that blocks growth of EOC cells in vitro and reduces tumor growth. UR214-9, a first-in-class small molecule septin inhibitor, identified through these studies, offers a new therapeutic strategy for treatment of EOC.

**Fig. 1.** UR214-9 (25 mg/kg M-F, I.P.) treatment controlled the growth of SKOV-3 cells derived xenografts in NSG mice.

---

**Objective:** The purpose of this study was to use imaging mass cytometry (IMC) to compare the tumor immune landscape of patients with high-grade serous ovarian cancer (HGSC) before and after CTLA4 immune checkpoint inhibitor treatment and determine the association between alterations in immune landscapes and progression-free survival (PFS).

**Method:** Fine needle biopsies were obtained from 8 patients with recurrent platinum-resistant HGSC enrolled in a phase 2 randomized trial evaluating use of CTLA4 and PD-L1 checkpoint inhibitors. Each patient had a pretreatment biopsy, and biopsies were retrieved after 3 cycles of CTLA4 inhibitor therapy. Progression-free survival (PFS) was recorded with 3 patients with a PFS >180 days and 5 with PFS <60 days. Formalin-fixed paraffin embedded (FFPE) tissue sections were prepared and stained for IMC analysis via Fluidigm protocol with 34 metal-tagged antibodies to detect various cell-specific and immune-related markers. The IMC data were obtained using the Fluidigm Helios CyTOF instrument and Hyperion Imaging System laser ablation module. A novel image informatics pipeline through Matlab was used to evaluate image intensity of each marker and cell location.

**Results:** Using the developed image informatics pipeline, cell types and locations were analyzed for 16 samples from 8 patients. In all patients, mean CD8+ T cells had an increased trend on treatment versus before treatment (205.6 vs 129.9 cells/mm², *P* = 0.086). In addition, an analysis of cell location showed that in all patients after treatment, the mean number of CD8+ T cells adjacent to M2...
macrophages increases significantly (0.09 vs 0.17 cells, \( P = 0.0460 \)) as well as the mean number of CD8+ T cells adjacent to B7H4+ tumor cells (0.035 vs 0.01 cells, \( P = 0.046 \)). Furthermore, patients with a long PFS had a significantly higher number of CD8+ cells neighboring B cells after treatment than patients with short PFS (0.12 vs 0.27 cells, \( P = 0.028 \)).

**Conclusion:** Using IMC and image informatics pipeline, we found that patients with a long PFS treated with a CTLA4 inhibitor showed a significant immune response: a higher number of CD8 T cells neighboring B cells after treatment. For all patients, the immune landscape altered after treatment. IMC and image informatics pipeline are robust tools that simultaneously analyze multiple biomarkers and spatial location of cells to better assess the tumor immune microenvironment and cellular interactions.

---

**305 - Poster Session**

**HE4 alters ovarian cancer cytokine expression to favor myeloid recruiting and macrophage differentiating factors**


**Objective:** The aim of this study was to describe the role of human epididymis protein 4 (HE4) in modifying cytokine expression in the ovarian tumor immune microenvironment.

**Method:** A retrospective analysis of peripheral blood cell counts and serum HE4 levels was undertaken for 34 women who carry a diagnosis of ovarian cancer; absolute monocyte count, absolute lymphocyte count, and monocyte/lymphocyte ratios were correlated to serum HE4 level. Tumor cells (NuTu19) were transfected with an HE4 over-expression vector or null vector. These cells were then transplanted into syngeneic rats, and the cytokine profiles of tumor and ascites were determined. In addition, in vitro cytokine expression by the tumor cells was determined, and their ability to modulate leukocyte cytokine expression was assessed in coculture experiments. Cytokine levels were determined using a multiplex analysis.

**Results:** In patients, serum HE4 level correlates with an increased serum monocyte-to-lymphocyte ratio. HE4 over-expression in ovarian cancer xenografts produces ascites with less INF-\( \gamma \) (\( P = 0.0027 \)), IL-12 (\( P = 0.036 \)), and IL-17 (\( P = 0.0005 \)) and more CCL2 (\( P = 0.0022 \)), CCL3 (\( P = 0.0001 \)), CCL5 (\( P < 0.0001 \)), CCL7 (\( P < 0.0001 \)), and IL-10 (\( P = 0.0031 \)). While the expression of all CCL cytokines was coming directly from the tumor cells, IL-10 expression was enhanced in cocultured leukocytes.

**Conclusion:** HE4 modulates the tumor microenvironment by inducing the production of suppressive and myeloid-recruiting cytokines by tumor cells and leukocytes. HE4 inhibition therefore represents a promising strategy for ovarian cancer immunotherapy.

---

**306 - Poster Session**

**Laterality and tumor cell type of stage I ovarian cancer in the United States**

A.B. Gardner*, M.C. Liu*, D.S. Kapp* and J.K. Chan*. *University of California, Irvine School of Medicine, Irvine, CA, USA, Stanford University School of Medicine, Stanford, CA, USA, California Pacific and Palo Alto Medical Foundation/Sutter Health Research Institute, San Francisco, CA, USA

**Objective:** Prior studies have shown that the removal of 1 ovary to decrease the risk of ovarian cancer while preserving the other ovary for hormonal function in younger women is provocative, particularly in those with genetic risk. If this practice is to be considered, then the laterality of ovarian cancer warrants investigation. We proposed to determine the demographic and clinicopathologic correlates of stage I ovarian cancer laterality.

**Methods:** Data were obtained from the Surveillance, Epidemiology, and End Results (SEER) database from 1973 to 2015. \( \chi^2 \) testing was used for statistical analysis.

**Results:** Of 4,865 patients with stage I ovarian cancer, the median age was 66 years (range <1–113). Of these, 79.4% identified as white, 6.6% as black, 12.5% as Asian, and 0.6% as Native American. Most patients had tumor histologies that were endometrioid (37.8%), followed by mucinous (24%), clear cell (20.9%), papillary serous (7.4%), granulosa (6.8%), and germ cell (3%). Overall, 50.8% of patients had right-sided disease. Of those with epithelial cancers, right-sided tumors were more likely to develop in papillary serous (51.4%), endometrioid (52.2%), and mucinous (50.9%). Clear cell were slightly more common on the left side (51.5%). In nonepithelial cancers, germ cell tumors were more common on the right (55.4%), and granulosa were present more on the left (52.6%); however, these findings were not statistically significant (\( P < 0.27 \)).

**Conclusion:** The laterality of cancer differs based on histology. Larger studies are warranted to examine the sidedness of ovarian cancer, particularly if unilateral oophorectomy with bilateral salpingectomies is considered for cancer prevention.
307 - Poster Session
Suicide among gynecologic cancer patients: What are the associated risk factors?
A.B. Gardne ara, M.C. Liu a, A. Chan b, A. Rohatgi c, A. Milkid a, D.S. Kapp b and J.K. Chan a.*
University of California, Irvine School of Medicine, Irvine, CA, USA, bStanford University School of Medicine, Stanford, CA, USA, cUniversity of California Davis, Davis, CA, USA, dCalifornia Pacific Medical Center, San Francisco, CA, USA, eCalifornia Pacific and Palo Alto Medical Foundation/Sutter Health Research Institute, San Francisco, CA, USA

Objective: The aim of this study was to compare the demographic and clinical characteristic of patients with gynecologic cancers who committed suicide after diagnosis.

Method: Data were extracted from the Surveillance, Epidemiology, and End Results database from 1973 to 2015. χ² tests were used for statistical analysis.

Result: Of 268,899 gynecologic cancer patients who died during the time period, 354 (0.13%) patients committed suicide. The median age of the suicide group was younger at 56 years compared to 66 years in patients with nonsuicidal deaths. There was a greater proportion of white patients who committed suicide (91.5%) relative to whites who died from nonsuicidal causes (83.9%) (P < 0.01). The majority of the suicide group was married (52%), while the nonsuicide group was mostly unmarried (51.6%) (P < 0.01). The suicide group had a higher proportion of cervical cancer diagnoses and lower proportion of ovarian cancers relative to the nonsuicide group (25.1% vs 16.5%, 30.5% vs 37.2%, respectively, P < 0.01). Only 21.5% of patients who committed suicide received chemotherapy versus 33.8% in the controls. Most patients who committed suicide resided in the Western region of the United States (64.7%), followed by the Midwest (14.1%), South (12.4%), and Northeast (8.8%) compared to those who died of alternate causes (49.6%, 21.0%, 13.3%, and 16.1%, P < 0.01). Over the study period from 1973 to 2015, the proportion of those who committed suicide increased from 33.3 to 40.7% (P < 0.01).

Conclusion: Suicide in gynecologic oncology patients is rare but may be underreported. Our data suggested that the proportion of patients who committed suicide appears to be higher for whites, with cervical cancer, and residing in western region of the United States.

308 - Poster Session
Feasibility of a platform trial in rare gynecologic cancers based on molecular analysis
J. Brown a, T.J. Herzog b, E.K. Crane c, A.L. Covens d, D. Arguello e, P. Ramos f, W. Chen f, A.C. ElNaggar g and J.H. Farley h. Levine Cancer Institute, Carolina's Medical Center, Charlotte, NC, USA, bUC Health Barrett Cancer Center, Cincinnati, OH, USA, cUniversity of Toronto, Toronto, ON, Canada, dCaris Life Sciences, Irving, TX, USA, eUniversity of Tennessee West Cancer Center, Memphis, TN, USA, fUniversity of Arizona Cancer Center at St. Joseph’s Hospital and Medical Center, a Dignity Health Member, Phoenix, AZ, USA

Objective: The aim of this study was to determine whether enough actionable mutations exist in rare gynecologic cancers to justify the design of a platform trial.

Method: We compiled all molecular profiling data performed at Caris Life Sciences through July 2019. Actionable mutations were identified in all nonepithelial and rare epithelial ovarian cancers, rare uterine, neuroendocrine gynecologic, and vulvar cancers.

Results: We identified 2,870 rare gynecologic cancers. Actionable mutations in stromal tumors (n = 244) included PIK3CA (8%), ARID1A (8%), and 20 other actionable mutations (<5% each). Actionable mutations in germ cell tumors (n = 43) included ARID1A (42%), PIK3CA (19%), TMB-high (14%), FBXW7 (11%), PTEN (10%), CDKN2A (9%), NFI (9%), and 17 other actionable mutations (<8% each). Among 1,136 rare epithelial ovarian cancers, actionable mutations in mucinous vulvar cancers (n = 153) included KRAS (58%), ARID1A (48%), CDKN2A (14%), PIK3CA (12%), copy number amplification (CNA) of HER2 (10%), and 23 other actionable mutations (<8% each). Actionable mutations in low-grade serous tumors (n = 307) included ARID1A (22%), KRAS (21%), BRAF (12%), and 17 other actionable mutations (<7% each). Actionable mutations in endometrioid tumors (n = 119) included ARID1A (80%), PTEN (31%), PIK3CA (30%), KRAS (19%), PIK3R1 (14%), TMB-high (11%), and 32 other actionable mutations (<8% each). Actionable mutations in clear cell ovarian cancers (n = 396) included ARID1A (87%), PIK3CA (43%), KRAS (10%), and 30 other actionable mutations (<7% each). Actionable mutations in ovarian cancers (n = 316) included ARID1A (30%), PIK3CA (7%), and 35 other actionable mutations (<7% each) including 1 BRAF fusion (50%) and several CNAs. Among 1,259 rare uterine cancers, 558 sarcomas, 485 serous cancers, and 216 clear cell cancers were identified. Actionable mutations in uterine sarcomas included ARID1A (13%), PTEN (7%), and 27 other actionable mutations (<6% each), including gene fusions in NTRK3, BRAF, and ALK. Actionable mutations in uterine serous cancers included ARID1A (41%), PIK3CA (32%), FBXW7 (20%), and actionable mutations in 27 other genes, CNAs, and fusion events (≤10% each). Actionable mutations in uterine clear cell cancers included ARID1A (61%), PIK3CA (34%), PTEN (17%), FBXW7 (12%), 32 other actionable mutations (≤10% each). Actionable mutations in 120 gynecologic neuroendocrine tumors included ARID1A (37%), PIK3CA (19%), PTEN (18%), and 28 other actionable mutations (<9% each). Actionable mutations in 68 vulvar cancers included PIK3CA (19%), CDKN2A (18%), TMB-high (10%), ARID1A (10%), and 20 other actionable mutations (<10% each).
**Conclusion:** A variety of actionable mutations are present among all rare gynecologic cancers, but mutations specific to individual histologies are not reliably present. This supports molecular profiling to identify potential targets and supports a platform trial strategy to study rare gynecologic cancers.

**309 - Poster Session**

**Cancer-associated protein Tetraspanin1 increases cell growth through AMPK in atypical endometriosis**

*H. Shin*<sup>a</sup>, D.B. Chaya<sup>b</sup>, W. Yang<sup>a</sup>, H. Cho<sup>a</sup>, S. Jeon<sup>c</sup>, B. Lee<sup>e</sup>, G.H. Han<sup>a</sup>, E. Lee<sup>a</sup> and J.H. Kima.<sup>a</sup> *Yonsei University College of Medicine, Seoul, South Korea, <sup>b</sup>Soonchunhyang Cheonan Hospital, Cheonan, South Korea, <sup>c</sup>Hallym University Kangdong Sacred Heart Hospital, Seoul, South Korea*

**Objective:** Tetraspanin1 (TSPAN1), a member of transmembrane 4 superfamilies, has been demonstrated to be important in cell invasion and metastasis in various types of cancers. However, the role of TSPAN1 in clear cell ovarian cancer has not been fully elucidated. The aim of the present study was to determine the functions of TSPAN1 in progression of endometriosis to clear cell ovarian cancer.

**Method:** RNA sequencing and tissue microarray (TMA) were performed in formalin-fixed paraffin-embedded (FFPE) tissues of non-atypical endometriosis (n = 9), atypical endometriosis (n = 18), and clear cell ovarian cancer (n = 17). The differentially expressed genes were selected by RNA sequencing analysis and validated by immunohistochemistry using TMA. Then the cell proliferation assay was conducted in immortalized endometriosis cell lines that were manipulated over-expression or knockdown of TSPAN1.

**Results:** RNA sequencing analysis showed that mRNA expression levels of TSPAN1 were 2.4-fold higher in atypical endometriosis and 80.7-fold higher in clear cell ovarian cancer than in non-atypical endometriosis. In TMA tissues, expression levels of TSPAN1 were also increased similarly to mRNA expression levels. We found that TSPAN1 over-expressing endometriosis cell lines grew faster than control cell lines, and reversed in knockdown of TSPAN1. In endometriosis cells, over-expression of TSPAN1 increased AMP-activated protein kinase (AMPK) activity, and the inhibition of AMPK activity by siRNA and inhibitor did not increase cell growth by TSPAN1.

**Conclusion:** We confirmed that TSPAN1 increased the growth rate of endometriosis cell lines via AMPK activity. These findings suggest the possibility of screening for high-risk endometriosis, which can progress to clear cell ovarian cancer, by identifying expression levels of TSPAN1.

**310 - Poster Session**

**Real-world evidence on clinical value of germline alterations of cancer predisposition genes in Chinese epithelial ovarian cancer**

*L. Li<sup>a</sup>, C. Zhu<sup>b</sup>, D. Shao<sup>b</sup> and M. Wu<sup>a</sup>. *Peking Union Medical College Hospital, Beijing, China, <sup>b</sup>BGI Genomics, Shenzhen, China*

**Objective:** Approximately 20%–25% of patients with ovarian cancer are associated with occurrence of germline genetic aberrations. National Comprehensive Cancer Network (NCCN) guidelines recommend multiple genetic testing including *BRCA1/2*, other HRR, MMR genes, as well as *TP53, STK11*, and *PTEN*. Previous investigations have indicated that germline mutations of *BRCA1/2* and other HRR genes display therapeutic as well as prognostic potential. The prognostic value of *BRCA1/2* and other HRR genes for patients with epithelial ovarian cancer (EOC) is not supported by real-world evidence. In this study, we evaluated clinical value of *BRCA1/2* and other cancer predisposition genes in a real-world practice environment.

**Method:** A total of 1,060 patients with EOC were recruited from 18 medical centers in China from January 2017 to January 2019. All patients were recruited with informed consent. Peripheral blood samples were collected followed by sequencing cancer predisposition genes by MGI-sequencing 2000 platform.

**Results:** There were 734 patients with complete follow-up data included in this analysis. The median progression-free survival (PFS) time was 13.75 months, and median overall survival time was 25.1 months. Patients with germline *BRCA2* mutations showed marginal advantage in PFS (P = 0.016, Gehan-Breslow-Wilcoxon test). For overall survival, patients with germline *BRCA1*, all *BRCA*, as well as all mutations showed significant improvement for germline *BRCA1* mutation (P = 0.06), for germline *BRCA1/2* mutation (P = 0.017), and for all patients with germline deleterious mutations (P = 0.0086). See Figure 1.

**Conclusion:** Our study is the first to show improvement in overall survival for patients with germline deleterious mutation of *BRCA* genes.
Preoperative neutrophil-to-lymphocyte ratio and platelet-to-lymphocyte ratio can assist in prediction of optimal cytoreduction in epithelial ovarian cancer patients

O. Tal, O.D. Feldstein, O. Elyashiv, E. Ben Shem, O. Peled and T. Levy. E. Wolfson Medical Center, Holon, Israel

**Objective:** There is no reliable way to predict which patients with epithelial ovarian cancer (EOC) will be deemed operable and which will require prior neoadjuvant chemotherapy (NACT), and therefore some patients are found to be inoperable after undergoing a diagnostic laparoscopy or laparotomy. Elevated inflammatory indices such as neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte ratio (PLR) have been shown to predict lower progression-free survival (PFS) and overall survival (OS); however, no study has addressed their prognostic significance with regard to surgical outcome. The aim of this study was to evaluate whether NLR and PLR can help predict optimal cytoreduction in EOC patients.

**Method:** EOC patients treated at our department between 2004 and 2019 were divided into two groups: primary debulking surgery (PDS) and NACT. The PDS group comprised patients who were deemed operable upon diagnosis, whereas the NACT group included patients who were deemed inoperable by preoperative CT or diagnostic laparoscopy/laparotomy, and received NACT, with or without subsequent surgery. Records were reviewed for age, pathology data, and complete blood count (CBC) values obtained adjacent to diagnosis.

**Results:** A total of 157 patients met the inclusion criteria, of which 67 were deemed operable (“primary”) and 89 inoperable (“secondary”) at diagnosis. Using one-way ANOVA test, we discovered that NLR and PLR values were significantly higher for the NACT group than for the PDS group: mean NLR values were 5.6 ± 2.7 versus 3.9 ± 3.2 (P = 0.01), respectively, and mean PLR values were 319.9 ± 159.7 versus 201.9 ± 129.05 (P = 0.01), respectively. Using an ROC curve, a cutoff point of 3.5 for NLR had 82% sensitivity, 66% specificity, 64% PPV, and 82% NPV for inoperability, while a cutoff point of 194,000 for PLR yielded a sensitivity of 82%, 69% specificity, 66% PPV, and 84% NPV.

**Conclusion:** NLR and PLR, when combined with preoperative CT, may assist in triaging patients to PDS or NACT.

AIF1 drives tumor progression via a cellular cross-talk with the tumor microenvironment

C. Cao, R. Yu, Y. Xia, D. Liu and Q. Gao. Tongji Hospital, Tongji Medical College, Huazhong University of Science & Technology, Wuhan, China, The Department of Obstetrics and Gynecology, Tongji Hospital, Wuhan, China

**Objective:** We investigated the expression pattern of AIF1 in stroma and epithelium, the cell type that the high expression of AIF1 came from, the molecular consequences of different expression patterns in tumorigenesis and metastasis, and the effects of the cross talk on tumor immunity in ovarian cancer.
**Conclusion:** Our findings offer new insight into how loss of HR repair. In addition, cytotoxicity assays demonstrated that Nu-7441 selectively sensitizes PEO1 to olaparib.

**Results:** Expression level of AIF1 is negatively related to methylation level and is high in ovarian cancer compared with the normal ovary. Stroma showed more sufficient AIF1 distribution compared with epithelium in expression profiles and clinical samples. By subtype, higher expression level and lower methylation level were identified in mesenchymal ovarian cancer. In addition, the methylation percentage of the promoter region of AIF1 in tumor-associated fibroblasts was significantly higher than that in tumor epithelial cells and normal fibroblasts. Furthermore, AIF1 was mainly from CD14 monocytes, which was verified by thp-1 and ovarian cancer cell lines. Of note, the correlation of AIF1 and PD-1, PD-L1, PD-L2, CTLA-4, Tim-3, and CD11b was validated by serial section IHC. Over-expressing AIF1 in RAW 264.7 could promote tumor microenvironment formation via cellular cross talk, including tumor angiogenesis, normal fibroblasts activation, MDSC recruitment, M2 transference, and tumor progression in vivo, whereas knockdown AIF1 in thp-1 showed the opposite phenomenon.

**Conclusion:** AIF1 has different expression patterns in stroma and epithelium of ovarian cancer. The high expression level of AIF1 is mainly from monocytes, and the high methylation level is mainly from fibroblasts in the tumor stroma, which is related to immunosuppression, tumor angiogenesis, and fibroblast activation.

---

**Method:** We used The Cancer Genome Atlas (TCGA) and GEO data classified by stroma and epithelium, with gene expression and methylation data. Patient-derived paired samples were collected for magnetic beads separation, CpG sites examination, serial section immunohistochemical staining (IHC), and multicolor immunofluorescence (IF). Coculture, Western blot, q-PCR, tube formation, IF, and other experiments were performed in vitro. Knockdown and over-expression AIF1 in mononuclear macrophages and mixing with ovarian cancer cell lines were used in vivo.

**Results:** Expression level of AIF1 is negatively related to methylation level and is high in ovarian cancer compared with the normal ovary. Stroma showed more sufficient AIF1 distribution compared with epithelium in expression profiles and clinical samples. By subtype, higher expression level and lower methylation level were identified in mesenchymal ovarian cancer. In addition, the methylation percentage of the promoter region of AIF1 in tumor-associated fibroblasts was significantly higher than that in tumor epithelial cells and normal fibroblasts. Furthermore, AIF1 was mainly from CD14 monocytes, which was verified by thp-1 and ovarian cancer cell lines. Of note, the correlation of AIF1 and PD-1, PD-L1, PD-L2, CTLA-4, Tim-3, and CD11b was validated by serial section IHC. Over-expressing AIF1 in RAW 264.7 could promote tumor microenvironment formation via cellular cross talk, including tumor angiogenesis, normal fibroblasts activation, MDSC recruitment, M2 transference, and tumor progression in vivo, whereas knockdown AIF1 in thp-1 showed the opposite phenomenon.

**Conclusion:** AIF1 has different expression patterns in stroma and epithelium of ovarian cancer. The high expression level of AIF1 is mainly from monocytes, and the high methylation level is mainly from fibroblasts in the tumor stroma, which is related to immunosuppression, tumor angiogenesis, and fibroblast activation.

---

**313 - Poster Session**

**The role of AKT and NHEJ pathways in the sensitivity of BRCA2-mutated epithelial ovarian cancer to PARP inhibitors**

A. Xiong, D. Gokyer, N. Shapiro-Franklin, Z.P. Lin and E.S. Ratner. Yale University School of Medicine, New Haven, CT, USA

**Objective:** PE01 epithelial ovarian cancer (EOC) cells contain a mutated BRCA2 gene, a tumor suppressor gene that functions to repair DNA double-strand breaks (DSBs) through the homologous recombination (HR) repair pathway. While this type of cancer has been treated by poly(ADP-ribose) polymerase (PARP) inhibitors, such as olaparib, novel targets are needed to develop therapeutic strategies to enhance the efficacy of these inhibitors. Our objective was to investigate the role of AKT signaling and nonhomologous end joining (NHEJ) repair pathways in promoting the survival of BRCA2-mutated EOC cells following olaparib-induced DNA damage.

**Method:** BRCA2-mutated PE01 and BRCA2-wildtype counterpart PE04 ovarian cancer cells were used. AKT activity was examined for the level of phosphorylated Ser473 at AKT by Western blot analysis. NHEJ activity in SKOV3-EJ5-GFP cells was determined by flow cytometry. Apoptosis and cytotoxicity were measured by caspase 3/7 activity and MTS cell proliferation assays, respectively.

**Results:** We found enhanced levels of phosphorylated AKT protein in PE01 cells, suggesting that the AKT pathway may be utilized in BRCA2-mutated cells to maintain cell survival and promote progression of the cancer by mediating prosurvival events. GFP reporter assays demonstrated that Nu-7441, an inhibitor of DNA-PK, disables the NHEJ pathway. Apoptosis assays found that the combination of olaparib and Nu-7441 enhances apoptosis in PE01 cells, such that Nu-7441 inhibits the NHEJ mechanism of EOC cells with dysfunctional HR repair. In addition, cytotoxicity assays demonstrated that Nu-7441 selectively sensitizes PE01 to olaparib.

**Conclusion:** Our findings offer new insight into how loss of BRCA2 function in HR repair initiates other cellular processes to promote tumor growth and suggest that NHEJ may be the predominant DNA repair pathway for DSBs in BRCA2-mutated ovarian cancer. They indicate that the AKT and NHEJ pathways may function as therapeutic targets for the treatment of BRCA2-mutated ovarian cancer.

---

**314 - Poster Session**

**Preliminary results from phase II trial of pembrolizumab with first line platinum based chemotherapy followed by maintenance pembrolizumab for patients with suboptimally cytoreduced advanced epithelial ovarian cancer**

D. Uyara, C.M. Michenerb, W.H. Bradleya, E. Bishopb, P.G. Roseb, S. Northeyc, L. Zhanga, P. Simpsona and J.S. Radera. aMedical College of Wisconsin, Milwaukee, WI, USA, bCleveland Clinic, Cleveland, OH, USA

**Objective:** The anti-PD1 antibody pembrolizumab is approved for the first-line treatment of select solid tumors. Pembrolizumab has previously demonstrated antitumor activity in heavily pretreated platinum-resistant ovarian cancer. This phase II trial (in progress) is evaluating the combination of carboplatin, paclitaxel, and pembrolizumab in patients with ovarian cancer and suboptimal cytoreduction. This represents our updated preliminary data.

**Method:** Patients with the diagnosis of stage III–IV epithelial ovarian cancer and any residual disease at the time of cytoreductive surgery meeting inclusion criteria were eligible to participate. Treatment consisted of carboplatin AUC 6 day 1; paclitaxel 80 mg/m2 days 1, 8, and 15; and pembrolizumab 200 mg day 1 q 21 days. Alternatives to weekly paclitaxel were also administered and included
paclitaxel 135 mg/m² day 1 or docetaxel 75 mg/m² day 1 q 21 days. The primary objectives were progression-free survival (PFS) and tolerable safety profile.

**Results:** Over 20 months 28 patients have been enrolled. There were no unanticipated toxicities noted. The most common grade 3 toxicities were neutropenia (67%) and anemia (25%). Most common grade 4 toxicities were respiratory (10%, including 1 respiratory failure, 1 pulmonary edema, and 1 pneumonitis), neutropenia (10%), and 1 cardiac event (congestive heart failure). A total of 7 patients were able to complete all treatments; 9 patients were discontinued from the study due to disease progression; 2 patients were removed from the study due to toxicity (1 patient with grade 4 pneumonitis and 1 patient with grade 4 heart failure); 2 patients withdrew consent; a total of 7 remain in follow-up without evidence of disease; and 6 patients remain in treatment. PFS at 3, 6, 9, and 12 months is 92%, 82%, 77%, and 59% respectively.

**Conclusion:** Pembrolizumab in combination with carboplatin and paclitaxel even on a weekly schedule was overall well tolerated. The most common grade 3–4 adverse events were cytopenias, likely primarily related to cytotoxic therapy, similar to previous trials using carboplatin and taxol. Although the follow-up is limited, current PFS at 12 months is 59% in this population of patients with residual disease after primary cytoreduction.

### 315 - Poster Session

**A CLIA-certified functional precision medicine assay, the PARIS© test, to predict drug response for ovarian cancer**

SE Engine Precision Medicine, Seattle, WA, USA, Washington State University, Spokane, WA, USA, Cancer Treatment Navigator, Seattle, WA, USA, Pacific Gynecology Specialists/Swedish Cancer Institute, Seattle, WA, USA

**Objective:** Ovarian cancer is one of the leading causes of cancer death among women, with 5-year survival rates at around 30% with standard-of-care therapy. There are also few actionable genetic targets recurrently seen in ovarian cancers. With this state of the field, functional precision medicine such as the PARIS© test based on drug testing of 3-dimensional tumor-derived organoids can highlight personalized therapies to women who have exhausted treatment options. We aim to show the PARIS© test’s utility in guiding treatment for ovarian cancer.

**Method:** The PARIS© test, developed by SEngine Precision Medicine, is a CLIA-certified high-throughput drug sensitivity test using a comprehensive collection of oncology drugs and is applicable to all solid tumors. To date, the test has been employed for 296 cancer specimens comprising >20 tumor types, and can be completed in a clinically actionable timeframe. Here we describe 12 cases of ovarian cancer for which organoids were derived from ascites, core biopsies, or surgical excisions, and subjected to the PARIS© test.

**Results:** Overall, the PARIS© test indicated 100% correlation with retrospective therapies for those patients for which previous clinical information was available (n = 7). The PARIS© test also indicated 80% concordance with drug sensitivities that correlate with the known genomics of each patient (n = 8). The test revealed repeated broad sensitivity to EGFR, PI3K, ALK, VEGFR, and HDAC inhibitors across the ovarian cohort. As an example of the power of unbiased functional drug testing to reveal drug sensitivities, we describe a case study of a patient with recurrent ovarian carcinoma who harbored loss of function mutations in BRCA1 and TP53. At the time of testing, the patient had progressed through 8 lines of chemotherapy, immunotherapy, and PARP inhibitor therapy. SEngine’s screen of 92 drugs, while corroborating resistance to previous treatments, revealed sensitivity to PI3K, HDAC, EGFR, BET, ALK, MEK, and SRC kinase inhibitors, providing several avenues of future treatment options. See **Table 1**.

**Conclusion:** Moving forward, functional precision medicine like SEngine’s PARIS© test can reveal therapeutic choices not predictable by DNA testing and offer ovarian cancer patients a chance of remission and survival.

**Table 1.** Clinical and genomic history of twelve ovarian cancer cases, along with functional screen results from the PARIS© test and associated genomic and clinical concordance.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Diagnosis</th>
<th>Previous treatments</th>
<th>Sample Type</th>
<th>Actionable mutations</th>
<th>Top Drug Targets</th>
<th>Approved Genomic Concordance</th>
<th>Retrospective Concordance</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE0032</td>
<td>high-grade serous ovarian cancer</td>
<td>1 tumor biopsy</td>
<td>BRCA1 (germline), TP53</td>
<td>WEE1, Src, IGF-1R, PARPi</td>
<td>yes</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>SE0070</td>
<td>ovarian cancer</td>
<td>2 ascites</td>
<td>n/a</td>
<td>PI3K, Src, HDAC, BET</td>
<td>n/a</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td>SE0099</td>
<td>stage IIIC ovarian cancer</td>
<td>3 ascites</td>
<td>n/a</td>
<td>Bcl2, HDAC, PI3K, EGFR, kinase</td>
<td>n/a</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>SE0105</td>
<td>recurrent ovarian cancer</td>
<td>5 tumor biopsy</td>
<td>TP53, Akt2, CCND2, FGFR2, FGFR5</td>
<td>PI3K, FGFR, EGFR, androgen</td>
<td>yes</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>SE0123</td>
<td>ovarian cancer</td>
<td>2</td>
<td>frozen tumor biopsy</td>
<td>BRCA1 loss (somatic), TP53, FGFR2, FGFR1, K-RAS, BCL2/3, Src, PIK3CA, PIK3CG, PIK3R1, PRKACA</td>
<td>PI3K, Src, Mek, Bcl2, FGFR, ALK, VEGFR, IGF-1R, EGFR</td>
<td>yes</td>
<td>n/a</td>
</tr>
<tr>
<td>SE0146</td>
<td>recurrent stage IIIC fallopian tube/ovarian cancer</td>
<td>3</td>
<td>tumor biopsy</td>
<td>BRCA1 loss (somatic), TP53, ERBB3, FGFI2, NF1</td>
<td>EGFR, Mek, Bcl2, RET, Src, VEGF, androgen, estrogen, progesterone</td>
<td>yes</td>
<td>unknown - PARP response indeterminate</td>
</tr>
<tr>
<td>SE0209</td>
<td>stage IV ovarian cancer</td>
<td>1</td>
<td>tumor biopsy</td>
<td>need genomic information</td>
<td>PI3K, BET, ALK, JAK, mTOR, CDK4/6, VEGFR, EGFR</td>
<td>n/a</td>
<td>yes</td>
</tr>
<tr>
<td>SE0210</td>
<td>stage IV serous ovarian cancer</td>
<td>4</td>
<td>ascites</td>
<td>PIK3CA, TP53, TERT activation</td>
<td>PI3K, Akt, mTOR, EGFR, HDAC, BET, retinoids</td>
<td>yes</td>
<td>yes - except cyclophosphamide</td>
</tr>
<tr>
<td>SE0211</td>
<td>recurrent high-grade serous ovarian cancer</td>
<td>8</td>
<td>ascites</td>
<td>BRCA1 (germline), TP53</td>
<td>PI3K, mTOR, EGFR, HDAC, BET, Src, MeK, ALK, Smo, kinase</td>
<td>n/a</td>
<td>yes - except cyclophosphamide</td>
</tr>
<tr>
<td>SE0217</td>
<td>stage IV serous ovarian cancer</td>
<td>2</td>
<td>tumor biopsy</td>
<td>n/a</td>
<td>PI3K, EGFR, Bcl2, VEGFR, ALK, Akt, FGFR, CDK4/6, estrogen, retinoids</td>
<td>n/a</td>
<td>yes</td>
</tr>
<tr>
<td>SE0247</td>
<td>metastatic serous ovarian cancer, stage IIIc</td>
<td>4</td>
<td>tumor biopsy</td>
<td>ESR1, NRG1, ER+, PR-</td>
<td>Mek, ALK, androgen, EGFR, HER2, CDK4/6, mTOR</td>
<td>yes</td>
<td>n/a</td>
</tr>
<tr>
<td>SE0248</td>
<td>high grade serous ovarian cancer</td>
<td>unknown</td>
<td>ascites</td>
<td>TP53, CCNE1</td>
<td>WEE1, Akt, B-RAF, Smo</td>
<td>n/a</td>
<td>unknown</td>
</tr>
</tbody>
</table>

### 316 - Poster Session

**Thromboembolic events post cytoreductive surgery in patients with ovarian, fallopian tube or primary peritoneal cancer**

D. Atallah, M. Moubarak, K. Abi Farraj and N. El Kassis. **Hôtel-Dieu de France University Hospital/Saint Joseph University, Beirut, Lebanon**

**Objective:** The purpose of this study was to determine the prevalence of deep vein thrombosis and pulmonary embolism after an extensive cytoreductive surgery for ovarian or fallopian tube cancer and the associated risk factors and to suggest preventive measures pre- and postoperatively to reduce these risks.

**Method:** A retrospective study conducted at **Hôtel-Dieu de France University Hospital** included all patients older than 16 years and receiving cytoreductive surgery for ovarian, fallopian tube, or primary peritoneal cancer between 2004 and 2017.

**Results:** A total of 123 patients were included. Mean age was 55 years. The prevalence of postoperative thromboembolic events in the studied population was 8.9%. Deep vein thrombosis and pulmonary embolism were found in 6.5% and 4.1% of patients, respectively. A correlation was found between the presence of venous catheter and the occurrence of thromboembolic events with \( P = 0.035 \) (OR = 4, CI 1.019–16.197). Also, partial colectomy with anastomosis, cholecystectomy, and appendectomy were found to be risk factors (0.001, 0.021, and 0.045, respectively). We found a correlation between hospital and intensive care stay and the duration of immobilization as well as a correlation between weight and hospital stay (\( P = 0.02 \)). Date of initiation of postoperative thromboprophylaxis was related to the amount of intraoperative bleeding (\( P = 0.024 \)).

**Conclusion:** Avoiding the placement of central venous catheter, reducing the patient weight preoperatively, encouraging early mobilization, reducing the hospital stay and the stay in the intensive care unit, and controlling and limiting the intra- and postoperative bleeding are measures that contribute to reduction of risk of thromboembolic event occurrence.

### 317 - Poster Session

**Economic burden associated with early progression in ovarian cancer**


**Objective:** Despite high initial response rates of ovarian cancer to platinum-based chemotherapy, the recurrence rate within 2 years following first-line chemotherapy is high. The median progression-free survival on current standard-of-care regimens (platinum-taxane)
ranges from 12 to 18 months. We assess the economic impact of early disease progression among patients with ovarian cancer at the 2- and 3-year landmarks.

**Methods**: Using a retrospective cohort study design, we identified ovarian cancer patients from the Surveillance, Epidemiology and End Results (SEER)–Medicare linked database who were ≤66 years and had completed 4–10 cycles of first-line chemotherapy from January 2009 to December 2015. The first-line chemotherapy initiation date was the index date. Using a previously validated algorithm, we classified patients into 2 mutually exclusive cohorts: early progressors and late progressors (using 12 months as threshold). Total health care costs (2015 US$) were measured from the index date until the end of continuous health care plan enrollment, death, or the relevant landmark using the restricted mean cost method. To account for variable length of follow-up and cost censoring, total mean costs were reported on a per patient per month basis (PPPM).

**Results**: A total of 450 patients (37%, total n = 1,228) were identified as early progressors compared to 414 patients (36%, total n = 1,135) at the 2- and 3-year landmarks, respectively. Observed baseline demographic and clinical characteristics were similar between both groups. After regression adjustment for baseline differences, early progressors had higher mean PPPM cost ($9,099 vs $5,842, mean difference, $3,257) and ($9,170 vs $6,288, mean difference, $2,882) vs late progressors at the 2- and 3-year landmarks, respectively. At both landmarks, drugs, physician services, and outpatient categories were the leading cost drivers. The most influential baseline factors associated with early progression were stage IV (versus III), single-agent therapy (versus combination), high NCI index score, and high grade at diagnosis.

**Conclusion**: Over a 3-year period following first-line treatment initiation, early disease progression in ovarian cancer was associated with significantly higher PPPM cost. Treatment strategies that delay progression in the first-line setting in ovarian cancer may present potential short-term cost-saving opportunities to partially offset potentially increased drug costs.

---

**318 - Poster Session**

**Mucinous ovarian malignancies 10-year overview of treatment and outcome from a single centre**

A. Madariaga, S. Garg, A.M. Oza, M. Rouzbahman, N. Dhani, L. Bonilla, S. Laframboise, J. Croke, L. Kasheran, S. Liu, G. Bhat, M. McMullen, L. Wang, V. Bowering and S. Lheureux. Princess Margaret Cancer Centre, University Health Network, Toronto, ON, Canada

**Objective**: The aim of this study was to evaluate the clinical outcomes in women with ovarian mucinous tumors and assess the prognostic impact of clinical, pathological, and molecular characteristics.

**Method**: We identified 310 patients from the Princess Margaret Cancer Centre registry database diagnosed with mucinous gynecologic tumors between January 2008 and August 2018. Patients with uncertain histology and extra-ovarian origin were excluded. Ninety-eight mucinous ovarian carcinoma (MOC), 90 borderline intestinal (MBI), and 23 seromucinous borderline tumors (SMB) were identified. Median follow-up was 3.6 years in MOC, 5.1 years in MBI, and 3.4 years in SMB.

**Results**: Median age at diagnosis in MOC was 49 years; 86% had early-stage (stage I–II) and 3-year OS was 93% (83%–97%); 14% had advanced stage (III–IV) and 3-year OS was 29% (5%–60%). HER2 was assessed by IHC/FISH in 15 patients (8 patients Her2+, 7 patients Her2–). All patients had initial surgery, regardless of stage. In stage I, 36% (28/78) had fertility-sparing surgery with no differences in PFS (3-year PFS debulking 89%, 73%–98%, vs fertility-sparing 92%, 72%–98%, P = 0.8) or OS (3-year OS debulking 94%, 79%–99%, vs fertility-sparing 95%, 69%–99%, P = 0.77). In stage II–IV, 65% (13/20) received adjuvant platinum-based chemotherapy, with no difference in PFS (no-adjuvant 1.7 years, 0.1–not reached (NR), vs adjuvant 0.9 years, 0.5–4.8, P = 0.41) or OS (no-adjuvant NR vs adjuvant 1.9 years, 0.8–6.2, P = 0.27). Twenty percent (20/98) of patients with MOC relapsed (early stage, 14%; advanced stage, 57%); 1-year OS from relapse was 63% (37%–81%). Treatment of choice at first progression was oxaliplatin based, with a clinical benefit of 57%, and at second progression clinical trials. Clinical trial participation was 35% (7/20); 20% (4/20) received targeted treatment (3 patients HER2 target; 1 patient cell-cycle). Tumor profiling was performed in 15 patients; TP53, KRAS, PIK3CA, and CDKN2A were the most frequently mutated genes; 47% (7/15) patients had 1 or alterations in HR-DDR genes. Median age of diagnosis in MBI and SMB was 49 and 53 years, respectively. All patients were treated with initial surgery. Three patients (3%) with MBI relapsed of which 2 were treated with surgery and 1 with observation (nonresectable). Tumor profiling was performed in a relapsed patient, with no alterations found. No patiet with SMB relapsed. See Figure 1.

**Conclusion**: MOC has a poor prognosis at relapse. HER2 over-expression by IHC/FISH was high in our cohort. Molecular profiling unravels multiple therapeutic options.
Objective: The purpose of this study was to evaluate biomarkers of outcome with weekly paclitaxel monotherapy in platinum-resistant epithelial ovarian carcinoma using shallow whole genome sequencing (sWGS).

Method: Patients with high-grade serous (HGS) or endometrioid ovarian carcinoma treated with weekly paclitaxel monotherapy in Princess Margaret Cancer Centre between January 2010 and December 2017 were identified. Patients with sufficient tissue and evidence of short-response (SR, ≤3 cycles) or long-response (LR, ≥8 cycles) to weekly paclitaxel were selected. sWGS was performed on archival tumors of 58 patients. Paclitaxel is a microtubule stabilizer that causes cell cycle arrest at G2/M checkpoint. The weekly administration of paclitaxel has been linked to potential induction of apoptosis or inhibition of angiogenesis. At such, copy number alterations in genes related to angiogenesis, cell cycle, apoptosis, microtubule stability, and response to paclitaxel were assessed. Genes related to peroxisomal biogenesis, involved in oxidation reactions and lipid biosynthesis, which have a potential role in chemotherapy resistancy, were also assessed. $\chi^2$ test was used to assess amplification differences in both cohorts.

Results: A total of 37 SR and 21 LR were analyzed; histologies were well balanced, being 95% HGS and 5% grade 2–3 endometrioid. Median number of cycles of weekly paclitaxel was 2.5 (2–3) in SR and 13 (8–36) in LR. Tubulin superfamily and cell cycle-related genes were assessed in both cohorts, and no differential amplification was seen. Apoptosis- and angiogenesis-related genes were analyzed in SR and LR; none of the genes was significantly differently amplified. Cytochrome enzymes related to paclitaxel metabolism, transporters, and paclitaxel targets were assessed, finding no significant amplification differences on both cohorts. There was a significant differential amplification of genes related to peroxisomal biogenesis, including $\text{PECR}$, $\text{PEX1}$, $\text{PEX10}$, and $\text{PEX11}$, in SR (0.045). There was an exceptional responder that received 36 cycles of weekly paclitaxel, with an unusual molecular profiling, including amplifications in angiogenesis-related $\text{CXCRI}$, $\text{CXCRII}$, $\text{IL1}$, and $\text{IRS1}$ genes. See Figure 1.

Conclusion: The mechanism underlying response to weekly paclitaxel treatment after progression to 3 weekly paclitaxel in ovarian cancer remains unknown. LR to WP might be multifactorial, and further studies including exceptional responders to weekly paclitaxel are needed for biomarker discovery.
Predictive factors of postoperative complications after cytoreductive surgery for ovarian cancer

D. Atallah and M. Moubarak, Hôtel-Dieu de France University Hospital/Saint Joseph University, Beirut, Lebanon

Objective: Ovarian cancer is the leading cause of death from gynecological cancer for women. The standard treatment consists of extensive cytoreductive surgery followed with adjuvant chemotherapy. This study aims to identify the common postoperative complications as well as to define predictive factors of their occurrence.

Method: This prospective study was conducted at Hôtel-Dieu University Hospital in Lebanon between October 2017 and October 2018. All patients older than 18 years who underwent cytoreductive surgery for ovarian cancer were followed up from the postoperative admission in the intensive care unit until discharge from hospital for at least for 30 days. Correlations between perioperative characteristics and complications were searched and analyzed.

Results: Forty patients were included. The mean age was 55 years. The mean surgical complexity score was 5. Major complications occurred in 32% of cases. They were associated with neoadjuvant chemotherapy ($P = 0.009$), elevated surgical complexity ($P = 0.037$), need for intraoperative transfusion, and stay at intensive care unit more than 48 hours ($P = 0.05$). Complications were infectious, hemodynamic, pulmonary, digestive, and surgical. Need for parenteral nutrition was significantly correlated with longer operative time and neoadjuvant chemotherapy. No correlation was found between occurrence of complications and the following parameters: age, stage, APACHE II score, Charlson comorbidity index, and preoperative albuminemia.

Conclusion: Cancer stage, neoadjuvant chemotherapy, high surgical complexity, need for transfusions, delayed extubation, and stay at intensive care unit more than 48 hours were predictive factors of higher postoperative morbidity in patients receiving cytoreductive surgery for ovarian cancer.
Objective: The aim of this study was to determine the utility of a decision-tree algorithm to predict for 90-day postoperative mortality in advanced ovarian cancers.

Method: Data were obtained on all patients with stage IV ovarian cancer using the National Cancer Data Base from 2004 to 2015. Age, Charlson-Deyo Score, AJCC clinical stage, tumor size, CA-125, ascites, histology, surgery, chemotherapy, and treatment sequence were extracted. After dividing the dataset into a training and a test set, a decision-tree analysis was performed under IBM SPSS Statistics v25.0 by X² Automatic Interaction Detector (CHAID) algorithm.

Results: Of 13,417 patients (median age 63 years, range 18–90 years) with AJCC clinical stage IV, serous, endometrioid, clear cell, mucinous, and undifferentiated tumors were found in 69.8%, 2.5%, 2.4%, 1.7%, and 0.3 %, respectively. Grade 1, 2, 3, and unknown were identified in 1.7%, 6.5%, 66%, and 25.9% of patients, respectively. The machine learning algorithm developed a mathematical model to predict for those at high risk for 90-day mortality. In our exploratory data analysis with unsupervised learning, the algorithm found that the most predictive factor for 90-day mortality was poor prognostic cell types with undifferentiated and mucinous advanced cancers having 90-day mortality at 8.5% and 18.3%, respectively. Of the high-grade serous tumors, the algorithm discovered that those >62 years had 90-day mortality of 3.7% compared to only 1.5% in those ≤62 years. Continuing in this decision tree node of older age patients with high-grade serous cancers, we found the next decision factor was treatment sequence in which primary surgery was associated with a 90-day mortality of 5.0% compared to 2.3% in neoadjuvant chemotherapy with interval surgery. However, Charlson-Deyo score, tumor size, ascites, and CA-125 were not important factors in our model.

Conclusion: Our data suggest that a decision-tree algorithm using machine learning can potentially be used as a guide to decrease 90-day mortality in stage IV ovarian cancer patients.

322 - Poster Session
Patterns of BRD4 protein expression in advanced stage high-grade serous ovarian cancers
S.S. Petersena, R. Alianib, S. Amayaa, A.J. Wilsonc and D. Khabelea. aUniversity of Kansas Medical Center, Kansas City, KS, USA, bThe University of Kansas School of Medicine, Kansas City, KS, USA, cVanderbilt University, Nashville, TN, USA

Objective: Previous results have associated elevated bromodomain and extraterminal 4 (BRD4) expression with poor overall survival in ovarian cancer. However, patterns of BRD4 expression in advanced-stage high-grade serous ovarian cancer (HGSOC) are not well characterized. The aim of this study was to evaluate BRD4 protein expression in primary and metastatic tumors of advanced-stage HGSOC.

Method: Immunostaining for BRD4 was performed on a tissue microarray (TMA) harboring 100 matched primary and metastatic advanced (>stage IIIC) HGSOC tumors from the University of Kansas Medical Center (KUMC). Staining intensity (1, weak; 2, moderate; 3, strong) and percentage of positive nuclei (0–100) were multiplied to yield an H-score for BRD4 expression. Pearson correlation coefficients were determined for BRD4 protein expression in primary and metastatic tumors. BRD4 expression in relation to platinum sensitivity was evaluated using Wilcoxon rank sum test. Overall survival (OS) was generated by Kaplan-Meier curves and Cox proportional hazard models using SAS v9.4.

Result: BRD4 expression was positively correlated between primary and metastatic tumors (r = 0.52, P < 0.0001). BRD4 expression was dichotomized around the median to determine high versus low expression for further analysis. High BRD4 expression (H-score >145) was not associated with platinum resistance in primary tumors (P = 0.13) or metastatic tumors (P = 0.89). In addition, high BRD4 expression in primary tumors was not associated with worse OS (HR = 1.29, 95% CI 0.46–3.66, P = 0.63) after controlling for age. Similarly, high BRD4 expression in metastatic tumors was not associated with worse OS (HR = 0.92, 95% CI 0.40–2.12, P = 0.84).

Conclusion: Patterns of BRD4 protein expression correlated in primary and metastatic advanced-staged HGSOC tumors. BRD4 protein expression was not associated with platinum resistance or survival outcomes. Further research is warranted to determine the use of BRD4 expression as a marker for targeted therapy.

323 - Poster Session
Phase I dose escalation clinical trial of stereotactic body radiation therapy (SBRT) for locoregional recurrences of ovarian cancer: Dose escalation and preliminary outcomes and quality of life results
Objective: Radiation therapy is infrequently used in the treatment of advanced ovarian cancer because of the propensity for peritoneal spread and the dose limitations of large field techniques. However, for patients with limited sites of recurrence, advanced radiation techniques such as stereotactic body radiation therapy (SBRT) may offer an effective treatment option. There are many clinical trials supporting the safety and efficacy of SBRT for lung and liver tumors, but the role for abdominopelvic targets adjacent to gastrointestinal mucosa remains largely investigational.

Method: A single institutional phase I dose escalation study was conducted to determine the maximum tolerated dose (MTD) of SBRT for patients with abdominopelvic recurrences of ovarian cancer. We utilized a 3+3 design with 3 dose levels: 8 Gy × 3 fractions (DL1), 9 Gy × 3 fractions (DL2), and 10 Gy × 3 fractions (DL3). The dose-limiting toxicity (DLT) monitoring period was 12 weeks after completion of SBRT prior to escalating to the next dose level. Secondary endpoints included local control, progression-free survival (PFS), overall survival (OS), and quality of life utilizing the EORTC QLQ-C30 assessment tool.

Results: Nine patients were enrolled, and the dose was safely escalated to DL3 with no DLT. Of the 9 patients, 8 have completed the DLT monitoring period with the final patient scheduled to complete DLT monitoring in November 2019. There have been no reported serious adverse events or any grade 2 or higher SBRT-related toxicities. No patients have had bowel complications or bowel surgery. Among the 5/9 patients who have completed 1-year follow-up, local control, PFS, and OS were 100%, 80%, and 100%, respectively. Of 5 patients, 3 patients with 1-year follow-up received SBRT on study in lieu of systemic therapy with 2/3 patients remaining off systemic therapy at 12-month follow-up. At 12 months after completion of SBRT, global health status/quality of life patient-reported outcomes were maintained from baseline values.

Conclusion: This phase I clinical trial offers preliminary evidence that SBRT can be delivered safely and appears effective in controlling limited locoregional recurrences of ovarian cancer, while maintaining quality of life. SBRT offers another potential tool in the armamentarium of treatments for gynecologic cancers with limited site recurrences.

324 - Poster Session
Transvaginal natural orifice transluminal endoscopic surgery (vNOTES) for omentectomy: A case series study

E. Matanes, L. Lowenstien, L. Kogan, A. Amit, R. Lauterbach and J. Baekelandt. aJewish General Hospital, McGill University, Montreal, QC, Canada, bTECHNION, Haifa, Israel, cRambam, Haifa, Israel, dImelda Hospital, Bonheiden, Belgium

Objective: Omentectomy is a common surgical procedure performed in the field of gynecological oncology. It is considered a part of the surgical staging of ovarian malignancy (1–2) and is an adjunctive procedure for nonendometroid endometrial malignancies. The objective of the study is to present our experience with transvaginal natural orifice transluminal endoscopic surgery (vNOTES) omentectomy and to evaluate the feasibility of this procedure.

Method: This was a retrospective study of the first 5 vNOTES omentectomy procedures performed at Rambam Health Care Campus (Israel) and Imelda Hospital (Belgium). The primary outcome was to accomplish the surgery through the vaginal GelPOINT, without insertion of an assistance abdominal trocar or conversion to the conventional vaginal approach. Secondary outcomes included surgical time, intraoperative bleeding, length of hospitalization, postoperative pain, and need for analgesia. Sociodemographic and clinical data were retrieved from patients’ electronic charts.

Results: Patients had a median age of 61 years (range 50–72 years) and a median BMI of 27 kg/m² (range 23–33 kg/m²). All women underwent staging surgical procedure due to suspicious ovarian mass with no extra-ovarian spread, confirmed by preoperative computed tomography. Final pathology revealed borderline serous disease for 3 patients; 1 patient had benign cystadenoma; and 1 patient had low-grade granulosa cell tumor of the ovary with no peritoneal spread. All operations were carried out to completion through the vaginal GelPOINT, without conversion. The median omentectomy time was 45 minutes (range 39–52 minutes). The median estimated intraoperative blood loss was 150 ml (range 20–200 ml). The median VAS score for pain assessment during the first 24 hours following surgery was 2 (range 1–2). Median demand of paracetamol per patient per 24 hours was 3 (range 2–5). See Figure 1.

Conclusion: vNOTES omentectomy is a feasible procedure with acceptable surgical times and minor associated perioperative complications.
Objective: The aim of this study was to examine the effects of hyperthermic cisplatin on DNA damage and DNA damage response in human and mouse epithelial ovarian cancer cell lines.

Method: Human (CP70) or mouse (ID8) epithelial ovarian cancer cell lines were treated with clinically relevant combinations of hyperthermia (42 degrees × 90 minutes) and cisplatin or their respective (normothermic and/or vehicle) controls (Figure 1A). Cell proliferation was analyzed at a 72-hour time point using a CellTiter-Glo assay. At early (90-minute) and late (48- or 72-hour) time points, cisplatin adducts were measured by mass spectrometry and protein levels of H2AX (a marker of DNA damage) and Rad51 (a DNA damage response protein) by immunoblot analysis and immunocytochemistry.

Results: At a 72-hour time point in both CP70 and ID8 cell lines, normothermic cisplatin treatment impaired cell proliferation in a dosedependent manner; this effect was even more pronounced in hyperthermic cisplatin-treated cells (Figure 1B). In CP70 cells at 90 minutes, there were significantly more cisplatin adducts in the hyperthermic cisplatin-treated cells than in the normothermic cisplatin-treated cells (1.717 vs 0.471, P < 0.05); there were no significant differences in cisplatin adducts at later time points (Figure 1C). At 90 minutes, H2AX protein levels did not differ between normothermic cisplatin-treated cells and hyperthermic cisplatin-treated cells (or from their respective controls) by immunoblot analysis and immunocytochemistry (not shown). However, at a 48-hour time point, there was an increase in H2AX expression in normothermic cisplatin-treated cells and an even more marked increase in hyperthermic cisplatin-treated cells (Figure 1D). Immunoblot (Figure 1E) as well as immunocytochemistry (not shown) for Rad51 showed no difference in protein expression at either time point. Importantly, these results were confirmed in both human and mouse cell lines.
Conclusions: These data suggest that hyperthermic cisplatin, as used clinically in HIPEC, attenuates the DNA damage response in both human and mouse epithelial ovarian cancer cell lines. Additional studies assessing combination therapies to further potentiate this effect through further inhibition of DNA repair pathways are underway and may have clinical implications for combinatorial therapy with HIPEC in patients with advanced ovarian cancer.

Fig. 1.

326 - Poster Session
HIPEC in ovarian cancer: The first case control study in Mexican patients with 10-year follow-up
J.M. Medina Sr.a, A.B. Gonzalez-Valdesb, F. Morales-Vasquezb, F. Rivera-Buendiab, H.N. López-Basaveb, H. Medina-Franco Sr.c, G. Flores-Ayala Sr.d and P.D. Sulca-Caveroe. aISSEMyM, Toluca, EM, Mexico, bInstituto Nacional de Cancerologia de México, México, DF, Mexico, cINCMyNSZ, Distrito Federal, DF, Mexico, dInstituto Jalicience de Oncología, Guadalajara, JA, Mexico, eUniversidad Nacional Autónoma de México, Ciudad de México, DF, Mexico

Objective: The aim of this study was to compare overall survival (OS) and progression-free survival (PFS) among ovarian cancer patients who underwent cytoreduction and HIPEC procedure versus patients who received only systemic chemotherapy in a 10-year follow-up of a case control study

Method: Cases were defined as patients treated by cytoreduction and HIPEC and were matched (1:2) with patients treated with chemotherapy only, defined as controls. PFS and OS in the 2 groups were measured and compared. PFS was calculated from initiation of treatment to progression, death, or the last known follow-up. OS was calculated from initiation of treatment to death or to the last known follow-up.

Results: Mean age was 53 years (SD 10) and 52 years (SD 10) for controls and cases, respectively. Most of the patients in both groups started with abdominal pain (67.4%) and abdominal distension (64.5%). According to FIGO stratification, 58% (80) were clinical stage IIIC, and 18.1% (25) were stage IV. We divided the patients into 2 groups, PCI <10 (65%) or >10 (34%). Complete cytoreduction (CCR0) was performed in 33 patients (71.7%) and optimal (with residual of less than 0.5 cm) in 13 patients (28.3%). No intraoperative deaths occurred. Severe complications occurred in 11 patients (37.93%). During the 10-year follow-up, 63.04% of recurrences (29 patients) were found. The estimated median OS on the HIPEC group was 99.1 months versus 38.9 months in the control group ($P = 0.0002$); the PFS was 32.8 months in the HIPEC group and 17.8 months in the systemic chemotherapy group ($P = 0.05$). See Figure 1.

Conclusion: We clearly appreciate how platinum resistance plays an important role in patient survival, with a difference of 40 months between those who are resistant and those who are not at the time of HIPEC. But even in platinum-resistant tumors we observed a mean survival of 50 months. Therefore, this study suggests that CRS and HIPEC in patients with recurrent ovarian cancer may be beneficial compared to conventional secondary debulking or systemic therapy as treatment alone, since DFI of 32.8 months and OS rates over 99.1
months post-HIPEC application are obtained. The measurement of OS from initial diagnosis is substantially modified to more than 104 months, a figure not seen before in advanced or recurrent disease of this neoplasm.

Fig. 1. Comparación Kaplan-Meier grupo I y grupo II desde la citoreducción.

### 327 - Poster Session

**Synchronous ovarian and uterine cancers in U.S. women, 2004-2015**

**M.C. Puckett**, J. Townsend and S.L. Stewart. *Centers for Disease Control and Prevention, Atlanta, GA, USA*

**Objective:** Ovarian and uterine cancers are the 5th and 6th leading causes of cancer death in U.S. women, and account for more than 77,000 new cancer cases diagnosed each year. Synchronous primary tumors, or tumors diagnosed within 1 year of each other, in gynecologic cancers are rare. We aimed to assess the incidence of synchronous ovarian and uterine cancers in the United States, along with the demographic and tumor characteristics of the women diagnosed with synchronous cancers.

**Method:** We analyzed incident cases of malignant epithelial ovarian and uterine cancers reported to population-based central cancer registries funded by the CDC National Program of Cancer Registries (NPCR) or the NCI Surveillance, Epidemiology, and End Results (SEER) program during the 2004–2015 time period. We considered women to have a synchronous ovarian and uterine cancer if the diagnosis of the other cancer occurred within 6 months of the first primary ovarian or uterine cancer. We conducted a descriptive analysis examining demographic and clinical characteristics among women having only a first primary uterine or ovarian cancer compared to women with synchronous cancers.

**Results:** Between 2004 and 2015, 7,654 women were diagnosed with synchronous ovarian and uterine cancers. During that same time period, 183,284 women were diagnosed with primary ovarian cancer alone. A total of 397,657 women were diagnosed with primary uterine cancer alone. Women with synchronous uterine and ovarian cancers were significantly younger (33.71% vs 14.77% younger than 50 years, \( P < 0.001 \)), most often lived in the Northeast and West (\( P < 0.001 \)), and were more likely to live in metropolitan areas (85.79% vs 83.8%, \( P < 0.001 \)). Women with synchronous cancers were more often diagnosed during the 2004–2009 period. The most common histology for ovarian cancers was endometrioid in women diagnosed with synchronous tumors, which differed significantly from women diagnosed with only ovarian cancer (50.49% vs 8.61%, \( P < 0.001 \)).

**Conclusions:** Women diagnosed with synchronous ovarian and uterine cancers differed significantly from women diagnosed with only ovarian or uterine cancer for multiple demographic variables and tumor characteristics. This could suggest that women meeting these characteristics who are diagnosed with either ovarian or uterine cancer may benefit from assessment for presence of the other cancer at the time of diagnosis.

### 328 - Poster Session

**A 7-year-old with bilateral, granulosa cell tumors, severe hypothyroidism, precocious puberty, and delayed bone-age: A case of Van Wyck-Grumbach syndrome diagnosis and recommendations**

**M.B. Reedya,b** and D. Phillipsb. *aTexas Tech University School of Medicine, Lubbock, TX, USA, bTexas Tech University Health Sciences Center, Lubbock, TX, USA*
Objective: This is a case report of a 7-year-old female who presented to the emergency department with a history of vaginal bleeding, increasing abdominal pain, and dehydration. A case of Van Wyk-Grumbach is presented.

Method: Computerized tomography (CT) of the abdomen and pelvis identified bilateral, adnexal cysts and proliferative-phase endometrium with no evidence of an inflammatory or malignant process. Serum tumor markers revealed elevated inhibin A, B, and estradiol. Severe hypothyroidism was diagnosed based on thyroid stimulating hormone of 1,890 mU/L and undetectable levels of T4 and T3.

Results: Gynecologic oncology consult found a distressed, afebrile, child with an acute surgical abdomen. Surgery consisted of bilateral ovarian cystectomies and biopsies. No evidence of an inflammatory or metastatic process was identified. Final pathology reported ovarian, low-malignant-potential (LMP), granulosa cell tumors. Molecular analysis was negative for the pathopnmeumonic FOXL2 mutations found in LMP granulosa cell tumors. Bone-age imaging identified an 18-month discrepancy (5 years, 6 months) less than the patient's age (7 years, 1 month). The patient's discrepant bone age, which should have shown an increase in age due to estrogen, was confirmed. Our search was for pediatric syndromes characterized by juvenile hypothyroidism, precocious puberty, granulosa cell tumors with delayed bone age. An exact match was identified, Van Wyk-Grumbach Syndrome (VW-GS). This syndrome was described in 1960 by Dr. Van Wyk and Dr. Grumbach and reported the discrepancies in bone age in this form of precocious puberty. Unfortunately, postoperative thyroid replacement was not started until the patient presented with recurrent uterine bleeding 7 weeks after discharge. Examination found recurrent 2-cm ovarian cysts with elevated inhibin and estradiol. Levothyroxine therapy resulted in complete resolution of ovarian cysts and tumor markers.

Conclusion: We report the diagnosis and management of a 7-year-old female with VW-GS. The syndrome distinguishes itself from other causes of precocious puberty by delayed bone age. Unfortunately, few reports were found in the gynecologic oncology literature. This case report describes this rare syndrome in the hope it can be recognized to prevent unnecessary surgical interventions.

329 - Poster Session
Survival impact of neoadjuvant and adjuvant chemotherapy cycles stratified by interval debulking surgical approach in advanced epithelial ovarian cancer
Y. Zhang, M.S. Grant, S.E. Paraghamian and L.H. Clark. University of North Carolina at Chapel Hill, Chapel Hill, NC, USA

Objective: Neoadjuvant chemotherapy (NACT) is a common treatment strategy for advanced epithelial ovarian cancer (EOC). We sought to assess the impact of both NACT and adjuvant chemotherapy (AC) on survival in EOC patients undergoing interval debulking surgery (IDS), comparing robotic and open approaches.

Method: EOC patients undergoing NACT followed by IDS from 2011 to 2018 at a single center were included in this retrospective cohort study. Clinical and pathologic factors were abstracted including number of cycles of chemotherapy and surgical approach. The primary endpoints were progression-free survival (PFS) and overall survival (OS). Cox proportional hazards regression models were used for multivariate survival analyses.

Results: A total of 85 patients were identified (n = 30 robotic IDS; n = 55 open IDS). Median age (64.4 years) did not differ between the 2 groups (P = 0.08). Ninety-one percent of patients were optimally cytoreduced (56% R0, 35% R1), and rate of R0 was not influenced by mode of surgery (55% open IDS vs 57% robotic IDS, P = 0.9). Mean follow-up time was longer in the open IDS group (32.0 vs 27.6 months, P = 0.2). Survival indices did not differ between patients undergoing open IDS and robotic IDS (PFS = 8.1 vs 11.0 months, P = 0.7; OS = 38.2 vs 30.3 months, P = 0.4). Cytoreduction to R0 improved both PFS and OS independent of surgical approach (Table 1). Subgroup analysis showed that receiving >6 total cycles of chemotherapy decreased both PFS and OS in patients undergoing robotic IDS but not open IDS. Separating by type of chemotherapy, NACT and AC cycles did not independently affect PFS or OS.

Conclusion: For advanced EOC patients undergoing IDS, use of minimally invasive surgery does not have an impact on rates of R0 resection in well-selected patients. Receiving >6 total cycles of chemotherapy was associated with a decrease in both PFS and OS in patients undergoing robotic IDS in this cohort and warrants further investigation.

Table 1.

<table>
<thead>
<tr>
<th>Cytoreduction</th>
<th>All (n=85)</th>
<th>R-IDS (n=30)</th>
<th>O-IDS (n=55)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PFS (95% CI)</td>
<td>PFS (95% CI)</td>
<td>PFS (95% CI)</td>
</tr>
<tr>
<td>Cytoreduction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>R1/R2</td>
<td>1.9 (1.1-3.2)</td>
<td>5.2 (1.8-15.5)</td>
<td>1.8 (1.0-3.5)</td>
</tr>
<tr>
<td>Total cycles</td>
<td>3.3 (1.7-6.4)</td>
<td>5.3 (1.6-17.5)</td>
<td>3.1 (1.4-7.2)</td>
</tr>
<tr>
<td>NAC cycles</td>
<td>&lt;=3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>------------</td>
<td>-----</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td></td>
<td>&gt;3</td>
<td>0.9 (0.5-1.4)</td>
<td>1.3 (0.7-2.4)</td>
</tr>
<tr>
<td>AC cycles</td>
<td>&lt;=3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>&gt;3</td>
<td>0.9 (0.5-2.0)</td>
<td>1.8 (0.8-3.8)</td>
</tr>
</tbody>
</table>

### 330 - Poster Session

Factors predicting hyperprogression in patients with advanced ovarian cancer receiving anti-programmed cell death 1-therapy

**J.Y. Choi, J.Y. Park, S.W. Lee, D.S. Suh, D.Y. Kim, J.H. Kim, Y.M. Kim and Y.T. Kim.** University of Ulsan College of Medicine, ASAN Medical Center, Seoul, South Korea

**Objective:** Hyperprogressive disease (HPD) is one of the unconventional responses to immunotherapy. It is associated with a rapid increase in tumor growth rate following immune checkpoint inhibitor (ICI) therapy. Targeted programmed cell death-1 (PD-1) inhibitors (e.g., pembrolizumab and nivolumab) have recently been approved for use in patients with advanced ovarian cancer. HPD has also been observed in this group of patients and is reportedly related to a worse outcome compared with the so-called "conventional" progression. Therefore, it is important to identify factors that predict HPD and select appropriate patients before starting ICI therapy.

**Method:** This single-center retrospective study is based on the medical records of 24 patients with advanced epithelial ovarian cancer who received single pembrolizumab or nivolumab therapy between September 2018 and July 2019. The definition of HPD used in this study is “≥2-fold increase in the tumor growth kinetics ratio during ICI treatment compared with the period prior to treatment onset.”

**Results:** Of the 24 patients, 4 (16.7%) were classified as exhibiting HPD. Moreover, HPD was significantly associated with hepatic metastasis in these 4 patients prior to PD-1 inhibitor therapy compared with that in patients without HPD (75%, 3/4, vs 10%, 2/20, \( P = 0.003 \)). At the initiation of the therapy, liver function test was normal in all patients, and no one experienced jaundice. However, the overall tumor burden, number of metastatic sites, and CA-125 level at therapy initiation were not significantly associated with HPD. In addition, age, Eastern Cooperative Oncology Group (ECOG) performance status, derived neutrophil to lymphocyte ratio (dNLR), baseline lactate dehydrogenase (LDH) level, number of prior lines of chemotherapy, tumor programmed death-ligand 1 (PD-L1) status, and platinum sensitivity showed no significant associations with HPD.

**Conclusion:** These results suggest that the presence of hepatic metastasis can be a predictor of hyperprogression. Further studies on a larger scale are required to elucidate the molecular mechanisms underlying HPD.

### 331 - Poster Session

The effect of intraperitoneal chemotherapy after interval cytoreductive surgery on recurrence and survival in patients with advanced-stage ovarian carcinoma


**Objective:** The aim of this study was to compare recurrence-free survival (RFS) and overall survival (OS) in patients with stage III–IV ovarian cancer who received intraperitoneal (IP) chemotherapy after neoadjuvant intravenous (IV) chemotherapy and interval cytoreductive surgery.

**Method:** An institutional ovarian cancer database was developed from January 2012 to August 2018. A subgroup of advanced-stage patients who received neoadjuvant chemotherapy followed by interval cytoreductive surgery were identified. Postoperative adjuvant chemotherapy regimens were either IV or IP platinum/taxane therapies. The dataset was analyzed for patient demographics, histology, stage, initial sites of disease, presence of ascites or pleural effusions, CA-125 levels, BRCA status, debulking status, and use of bevacizumab. Death record searches were used to confirm current survival status for all patients lost to follow-up prior to 12 months. RFS was defined as end of platinum therapy to first recurrence, and OS was defined as initiation of platinum therapy to death.

**Results:** A total of 143 patients with ovarian cancer underwent neoadjuvant chemotherapy: 93 had IV and 50 had IP adjuvant chemotherapy. Patients receiving IV only were older than the IP group (69.8 ± 10.7 vs 63.2 ± 9.9 years, \( P < 0.001 \)). There was no difference between groups by BMI, preoperative stage, histology type, BRCA status, debulking status, use of bevacizumab, or total chemotherapy cycles. Complete (R0) debulking was performed on 80.4% of patients, and 96.5% of patients had optimal debulking.
Conclusion: There was a nonstatistical trend toward improved RFS and OS for patients who underwent combination IP chemotherapy following neoadjuvant chemotherapy and interval cytoreductive surgery. These results are similar to improved outcomes with IP therapy reported in previous GOG clinical trials of optimally resected patients who underwent primary debulking surgery.

---

**332 - Poster Session**

**Transcriptomic analysis of hyperthermic intraperitoneal chemotherapy (HIPEC) in a cellular model of ovarian cancer**

M.P. Horowitza, E.L. Esakovb, C. Hongb, C.M. Michenerb, P.G. Rosea, T.H. Hwangb, R. DeBernardob and O. Reizesb. *aThe Cleveland Clinic Foundation, Cleveland, OH, USA, bCleveland Clinic, Cleveland, OH, USA*

**Objective:** The aim of this study was to use an unbiased approach to determine pathways regulated by hyperthermic intraperitoneal chemotherapy (HIPEC) in a cellular model of ovarian cancer, with the goal of discovering druggable pathways that could potentiate the survival benefit of HIPEC in patients with advanced ovarian cancer.

**Method:** We treated the human epithelial ovarian cancer cell line, CP70, with clinically relevant combinations of hyperthermia and cisplatin (42 degrees × 90 minutes) and performed RNA-sequencing at early (90-minute) and late (72-hour) time points to determine acute and chronic transcriptomic changes induced by hyperthermic cisplatin (**Figure 1A**). Integrated pathway analysis was then performed to determine cellular pathways that are activated/repressed by hyperthermic cisplatin.

**Results:** At 90 minutes, hyperthermic cisplatin significantly altered the following pathways most dramatically (GSEA, *P* < 0.05 for each pathway): chemotaxis, TGF-beta receptor signaling pathway, cellular response to hormone stimulus, TLR-3 signaling pathway, TRIF-dependent TLR signaling pathway, PERK-mediated unfolded protein response, positive regulation of apoptotic process, regulation of DNA-binding transcription factor activity, chemokine-mediated signaling pathway, base excision repair, and nucleotide excision repair (**Figure 1B**). Compared to pathways that were altered by hyperthermic vehicle or normothermic cisplatin controls, the pathways that were uniquely altered by hyperthermic cisplatin were the inflammatory, chemotaxis/chemokinesis, and DNA damage repair pathways. At 72 hours, the pathways that remained uniquely altered by hyperthermic cisplatin treatment were the inflammatory pathways (**Figure 1C**).

**Conclusion:** Inflammatory pathways are differentially regulated in an ovarian cancer cell line treated with hyperthermic cisplatin compared to controls. Despite a relatively brief exposure to hyperthermia (90 minutes), sustained changes in these inflammatory pathways are detected at much later time points (72 hours). These data suggest that inflammatory pathways play a role in the survival benefit of HIPEC in advanced ovarian cancer. Modulation of inflammatory pathways in combination with HIPEC may further improve survival in patients with advanced ovarian cancer.
Objective: The nonspecific beta-blocker propranolol is known to have survival benefit in ovarian cancer patients. The purpose of this study is to determine the adrenergic receptor stimulation effect on notch signaling system in epithelial ovarian cancer cells.

Method: Hela, SKOV-3, and NIH OVCA-3 cells and propranolol, isoproterenol, and dopamine were used for MTT assay and real time PCR. Propranolol, isoproterenol, and dopamine effects were analyzed in notch signaling of ovarian cancer cells.

Results: Propranolol and isoproterenol were suppressors of ovarian cancer cell proliferations. Notch signaling system actions were changed with these catecholamine actions. Dopamine inhibited ovarian cancer cell proliferation but not cervical cancer cell proliferation. Neuroblastoma cells showed dramatic inhibition by propranolol. See Figure 1.

Conclusion: The catecholamines were more active in ovarian cancer cells than in cervical cancer cells. Catecholamine effect on ovarian cancer cells is related to activating notch signaling system. Ovarian cancer cells could be similar in response with neural cancer cells. The regulation of catecholamine could be helpful in treating ovarian cancer patients in the future.
Objective: Better strategies are needed to stratify patients with epithelial ovarian cancer (EOC) to select treatment regimens most likely to be effective. Here we present a robust strategy to holistically assess broad spectrum DNA damage and repair (DDR) defects in EOC termed repair assisted damage detection (RADD). RADD measures the DNA damage left behind by defective repair machinery to characterize DNA repair defects to predict treatment response for EOC.

Method: In RADD, a DNA repair enzyme cocktail is applied to detect and excise damage, and a modified nucleotide is inserted to tag damage site, allowing quantification (Figure 1). RADD measured DNA damage in 3 EOC cell lines: OVCAR8, OV90, and SKOV3, before and after treatment with platinum and paclitaxel. FFPE tissue from EOC patients both pre- and post-neoadjuvant chemotherapy (NACT) were assessed via RADD. Disease outcome data were collected. An ordinal scoring system was developed to stratify patients by basal level of DDR defects pretreatment. Changes in RADD assessed DNA damage post-treatment, and relevant disease outcomes were then analyzed to determine whether RADD-based assessment could predict response to chemotherapy.

Results: Significant differences in basal DDR damage were detected in EOC cell lines by RADD and increasing damage levels trend with altered therapeutic efficacy. Basal RADD intensity was measured for pre- and post-treatment patient samples. The DNA damage levels were observed: low, moderate, and high. Changes in DNA damage levels occurred after NACT. Interestingly, the patients with the lowest RADD signal and smallest reduction in damage levels after treatment also showed the shortest PFS.

Conclusions: This pilot study shows differences in DDR can be measured with RADD in EOC cell lines and patient samples. Our results suggest that stratification by DNA damage can predict response to treatment and reflect DNA repair capacity. RADD’s direct measurement of DNA repair loss represents a potential method to better “fit” patients to treatments that exploit their individual DNA repair defects.
A novel NSAID derivative, MCI-030 in the chemoprevention of ovarian cancer in hens
L. Madeira da Silva, G.A. Piazza and J.M. Scalici. Mitchell Cancer Institute, University of South Alabama, Mobile, AL, USA

Objective: Utilization of the hen model of epithelial ovarian cancer (EOC) preserves genetic, hormonal, immune, and inflammatory integrity and provides a robust efficacy assessment in regard to preventive strategies. We have previously shown that Sulindac derivative MCI-030 is a potent, less toxic alternative to traditional NSAIDs for chemoprevention in EOC via its inhibition of PDE10. Here we report an interim assessment of its efficacy as a chemoprevention agent.

Method: One-hundred fifty 2.5- to 3-year-old white leghorn hens were divided into 3 groups: MCI-030, Sulindac, and control. Treatment was administered in the feed, and hens were fed ad libitum under the supervision of the veterinary team. Hens were monitored for toxicity and clinical evidence of disease. Moribund or ill-appearing hens were sacrificed and underwent necropsy. After 6 months of treatment, a total of 60 hens underwent necropsy and were formally assessed for evidence of tumor. Cancer incidence and ovulatory abnormality were analyzed by a 1-way ANOVA with Bonferroni Multiple Comparison Test.

Results: Cancer incidence in the control group was 25%, with Sulindac and MCI-030 showing a 20% and 15% incidence, respectively. At necropsy, in addition to fewer hens with malignancies, the MCI-030 group displayed fewer sequelae of aberrant ovulation (10%) than the control (25%) and Sulindac (25%) groups. When analyzed as a continuum from normal, to aberrant ovulation, to cancer among the 3 treatment groups, there was significant difference in incidence ($P = 0.0183$). This difference did not hold based on cancer incidence or between individual treatment groups and control. See Figure 1.

Conclusion: Preliminary evaluation of cancer incidence at 6 months of treatment suggests the possibility that MCI-030 may reduce the incidence of ovarian cancer in the hen model. We have successfully shown that the toxicity of this agent is minimal and now have preliminary clinical evidence of a treatment effect. Work is underway to evaluate the impact of PDE10 inhibition involved in this effect, although there is evidence of PDE10 pathway alteration.
336 - Poster Session
Racial disparities in surgical outcomes of patients undergoing debulking surgery for ovarian cancer
J.N. Staples and K. Ring, University of Virginia, Charlottesville, VA, USA

Objective: While racial disparities in ovarian cancer survival have been well documented, disparities in short-term outcomes are less studied. We aimed to identify racial differences in perioperative morbidity among white and black women following debulking surgery for ovarian cancer.

Method: Using data from the American College of Surgeons National Surgical Quality Improvement Program (NSQIP), we performed a retrospective cohort study including women who underwent open debulking surgery for ovarian cancer in 2016 and 2017. Clinicopathologic factors were abstracted, including preoperative patient characteristics, rates of perioperative complications, reoperation, readmission, and 30-day mortality. Perioperative complications were classified as mild/moderate or serious. Multivariate logistic regression modeling was performed to evaluate associations between race and outcomes.

Results: A total of 3,474 white women and 468 black women who underwent debulking surgery for ovarian cancer were identified. Black women were 5 years younger on average (55 years vs 60 years, \( P < 0.0001 \)) with higher rates of diabetes (17% vs 12%, \( P = 0.0040 \)) and hypertension (55% vs 39%, \( P < 0.0001 \)). Furthermore, black women were more likely to have poor nutrition (albumin <3.5 g/dL, 48% vs 37%, \( P < 0.0001 \)), anemia (hematocrit <30%, 22% vs 13%, \( P < 0.0001 \)), and renal disease (creatinine >1.2, 10% vs 5%, \( P < 0.0001 \)). The overall rate of any postoperative morbidity was 33% among both black and white women. Despite black women having higher rates of a preoperative transfusion requirement (5% vs 1%, \( P < 0.0001 \)), there was no difference in rates of postoperative transfusion (26% for black women vs 24% for white women, \( P = 0.26 \)). Furthermore, there was no difference in rates of infection, deep vein thrombosis, or pulmonary embolism between the 2 groups. Readmission, reoperation, and 30-day mortality were also similar.

Conclusion: Despite less favorable preoperative characteristics, black women have similar rates of perioperative complications. While there is seemingly no difference in short-term outcomes between races, further research is necessary to better understand the disparities that exist in long-term outcomes.

337 - Poster Session
Predicting chemosensitivity in epithelial ovarian cancer using patient derived tissue organoids
J.W. Gorski\textsuperscript{a}, J.R. McCorlde\textsuperscript{a}, J. DeJohn\textsuperscript{b}, B.T. Burgess\textsuperscript{a}, A.B. McDowell Jr.\textsuperscript{a}, M.B. Rigg\textsuperscript{a}, R.W. Miller\textsuperscript{a}, C.S. Dietrich III\textsuperscript{a}, L.A. Baldwin\textsuperscript{a}, C.P. Desimone\textsuperscript{a}, H.H. Gallion\textsuperscript{a}, F.R. Ueland\textsuperscript{a} and J. Kolesar\textsuperscript{b}. \textsuperscript{a}University of Kentucky Medical Center, Lexington, KY, USA, \textsuperscript{b}University of Kentucky College of Medicine, Lexington, KY, USA

Objective: The aims of this study were to develop patient-derived tissue organoids from epithelial ovarian cancer tissue obtained at the time of debulking surgery; to perform chemosensitivity profiling with standard-of-care agents and correlate to clinical outcome; and to determine the integrated genetic homology of tumor organoids with associated primary tumor tissue.

Method: Tumor tissue was obtained from patients at the time of debulking surgery, dissociated, and established in vitro using factor-defined media. Representative micrographs were H&E stained and compared with primary tumor. Eleven anticancer compounds were tested as monotherapy, as well as a 4:1 carboplatin/paclitaxel combination. Cytotoxicity was measured using high content imaging for Caspase 3/7 fluorometry as well as cellular viability via MTS assay. EC\textsubscript{50} results of each tested agent were compared against each patient’s response to chemotherapy. Molecular profiling was accomplished using a next-generation sequencing (NGS) panel and whole
transcriptome RNA-seq. Mutational concordance was performed by comparison of sequencing results between the primary tumor specimen and the resultant tumor organoids.

**Results:** So far, 11 patient-derived tissue organoids cell lines have been established, and 6 have been fully characterized. Three samples demonstrate inherent sensitivity to carboplatin, and 3 samples demonstrate resistance (Table 1). Ninety-eight percent of called somatic variants and 96% of total variants (all somatic, germline, and VUS) identified in the primary tumor are also present in the tissue organoid sequence. Five more samples are currently proliferating and will soon achieve biomass necessary for full characterization.

**Conclusion:** Ovarian epithelial tissue organoids can be successfully established from patients at the time of debulking surgery in the chemo-naive and neoadjuvant settings. Tissue organoids demonstrate a high degree of genetic homology to primary tumor tissue. Interestingly, altered variant allelic fractions in some canonical pathogenic genes, such as TP53, are indicative of potential clonal selection events. Chemosensitivity profiles appear to recapitulate clinical response, but correlation with advanced-stage patients is ongoing.

**Table 1. Selection of sensitivity profiles of TOs to standard-of-care chemotherapeutic agents.**

<table>
<thead>
<tr>
<th>ID #</th>
<th>TNM Stage</th>
<th>Age</th>
<th>Histology &amp; Specimen Site</th>
<th>Treatment Course</th>
<th>Drug Sensitivity Profile (MTS EC50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>UK1226</td>
<td>pT3aN0M1</td>
<td>57</td>
<td>Ovarian low grade serous carcinoma w/ marked psammoma bodies</td>
<td>• 5/2019: Optimal debulking (R0cm) • 6/2019: Adjuvant carboplatin/paclitaxel</td>
<td>Carb: 120.3uM [R] Pac: 60/29nM [R] C/P: 21/5uM [S] Gem: 42.5nM [R] Topo: 259.9nM [R]</td>
</tr>
<tr>
<td>UK1254</td>
<td>ypT3cNx</td>
<td>49</td>
<td>Ovarian, residual high grade serous (CRS1)</td>
<td>• 5/2019: Neoadjuvant carboplatin/paclitaxel x3 • 7/2019: Interval debulking (R&lt;1cm) • 8/2019: Adjuvant carboplatin/paclitaxel/bevacizumab</td>
<td>Carb: 50.2uM [R] Pac: 0.22nM [S] C/P: 11.76uM [S] Gem: 23.84nM [S] Topo: 149.7nM [S]</td>
</tr>
<tr>
<td>UK1393</td>
<td>T3cNX</td>
<td>46</td>
<td>Ovarian high grade serous, omentum metastasis</td>
<td>• 12/2018: Optimal debulking (R0cm); adjuvant carboplatin/paclitaxel/bevacizumab</td>
<td>Carb: 0.12nM [S] Pac: 10.6nM [S] C/P: 0.138uM [S] Gem: 23.92nM [R] Topo: 366nM [R]</td>
</tr>
<tr>
<td>UK2238</td>
<td>T1c2pN0</td>
<td>48</td>
<td>Ovarian, mixed borderline (80% serous, 15% mucinous, 5% Brenner)</td>
<td>• 8/2019: Optimal debulking (R0cm)</td>
<td>Carb: 3.319uM [S] Pac: 0.18nM [S] C/P: 0.52uM [S] Gem: 0.68nM [S] Topo: 122.9nM [S]</td>
</tr>
</tbody>
</table>

Key: Carb = carboplatin, Pac = paclitaxel, C/P = carboplatin/paclitaxel, Gem = gemcitabine, Topo = topotecan. [S] = sensitive, [R] = resistant.

338 - Poster Session
Assessing the impact of cardiometabolic risk on ovarian cancer survival among African-American women in the African-American cancer epidemiology study (AACES)

[N. Staples, L.C. Peres, F. Camacho, A.J. Alberg, E. Bandera, J. Barnholtz-Sloan, M.L. Bondy, M.L. Cote, E. Funkhouser, P.G. Moorman, E.S. Peters, A.G. Schwartz, P.D. Terry, J.M. Schildkraut. University of Virginia, Charlottesville, VA, USA, Moffitt Cancer Center-University of South Florida, Tampa, FL, USA, Medical University of South Carolina, Charleston, SC, USA, UMDNJ-The Cancer Institute of New Jersey, New Brunswick, NJ, USA, Case Western Reserve - MacDonald Women’s Hospital, Cleveland, OH, USA, Baylor College of Medicine, Houston, TX, USA, Karmanos Cancer Institute, Detroit, MI, USA, University of Alabama at Birmingham, Birmingham, AL, USA, Duke University School of Medicine, Durham, NC, USA, Woman’s Hospital, LSU Health Sciences Center, Baton Rouge, LA, USA, Wayne State University, Detroit, MI, USA, University of Tennessee Health Science Center, Memphis, TN, USA]
**Objective:** African-American women with epithelial ovarian cancer (EOC) demonstrate poorer survival compared to other racial/ethnic groups. The reasons for these differences are unclear. Few studies have examined the association of cardiovascular diseases with ovarian cancer survival, and these have yielded inconsistent results. Race-specific effects of this relationship have not been adequately addressed. Here, we estimate the effect of cardiovascular comorbid conditions on survival among African-American women with EOC.

**Method:** Data were available from 593 women with ovarian carcinoma enrolled in the African-American Cancer Epidemiology Study (AACES). The median follow-up time was 62 months. Past medical history of hypertension, hyperlipidemia, and diabetes, including medication use, was based on self-report. We used unadjusted Kaplan-Meier survival curves and log rank tests to evaluate survival patterns for patients with and without each condition. Cox proportional hazards models were used to evaluate the association between each condition and its associated medication use and overall survival (OS) while adjusting for other covariates.

**Results:** Among this study population, the prevalence of hypertension, hyperlipidemia, and diabetes is 65%, 33%, and 22%, respectively. High-grade serous carcinoma was the most common histology (66%), and the majority of patients had stage III or IV disease (62%). Log rank tests revealed decreased OS for women with hypertension \((P = 0.03)\) and diabetes \((P = 0.001)\); however, there was no difference in survival by history of hyperlipidemia. No difference in OS was observed with beta-blocker, diuretic, statin, insulin, or metformin use. After adjustment for confounding in multivariate models, no significant association was observed with any condition or use of its associated medications.

**Conclusion:** A history of cardiovascular conditions and medication use did not appear to have an impact on outcomes in this population of African-American women; however, prevention and careful early management of these comorbidity conditions may have an impact on survival indirectly by decreasing competing risks and allowing improved tolerability of treatment. In addition, given the relatively short period of follow-up, the impact of comorbidity conditions and associated treatments on survival may be detectable with longer follow-up.

---

**339 - Poster Session**

**Genomic analysis of high-grade serous ovarian cancer in young and older women**


**Objective:** The median age of diagnosis for high-grade serous ovarian cancer (HGSOC) is 63 years, but HGSOC affects women of all ages. As a group, HGSOCs are characterized by recurrent *TP53*, *BRCA1*, and *BRCA2* mutations and alterations in homologous recombination (HR) DNA repair. We sought to determine whether the mutational landscapes and genomic features of HR are distinct between older and younger HGSOC patients.

**Method:** Mutation and clinical data of HGSOCs from The Cancer Genome Atlas (TCGA) were obtained from cBioPortal. Women were stratified by age quartiles, with “young” women as those in the bottom quartile and “older” as those in the top quartile. Mutational signatures were defined using deconstructSigs. Genomic features of HR deficiency, including *BRCA1* and *BRCA2* mutation status, were obtained from our previously published pan-TCGA analysis.

**Results:** The young cohort included 75 women diagnosed between 34 to 51 years, and the older cohort included 75 women diagnosed at 68 to 89 years. The number of somatic mutations did not differ between young and older HGSOC patients (median 101, range 27–473, vs 109, range 24–2,926, respectively; \(P = 0.305\)). *BRCA1* germline mutations were significantly more prevalent in young patients \((13 vs 3, P = 0.0084)\); however, no difference in the prevalence of *BRCA2* mutations was found \((11 vs 6, P = 0.2086)\). Consistent with these findings, genomic features of HR deficiency were significantly less frequent in older HGSOC patients: a dominant mutational signature 3, associated with HR deficiency, was found in 65% of young versus 48% of older patients \((P = 0.033)\), whereas a dominant aging-associated mutational signature 1 was more common in the older cohort \((32% vs 11%, P = 0.003)\). Large-scale state transition scores were lower in older than in younger HGSOCs \((median 22, range 5–42, vs 29, range 2–48, P = 0.007)\), and small insertions/deletions with microhomology were also less common in older than in younger HGSOC patients \((median 1.5, range 0–16, vs 3, range 0–14, P = 0.00117)\).

**Conclusion:** HGSOC patients diagnosed at older age less frequently harbor *BRCA1* germline mutations and display fewer genomics features of HR deficiency than younger patients. Individualized HR directed treatment options for older women may be required.

---

**340 - Poster Session**

**Ovarian tumor associated hydroxyapatite: A potential biomarker for predicting treatment outcome**

M.N. Tantawy, B.A. Crispens, A. Beeghly-Fadiel, F. Yull, J.C. Watkins, J.O. McIntyre, R.D. Alvarez, J.C. Gore and A.J. Wilson. *Vanderbilt University Medical Center, Nashville, TN, USA, bVanderbilt University, Nashville, TN, USA, cThe Vanderbilt-Ingram Cancer Center, Nashville, TN, USA*

**Objective:** Germline mutations associated with HR deficiency, was found in 65% of young versus 48% of older patients \((P = 0.033)\), whereas a dominant aging-associated mutational signature 1 was more common in the older cohort \((32% vs 11%, P = 0.003)\). Large-scale state transition scores were lower in older than in younger HGSOCs \((median 22, range 5–42, vs 29, range 2–48, P = 0.007)\), and small insertions/deletions with microhomology were also less common in older than in younger HGSOC patients \((median 1.5, range 0–16, vs 3, range 0–14, P = 0.00117)\).

**Conclusion:** A history of cardiovascular conditions and medication use did not appear to have an impact on outcomes in this population of African-American women; however, prevention and careful early management of these comorbidity conditions may have an impact on survival indirectly by decreasing competing risks and allowing improved tolerability of treatment. In addition, given the relatively short period of follow-up, the impact of comorbidity conditions and associated treatments on survival may be detectable with longer follow-up.

---

**339 - Poster Session**

**Genomic analysis of high-grade serous ovarian cancer in young and older women**


**Objective:** The median age of diagnosis for high-grade serous ovarian cancer (HGSOC) is 63 years, but HGSOC affects women of all ages. As a group, HGSOCs are characterized by recurrent *TP53*, *BRCA1*, and *BRCA2* mutations and alterations in homologous recombination (HR) DNA repair. We sought to determine whether the mutational landscapes and genomic features of HR are distinct between older and younger HGSOC patients.

**Method:** Mutation and clinical data of HGSOCs from The Cancer Genome Atlas (TCGA) were obtained from cBioPortal. Women were stratified by age quartiles, with “young” women as those in the bottom quartile and “older” as those in the top quartile. Mutational signatures were defined using deconstructSigs. Genomic features of HR deficiency, including *BRCA1* and *BRCA2* mutation status, were obtained from our previously published pan-TCGA analysis.

**Results:** The young cohort included 75 women diagnosed between 34 to 51 years, and the older cohort included 75 women diagnosed at 68 to 89 years. The number of somatic mutations did not differ between young and older HGSOC patients (median 101, range 27–473, vs 109, range 24–2,926, respectively; \(P = 0.305\)). *BRCA1* germline mutations were significantly more prevalent in young patients \((13 vs 3, P = 0.0084)\); however, no difference in the prevalence of *BRCA2* mutations was found \((11 vs 6, P = 0.2086)\). Consistent with these findings, genomic features of HR deficiency were significantly less frequent in older HGSOC patients: a dominant mutational signature 3, associated with HR deficiency, was found in 65% of young versus 48% of older patients \((P = 0.033)\), whereas a dominant aging-associated mutational signature 1 was more common in the older cohort \((32% vs 11%, P = 0.003)\). Large-scale state transition scores were lower in older than in younger HGSOCs \((median 22, range 5–42, vs 29, range 2–48, P = 0.007)\), and small insertions/deletions with microhomology were also less common in older than in younger HGSOC patients \((median 1.5, range 0–16, vs 3, range 0–14, P = 0.00117)\).

**Conclusion:** HGSOC patients diagnosed at older age less frequently harbor *BRCA1* germline mutations and display fewer genomics features of HR deficiency than younger patients. Individualized HR directed treatment options for older women may be required.
**Objectives:** The treatment of ovarian cancer may require surgery and/or chemotherapy. However, ovarian cancer lacks the availability of biomarkers and tools that can help predict which patients may benefit from neoadjuvant chemotherapy first versus surgery, identify sites of disease, inform treatment interventions, and determine the effectiveness of treatment. Hydroxyapatite (HAP), Ca_{10}(PO_4)_6OH_2, has been shown to be directly produced by some types of malignancies via a classical mechanism. We have shown that HAP-binding targeting radiotracers, such as FDA-approved ^{18}F-labeled sodium fluoride (^{18}F-NaF), used with positron emission tomography (PET) imaging detect breast tumors. In this work, we aimed at investigating whether HAP is present in the extracellular matrix of patients with ovarian cancer and whether ^{18}F-NaF PET can reliably detect peritoneal tumors in mouse models.

**Method:** We evaluated 26 clinically annotated epithelial ovarian cancer cases originally diagnosed as high-grade serous/papillary ovarian cancer (HGSOC). The samples were stained with alizarin red S for calcium and von Kossa for calcium phosphates, and underwent Raman spectroscopy for calcium phosphate hydroxyapatite. Furthermore, we imaged synergic mouse models of ovarian cancer bearing ID8 peritoneal tumors with ^{18}F-NaF PET.

**Results:** Among the 26 clinical samples investigated, we discovered that 10 cases scored positive for extracellular HAP and 16 were negative (see Figure 1). Only 4 of the HAP-positive cases demonstrated resistance to chemotherapy, while 11 of the 16 HAP-negative cases were resistant to treatment. In addition, we were able to clearly identify peritoneal tumors in the mice studied with high specificity and signal-to-background ratio as HAP is generally absent in normal soft tissue.

**Conclusion:** This is the first discovery of tumor extracellular HAP in ovarian cancer. There is an indication within this small cohort of patients studied that ovarian tumors with extracellular HAP could have increased benefit from chemotherapy. Because of the heterogeneity of the tumors and the tumor extracellular HAP distribution, in vivo imaging can potentially be used to test ovarian cancer patients for extracellular HAP more efficiently than needle biopsies. More clinical samples will be investigated.

**Fig. 1.** Histological assessment of TMA. (A.1) A sample from a patient with HGSOC stained with alizarin red S (for calcium) and (A.1) von Kossa (for phosphates). Dark spots indicate positive stains. (A.3) A Raman shift at ~960 cm\(^{-1}\) characteristic of hydroxyapatite, was clearly detected despite silica interference from a glass slide (a large peak between 990 and 1040 cm\(^{-1}\)). Taken together, this indicates the presence of extracellular HAP. (B.1) A sample from a patient with HGSOC but scored negative for alizarin red S and (B.2) von Kossa. (B.3) No Raman shift was detected at ~960 cm\(^{-1}\) indicating absence of extracellular HAP.

341 - Poster Session
Efficacy and safety of oral poly (ADP-ribose) polymerase inhibitor fluzoparib in patients with BRCA1/2 mutations and recurrent ovarian cancer
N. Li\(^{a}\), H. Bu\(^{b}\), J. Liu\(^{c}\), J. Zhu\(^{d}\), Q. Zhou\(^{e}\), L. Wang\(^{f}\), R. Yin\(^{g}\), X. Wu\(^{h}\), S. Yao\(^{i}\), K. Gu\(^{j}\), H. Zhang\(^{k}\), G. Li\(^{l}\), H. Pan\(^{m}\), Q. Wu\(^{n}\), R. An\(^{o}\), X. Yang\(^{p}\), Y. Zhu\(^{q}\), X. Wan\(^{r}\), W. Duan\(^{s}\), J. Xiong\(^{t}\), Y. Wang\(^{u}\), Q. Wang\(^{v}\), J. Zou\(^{w}\) and L. Wu\(^{x}\). \(^{a}\)National Cancer Center/National Clinical Research Center for Cancer/Cancer Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, China, \(^{b}\)Qilu Hospital, Shandong University, Jinan, China, \(^{c}\)Sun Yat-sen University Cancer Center, Guangzhou, China, \(^{d}\)Zhejiang Cancer Hospital, Zhejiang, China, \(^{e}\)Chongqing University Cancer Hospital, Chongqing Cancer Institute and Chongqing Cancer Hospital, Chongqing, China, \(^{f}\)Cancer Hospital of Hefei Medical University, Hefei, China, \(^{g}\)The First Affiliated Hospital of Anhui Medical University, Hefei, China, \(^{h}\)The Fourth Hospital of Hebei Medical University, Shijiazhuang, China, \(^{i}\)Union Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China, \(^{j}\)Zhejiang University School of Medicine Sir Run Run Shaw
Objective: Fluzoparib is a potent orally administered poly(ADP-ribose) polymerase (PARP) inhibitor. The safety and tolerability of fluzoparib has been evaluated in a phase 1 trial (NCT02575651). In this study, we aim to characterize the efficacy and safety of fluzoparib in patients with germline BRCA1 or BRCA2 mutations and recurrent ovarian cancer who had received ≥2 prior lines of chemotherapy.

Method: This was an open-label, multicenter, phase 2 study of oral fluzoparib in Chinese patients with recurrent ovarian cancer. Adult patients (≥18 years) with germline BRCA1 or BRCA2 mutations and platinum-sensitive recurrent high-grade serous (grade 2 or 3) epithelial ovarian, fallopian tube, or primary peritoneal cancer who had been treated with 2 or more previous platinum-based chemotherapy regimens were enrolled. Patients were treated with fluzoparib capsule at 150 mg orally twice daily up to disease progression or intolerable toxicity. The primary endpoint was objective response rate (ORR) per Response Evaluation Criteria in Solid Tumors (RECIST) v1.1.

Results: From April 4, 2018, to March 21, 2019, 113 patients at 26 sites were enrolled. All patients were with gBRCA1 or BRCA2 mutations, 72.6% with partially platinum-sensitive disease, and 3.5% with platinum-resistant disease. At the data cutoff date (July 15, 2019), median study follow-up was 8.3 months. The IRC-assessed ORR and disease control rate (DCR) were 69.0% (78/113) and 94.7% (107/113), respectively. Median duration of response was 10.1 months (95% CI 7.23–NC). Serious treatment-related adverse events occurred in 19 (24.8%) patients. The most common treatment-related adverse events were nausea (62.8%), fatigue (55.8%), decreased anemia or hemoglobin (55.8%), decreased white blood cell count (54.9%), thrombocytopenia (38.1%), decreased neutrophil count (37.2%), and decreased appetite (31.9%). The most common (≥5%) grade ≥3 treatment-related adverse events were decreased anemia/hemoglobin (28.3%), thrombocytopenia (10.6%), decreased white blood cell count (8.8%), decreased neutrophil count (6.2%), and decreased lymphocyte cell count (5.3%). No patients discontinued study treatment because of treatment-related adverse events. See Figure 1.

Conclusion: Fluzoparib had demonstrated promising antitumor activity and an acceptable safety profile in patients with recurrent BRCA1- or BRCA2-mutated ovarian cancer.

Fig. 1. Best percentage change in sum of diameters of target lesions from baseline (A), and time to response and duration of response.
Method: We utilized a gene set-based analysis to delve into the immunofunctionomes of OCCC in the early and advanced stages by integrating quantified biological functions defined by 1,454 gene ontology terms and 674 reactome pathway gene sets downloaded from the Gene Expression Omnibus database. There were 85 OCCCs and 136 normal ovarian tissue controls with DNA microarray gene expression profiles converted to the functionome, and we extracted the relevant offspring to sort out and rebuild the immunofunctionomes for OCCC at different staging groups by machine learning.

Results: The final results showed that several deregulated pathogenic functions coexist in the immunopathogenesis of the early and advanced stages of OCCC, and the complement-related activation pathway was inferred to be the lead dysfunctional immunological pathway for pathogenesis that assisted in carcinogenesis among all stages of OCCC. We also found 7 immunological genes involved in a complement system that had a significant influence on survival of OCCC.

Conclusion: These findings can contribute to further immunotherapy for OCCC in the future.
Objective: The aim of this study was to report the characteristics and outcomes of patients presenting ovarian metastases from breast cancer.

Method: This is a retrospective study reviewing the characteristics of ovarian metastases from breast cancer diagnosed in 20 years (from 1997 to 2017) at Hôtel-Dieu de France University hospital, a tertiary care center in Beirut, Lebanon.

Results: We reviewed the data of 1,137 patients with ovarian tumors. Ovarian metastases from breast cancer were found in 13 patients. Mean age was 59 years; 46% of patients received CT-scan, and only in 15% of cases was a PET-CT scan performed. The mean interval time between the primary diagnosis of breast cancer and the occurrence of ovarian metastasis was 52 months. The most common histologic type found was invasive lobular carcinoma (60% of patients). Extraovarian metastases were found in 69% of patients (9 out 13 patients). The extraovarian metastases concerned the following organs: uterus (3 patients), bone marrow (5 patients), liver (5 patients), lungs (3 patients), brain (3 patients), stomach (1 patient), and adrenal gland (2 patient). All patients were treated surgically and received adjuvant chemotherapy. Cytoreductive surgery was performed in 5 patients. A unilateral or bilateral adnexitomy was done in 1 and 7 patients, respectively. Mean survival was 60 months. Recurrence was noted in 46% of patients (6 out 13 patients). Mean time to recurrence was 38 months.

Conclusion: Ovarian metastases from breast cancer occur rarely and are associated with worse prognosis. Despite surgical and adjuvant therapy, the recurrence rate is very high.

Cervical

345 - Poster Session
GOG 3016/ENGOT-cx9: An open-label, multi-national, randomized, phase III trial of cemiplimab, an anti-programmed death (PD)-1, versus investigator's choice (IC) chemotherapy in ≥2 line recurrent or metastatic cervical cancer
who received postoperative systemic chemotherapy, the presence of malignant cells was not associated with OS (HR = 1.21, 95% CI

with decreased OS among those who received concurrent chemoradiotherapy (HR = 1.84, 95% CI 1.04–3.24). However, among women

367 patients have been randomized from 59 sites in 10 countries.

Results:

(Systematic review was added for further analysis. Propensity score inverse probability of treatment weighting was used to assess the impact of malignant peritoneal cytology on survival. Among 1,409 analyzed cases, 88 (6.2%, 95% CI 5.0–7.5) had malignant cells in the peritoneal cytology testing, whereas 1,321 (93.8%) did not. On multivariate analysis, adenocarcinoma (OR = 6.18, 95% CI 3.49–0.9), adenosquamous carcinoma (OR = 2.57, 95% CI 1.08–6.13), pelvic lymph node metastasis (OR = 6.51, 95% CI 3.43–12.3), parametrial involvement (OR = 1.87, 95% CI 1.07–3.27), uterine corpus invasion (OR = 2.74, 95% CI 1.61–4.67), and ovarian metastasis (OR = 5.72, 95% CI 2.34–14.0) remained independent factors associated with malignant peritoneal cytology. On weighted models, the presence of malignant cells on peritoneal cytology was associated with decreased disease-free survival (HR = 1.78, 95% CI 1.36–2.32) and overall survival (OS = 1.93, 95% CI 1.44–2.59). On sensitivity analyses, the presence of malignant cells was associated with decreased OS in adenocarcinoma/adenosquamous carcinoma (HR = 3.28, 95% CI 2.18–4.94) and high-risk group (HR = 1.51, 95% CI 1.12–2.03). Malignant peritoneal cytology was also associated with decreased OS among those who received concurrent chemoradiotherapy (HR = 1.84, 95% CI 1.04–3.24). However, among women who received postoperative systemic chemotherapy, the presence of malignant cells was not associated with OS (HR = 1.21, 95% CI

Objective: Options are limited for patients with recurrent or metastatic cervical carcinoma after progression on standard first-line platinum-taxane based chemotherapy with or without bevacizumab. Cemiplimab is a high-affinity, human, hinge-stabilized immunoglobulin G4 monoclonal anti–PD-1 that has shown antitumor activity and durable responses in patients with advanced cutaneous squamous cell carcinoma (CSCC) in phase 1 expansion cohorts (NCT02383212) and a phase 2 study (NCT02760498). Cemiplimab-rwlc is approved by the FDA for treatment of patients with metastatic or locally advanced CSCC who are not candidates for curative surgery/radiation. Cemiplimab is also approved by the EMA for the aforementioned indication.

Method: GOG 3016/ENGOT-cx9 (NCT03257267) is an open-label, randomized (1:1), phase 3 trial of cemiplimab versus investigator choice chemotherapy in women ≥18 years with cervical cancer who have progressed following the last dose of first-line platinum-containing therapy. For up to 96 weeks, patients will receive cemiplimab 350 mg every 3 weeks (Q3W) or chemotherapy (pemetrexed 500 mg/m² Q3W; topotecan 1 mg/m² daily × 5 days, Q3W; irinotecan 100 mg/m² days 1, 8, 15, and 22, followed by 10–14 days' rest, for a 42-day (6-week) cycle; gemcitabine 1,000 mg/m² days 1 and 8, Q3W; or vinorelbine 30 mg/m² days 1 and 8, Q3W). The primary objective is to compare overall survival in patients treated with either cemiplimab or investigator choice chemotherapy. Secondary objectives are to compare progression-free survival, objective response rate, duration of response, safety profiles, and quality of life. The total study duration will be approximately 44 months (33 months of accrual and 11 months follow-up). Approximately 534 patients in the overall population will be enrolled, including 436 patients with SCC histology, at approximately 100 sites globally. Data will be monitored by an independent data-monitoring committee during the study. This study is currently recruiting. As of September 2019, 367 patients have been randomized from 59 sites in 10 countries.

Results: n/a

Conclusion: n/a

Objective: The aim of this study was to examine the association between peritoneal cytology results and survival of women with early-stage cervical cancer.

Method: This is a nationwide multicenter retrospective study examining consecutive women with clinical stage IB1–IIB cervical cancer who underwent radical hysterectomy and pelvic lymphadenectomy with peritoneal cytology results available from 2004 to 2008. Propensity score inverse probability of treatment weighting was used to assess the impact of malignant peritoneal cytology on survival. Systematic review was added for further analysis.

Results: Among 1,409 analyzed cases, 88 (6.2%, 95% CI 5.0–7.5) had malignant cells in the peritoneal cytology testing, whereas 1,321 (93.8%) did not. On multivariate analysis, adenocarcinoma (OR = 6.18, 95% CI 3.49–0.9), adenosquamous carcinoma (OR = 2.57, 95% CI 1.08–6.13), pelvic lymph node metastasis (OR = 6.51, 95% CI 3.43–12.3), parametrial involvement (OR = 1.87, 95% CI 1.07–3.27), uterine corpus invasion (OR = 2.74, 95% CI 1.61–4.67), and ovarian metastasis (OR = 5.72, 95% CI 2.34–14.0) remained independent factors associated with malignant peritoneal cytology. On weighted models, the presence of malignant cells on peritoneal cytology was associated with decreased disease-free survival (HR = 1.78, 95% CI 1.36–2.32) and overall survival (OS = 1.93, 95% CI 1.44–2.59). On sensitivity analyses, the presence of malignant cells was associated with decreased OS in adenocarcinoma/adenosquamous carcinoma (HR = 3.28, 95% CI 2.18–4.94) and high-risk group (HR = 1.51, 95% CI 1.12–2.03). Malignant peritoneal cytology was also associated with decreased OS among those who received concurrent chemoradiotherapy (HR = 1.84, 95% CI 1.04–3.24). However, among women who received postoperative systemic chemotherapy, the presence of malignant cells was not associated with OS (HR = 1.21, 95% CI

346 - Poster Session

Significance of malignant peritoneal cytology on survival of women with early-stage cervical cancer

Y. Nagase1, K. Matsuo3, M. Shimada1, S. Matsuzaai, H. Machida4, T. Saito3, S. Kamiura3, T. Iwata1, T. Sugiymaa and M. Mikami4. 1Osaka University, Osaka, Japan, 2University of Southern California, Los Angeles, CA, USA, 3Tohoku University School of Medicine, Miyagi Prefecture, Japan, 4Tokai University School of Medicine, Kanagawa, Japan, 5National Hospital Organization Kyushu Cancer Center, Fukuoka Prefecture, Japan, 6Osaka International Cancer Institute, Osaka, Japan, 7Keio University School of Medicine, Tokyo, Japan, 8Iwate Medical University School of Medicine, Morioka, Japan

Objective: The aim of this study was to examine the association between peritoneal cytology results and survival of women with early-stage cervical cancer.

Method: This is a nationwide multicenter retrospective study examining consecutive women with clinical stage IB1–IIB cervical cancer who underwent radical hysterectomy and pelvic lymphadenectomy with peritoneal cytology results available from 2004 to 2008. Propensity score inverse probability of treatment weighting was used to assess the impact of malignant peritoneal cytology on survival. Systematic review was added for further analysis.

Results: Among 1,409 analyzed cases, 88 (6.2%, 95% CI 5.0–7.5) had malignant cells in the peritoneal cytology testing, whereas 1,321 (93.8%) did not. On multivariate analysis, adenocarcinoma (OR = 6.18, 95% CI 3.49–0.9), adenosquamous carcinoma (OR = 2.57, 95% CI 1.08–6.13), pelvic lymph node metastasis (OR = 6.51, 95% CI 3.43–12.3), parametrial involvement (OR = 1.87, 95% CI 1.07–3.27), uterine corpus invasion (OR = 2.74, 95% CI 1.61–4.67), and ovarian metastasis (OR = 5.72, 95% CI 2.34–14.0) remained independent factors associated with malignant peritoneal cytology. On weighted models, the presence of malignant cells on peritoneal cytology was associated with decreased disease-free survival (HR = 1.78, 95% CI 1.36–2.32) and overall survival (OS = 1.93, 95% CI 1.44–2.59). On sensitivity analyses, the presence of malignant cells was associated with decreased OS in adenocarcinoma/adenosquamous carcinoma (HR = 3.28, 95% CI 2.18–4.94) and high-risk group (HR = 1.51, 95% CI 1.12–2.03). Malignant peritoneal cytology was also associated with decreased OS among those who received concurrent chemoradiotherapy (HR = 1.84, 95% CI 1.04–3.24). However, among women who received postoperative systemic chemotherapy, the presence of malignant cells was not associated with OS (HR = 1.21, 95% CI
Systematic review including our results showed that malignant peritoneal cytology was associated with decreased OS (HR = 2.17, 95% CI 1.67–2.82). See Figure 1.

**Conclusion:** Presence of malignant cells in peritoneal cytology is associated with aggressive tumor characteristics and decreased survival in early-stage cervical cancer. The benefit of systemic chemotherapy for this subgroup requires further investigation.

![Graph](image)

**Fig. 1.** Overall cohort.

---

**347 - Poster Session**  
**Lost annual productivity costs due to cervical cancer deaths in England and Wales in 2017**  
D. Kratochvil\(^a\), C. Nwankwo\(^b\) and S.L. Corman\(^a\).  
\(^a\)Pharmerit International, Bethesda, MD, USA, \(^b\)MRL, Kenilworth, NJ, USA

**Objective:** An estimated 728 deaths due to cervical cancer occurred in England and Wales in 2017, with more than half of deaths occurring in women younger than 65 years. We constructed an economic model to estimate the annual productivity costs associated with cervical cancer death in England and Wales for the year 2017.

**Method:** The model calculated the number of women who would be alive in 2017 if they had not died from cervical cancer, and the lost earnings resulting from early mortality. The age-stratified annual number of deaths from cervical cancer per year (1940–2017) was obtained from The National Archives. Life tables were then used to determine the probability of survival to the age the patient would have been in 2017, had she not died of cervical cancer. The proportion of patients employed and median annual wage per year, including fringe benefits, were obtained from the Organisation for Economic Co-Operation and Development. The primary model outcome was the total annual productivity costs attributable to cervical cancer deaths in 2017. Results are reported in 2017 Great Britain pounds (£).

**Results:** A total of 139,985 women in England and Wales died of cervical cancer between 1940 and 2017. The model estimated that 18,504 of these women would be alive in 2017 had they not died from cervical cancer; of these, 7,322 would have been part of the work force in 2017 based on age and labor participation rate. The total productivity loss in 2017 due to cervical cancer was estimated at £303.2 million.

**Conclusion:** Cervical cancer deaths in England and Wales are associated with substantial indirect costs owing to lost earnings.

---

**348 - Poster Session**  
**Association between hospital surgical volume and outcomes of fertility-sparing trachelectomy for early-stage cervical cancer**  
R.S. Mandelbaum\(^a,b\), S. Matsuzaki\(^b\), K. Matsushima\(^b\), M. Klar\(^c\), L.D. Roman\(^d\), J.D. Wright\(^e\) and K. Matsuo\(^f\).  
\(^a\)Keck School of Medicine of USC, Los Angeles, CA, USA, \(^b\)University of Southern California, Los Angeles, CA, USA, \(^c\)University of Freiburg, Fahnbergplatz, Germany, \(^d\)LAC+USC Medical Center - Women and Children's Hospital, Los Angeles, CA, USA, \(^e\)Columbia University College of Physicians and Surgeons, New York, NY, USA, \(^f\)LAC+USC Medical Center, Los Angeles, CA, USA

**Objective:** The aim of this study was to examine the association between hospital surgical volume and perioperative outcomes of fertility-sparing trachelectomy performed for cervical cancer.
**Method:** This is a population-based retrospective observational study utilizing the Nationwide Inpatient Sample from 2001 to 2011. Women aged ≤45 years with cervical cancer who underwent trachelectomy were included. Perioperative outcomes were assessed based on hospital surgical volume in a weighted model. Annualized trachelectomy hospital surgical volume was defined as the average number of procedures a hospital performed per year in which at least 1 case was performed: low-volume (average 1 case per year), mid-volume (average >1 but ≤2 cases per year), and high volume (average >2 cases per year).

**Results:** A total of 815 trachelectomies were performed at 89 hospitals in the analysis. There were 68 (76.4%) hospitals with 363 (44.5%) cases in the low-volume group, 15 (27.1%) hospitals with 187 (23.0%) cases in the mid-volume group, and 6 (6.7%) hospitals with 265 (32.5%) cases in the high-volume group. The high-volume group had a higher rate of lymphadenectomy performance than other groups (94.0% for low-volume, 82.4% for mid-volume, and 93.2% for high-volume, $P = 0.001$). The high-volume group also had a lower risk of perioperative complications (10.5% for low-volume, 22.5% for mid-volume, and 5.3% for high-volume, $P < 0.001$) and prolonged hospital stay ≥7 days (6.3% for low-volume, 7.5% for mid-volume, and 1.9% for high-volume, $P = 0.012$) following trachelectomy compared to other groups. On multivariate analysis, the high-volume group had a 40% decreased perioperative complication risk compared to the low-/mid-volume groups (adjusted odds ratio = 0.60, 95% CI 0.43–0.85, $P = 0.004$). See **Figure 1**.

**Conclusion:** Fertility-sparing trachelectomy for young women with cervical cancer is a rare surgical procedure; the majority of hospitals perform few cases annually. Higher hospital surgical volume for trachelectomy is associated with reduced perioperative morbidity.

![Fig. 1](image)

**349 - Poster Session**
**Significance of wait time for surgery on survival of women with early-stage cervical cancer**
Objective: A prior study demonstrated that wait time of ≥56 days for definitive surgical treatment of early-stage cervical cancer is associated with decreased long-term survival. This study examined the significance of a wait time of ≥56 days from cervical biopsy to surgical treatment on survival of women with early-stage cervical cancer.

Method: This is a single-institution retrospective observational study at a tertiary referral medical center examining women who underwent primary hysterectomy or trachelectomy for FIGO 2018 stage IA, IB, and IIA invasive cervical cancer from 2000 to 2017 (n = 217). Patients were divided into 2 groups based on wait time from the diagnosis of invasive cervical cancer via biopsy to definitive surgery: short wait time (<56 days, n = 110) versus long wait time (≥56 days, n = 107). Propensity score inverse probability of treatment weighting (PS-IPTW) was used to match the demographics between the two groups, and survival outcome was assessed.

Results: In this cohort, the median age was 45 years, and the most common histology type was squamous (n = 148, 68.2%). The most common cancer stages were IB1 (n = 64, 29.5%) and IA1 (n = 63, 29.0%), followed by IB2 (n = 55, 25.3%). The median wait time was 55 days (IQR 41–82 days) among 217 patients, and cancer stage was the only preoperative factor associated with wait time. Among stage I patients, higher stage was associated with shorter wait time (79, 65, 52, 49, and 42 days for stage IA1, IA2, IB1, IB2, and IB3, respectively, P < 0.001). In a PS-IPTW model (n = 277), the median follow-up was 4.6 years, with 21 recurrences and 14 deaths during follow-up. Women in the long-wait-time group had disease-free survival (5-year rates, 91.8% vs 90.3%, HR = 0.98, 95% CI 0.42–2.30; Figure 1 panel A) and overall survival (92.5% vs 94.6%, HR = 1.12, 95% CI 0.41–3.34; Figure 1 panel B) similar to those in the short-wait-time group.

Conclusion: Our study suggests that a long wait time of ≥56 days between diagnosis and definitive surgical treatment with hysterectomy or trachelectomy may not be associated with short-term survival of women with early-stage cervical cancer.

Fig. 1. Survival outcomes based on wait-time for surgery.

350 - Poster Session
Non-brachytherapy approach to treatment of locally advanced cervical cancer
N. Salim, V.B. Nosov, D. Zvereva, O. Novikova, A. Tedeeva, I. Trofimenko, E. Moskalets, N. Gromova and P. Koposov. European Medical Center, Moscow, Russian Federation
Objective: Concomitant chemoradiation therapy (CRT) that includes both external beam radiotherapy (EBRT) and brachytherapy (BT) is the current standard of care in treatment of locally advanced cervical cancer (LACC). Volumetric modulated arc technology provides potential benefits allowing for dose escalation and decreased toxicities. This non-BT approach offers improved accuracy and no geographical miss due to adaptive radiotherapy, but oncologic outcomes still need to be evaluated.

Method: Patients with LACC (stages 1B3–IVA) who underwent CRT using EBRT and simultaneous integrated boost at our institution were evaluated prospectively from May 2015 to April 2019. All were initially assessed by a gynecologic oncologist, then with pelvic MRI and 18FDG-PET/CT. Tumor histology was confirmed by an expert pathologist. Interval CT was performed during treatment; pelvic examinations with cytology every 3 months and PET/CT at 3 and 12 months after completion of treatment were performed. Oncologic outcomes and toxicities were assessed.

Results: Twenty-one patients were analyzed: median age was 54 years (30–76 years); 19 patients had squamous cell histology and 2 had adenocarcinoma. Median follow-up was 26 months (3–44). The average dose administered to the gross tumor volume was 90.2 Gy (79.5–96.6), 79.8 Gy to all PET/MRI positive lymph nodes (63.0–89.7). No patients received BT; all but 3 received chemotherapy. Three-year local control was 100% (PFS = 90.4% and OS = 100%). There were 2 recurrences: a solitary skull lesion 18 months following CRT in a patient with mesonephric adenocarcinoma and a metastasis to a transposed ovary 15 months after CRT. No grade 3–4 toxicities were seen. Only 1 patient (4.7%) had late rectal grade II toxicity.

Conclusion: Non-brachytherapy CRT for LACC is feasible. It allows for a significant dose escalation, thus providing better local control and likely increases PFS and OS at no cost of serious toxicity. Randomized studies comparing this approach to the current standard of care are needed.

351 - Poster Session
Minimally invasive radical hysterectomy for early-stage cervical cancer: Association between hospital surgical volume and perioperative outcomes
S. Matsuzaki, a R.S. Mandelbaum, b K. Matsushima, c M. Klar, d L.D. Roman, e J.D. Wright, f and K. Matsuo. aUniversity of Southern California, Los Angeles, CA, USA, bUniversity of Freiburg, Fahrenbergplatz, Germany, cLAC-USC Medical Center - Women and Children's Hospital, Los Angeles, CA, USA, dColumbia University, New York, NY, USA, eLAC-USC Medical Center, Los Angeles, CA, USA

Objective: U.S. surgeons began adopted minimally-invasive radical hysterectomy (MIS-RH) for early-stage cervical cancer in the mid-late 2000s. This study examined the association between hospital surgical volume for MIS-RH and perioperative outcomes for early-stage cervical cancer.

Method: The Nationwide Inpatient Sample was retrospectively queried from 2007 to 2011 for all radical hysterectomies performed for early-stage cervical cancer. Annualized hospital surgical volume was defined in the unweighted model as the average number of procedures performed per year in which at least 1 procedure was performed: low volume (average <2 procedures per year), mid volume (average ≥2 but <4 procedures per year), and high volume (average ≥4 procedures per year). Trends, characteristics, and outcomes related to MIS-RH use were assessed in the weighted model.

Results: Among 14,861 women who underwent radical hysterectomies, the utilization of MIS-RH increased from 11.4% to 22.5% (P < 0.001). There were 2,202 MIS-RH procedures performed at 163 hospitals in the analysis. There were 79 (48.5%) hospitals with 521 (23.7%) procedures in the low-volume group, 63 (38.7%) hospitals with 986 (44.8%) procedures in the mid-volume group, and 21 (12.9%) hospitals with 695 (31.6%) procedures in the high-volume group. The high-volume group had a higher rate of lymphadenectomy performance than other groups (89.6% for low volume, 92.4% for mid volume, and 94.0% for high volume; P = 0.020). Hospital MIS-RH volume was not associated with perioperative complication rates: any complication, 14.6% for low-volume, 14.8% for mid-volume, and 18.1% for high-volume; P = 0.126; or multiple complications, 3.8%, 3.8%, and 5.3%, respectively; P = 0.250 (Figure 1, top panel). In contrast, among 11,187 open-RH procedures, the high-volume group had a lower multiple perioperative complication rate than other groups: 12.2% for low volume, 11.8% for mid volume, and 8.7% for high volume; P < 0.001 (Figure 1, bottom panel).

Conclusion: Between 2007 and 2011, higher hospital surgical volume was associated with a lower perioperative complication rate in open-RH, but this volume-outcome association was not observed for MIS-RH, suggesting the complexity of this surgical procedure and possible learning-curve effect.
The institutional learning curve is associated with survival outcomes of robotic radical hysterectomy for early-stage cervical cancer

K.J. Eoh, S.W. Kim, J.W. Kim and Y.T. Kim. Yonsei University College of Medicine, Seoul, South Korea

Objective: The aim of this study was to compare the surgical and survival outcomes between abdominal radical hysterectomy (ARH) and robotic radical hysterectomy (RRH).

Method: A retrospective cohort of patients undergoing radical hysterectomy for cervical cancer from 2006 to 2018 was identified. Patients with stage IA to IB cervical cancer were included and grouped by ARH versus RRH. The RRH group was further divided into 2 groups based on the year of enrollment (RRH1, 2006~2012, and RRH2, 2013~2018). Tumor characteristics, recurrence rate, progression-free survival (PFS), and overall survival (OS) were compared between the groups. *P* values <0.05 (two-sided) were considered statistically significant.

Results: A total of 310 patients were identified; 142 and 168 underwent ARH and RRH, respectively. RRH1 and RRH2 had 77 and 91 patients, respectively. Interestingly, the RRH2 group was more likely to have larger tumor size (1.7 ± 1.4 vs 2.0 ± 1.1 vs 2.4 ± 1.7 cm, *P* = 0.014) and higher stage (*P* < 0.001) than the RRH1 group. However, the RRH2 group showed significantly favorable progression-free survival (PFS), compared with the RRH1 group. There was no difference between the ARH and RRH2 groups in PFS (*P* = 0.629), whereas overall the RRH group showed significantly shorter PFS than the ARH group. In multivariate analysis, the institutional learning curve represented by the operation year was 1 of the significant predictors for PFS (HR = 0.065, *P* = 0.0162), along with tumor size (HR=5.651, *P* = 0.0241).

Conclusion: The institutional learning curve, represented by the operation year, is one of the most significant factors associated with outcomes of robotic radical hysterectomy for early-stage cervical cancer.

---

Is hysterectomy necessary for the treatment of stratified mucin-producing intraepithelial lesions (SMILE) of the cervix?

**Objective:** Stratified mucin-producing intraepithelial lesion (SMILE) is an uncommon premalignant cervical intraepithelial lesion characterized by histopathologic features resembling those observed in HSIL and AIS. Because of its hybrid morphology, there is no consensus as to the most appropriate category for this lesion and it poses a pathologic challenge with no specific management guidelines.

**Method:** A retrospective pathology review of all cases of cervical intraepithelial lesions, with confirmation of all SMILE lesions, at a single institution between 2007 and 2019 was performed. Clinical and pathologic characteristics, management options, and patient outcomes were reviewed and analyzed.

**Results:** Twenty-four patients with SMILE were identified. Mean age at diagnosis was 36.2 years with 67% (16/24) diagnosed younger than 40 years. Of these, 54% (13/24) were nulliparous and 63% (15/24) had a past history of abnormal Pap smears. Ninety-two percent (22/24) were positive for hrHPV, with 13% (n = 3) presenting with a normal Pap smear. Diagnosis was made primarily on colposcopy (n = 16), cold knife cone/LEEP (n = 7), or hysterectomy (n = 1). Seventy-one percent (17/24) had a co-existing precancerous lesion at time of diagnosis; most common was HSIL (53%). Five invasive lesions were also identified at time of SMILE diagnosis (2 adenocarcinoma, 3 adenosquamous), 3 of which underwent chemoradiation. Among all patients, 25% (6/24) underwent hysterectomy (4 simple, 2 radical), while 63% (15/24) of patients underwent fertility-sparing excisional procedure, 13 with negative margins and 2 with positive margins for definitive treatment. Over a median follow-up of 29 months, 100% of the fertility-sparing patients with negative margins had no recurrence. Among the 2 patients with positive margins, 1 did not recur and the other underwent repeat excision with persistent SMILE identified, subsequent negative margin, and no recurrence since. See Table 1.

**Conclusion:** To date, this is the largest cohort of SMILE cases. Our data reveal that most patients with SMILE are young, hrHPV+, and nulliparous, and present with co-existing lesions. Diagnosis is commonly made at time of colposcopic biopsies or excisional procedure. Excisional procedure with negative margins may be sufficient fertility-sparing treatment for pre-invasive SMILE lesions with low risk of recurrence.

**Table 1.** Clinicopathologic features of patients with stratified mucin-producing intraepithelial lesions (SMILE) of the cervix (n = 24)
*One pap smear concomitant with ASCUS, AGC.*

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Parity</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nulliparous</td>
<td>13</td>
<td>53</td>
</tr>
<tr>
<td>Parous</td>
<td>11</td>
<td>46</td>
</tr>
<tr>
<td><strong>hrHPV Status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>22</td>
<td>92</td>
</tr>
<tr>
<td>Negative</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td><strong>Initial Pap smear diagnosis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>LSIL</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>HSIL</td>
<td>4</td>
<td>17</td>
</tr>
<tr>
<td>ASCUS</td>
<td>7</td>
<td>29</td>
</tr>
<tr>
<td>ASC-H</td>
<td>8</td>
<td>33</td>
</tr>
<tr>
<td>AGC</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td><strong>SMILE diagnosis specimen</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cervical biopsy</td>
<td>14</td>
<td>58</td>
</tr>
<tr>
<td>CKC/LEEP</td>
<td>7</td>
<td>29</td>
</tr>
<tr>
<td>ECC</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Hysterectomy</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td><strong>Concurrent lesion at time of diagnosis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative</td>
<td>7</td>
<td>29</td>
</tr>
<tr>
<td>LSIL</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>HSIL</td>
<td>13</td>
<td>53</td>
</tr>
<tr>
<td>AIS</td>
<td>6</td>
<td>25</td>
</tr>
<tr>
<td>Adenocarcinoma</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td><strong>Procedure for SMILE</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CKC/LEEP</td>
<td>15</td>
<td>83</td>
</tr>
<tr>
<td>Hysterectomy</td>
<td>6</td>
<td>33</td>
</tr>
</tbody>
</table>

(2 simple, 4 radical)
Objective: Cervical cancer in the setting of uterovaginal prolapse is exceedingly rare. Altered anatomy can complicate treatment of underlying cancer. The objective of this study was to evaluate the practice patterns and outcomes regarding cervical cancer associated with procidentia.

Method: We conducted a systematic search of online databases (PubMed, Embase, Medline, and the Cochrane Library) from 1990 to 2018 of all cases of cervical cancer associated with stage III–IV uterovaginal prolapse. Patient demographics, pathology, surgical management, chemotherapy, radiation, and disease-free survival were compared.

Results: We identified 15 patients with cervical cancer with procidentia (squamous cell carcinoma, 14; clear cell carcinoma, 1). The mean age at diagnosis was 74 years (range 54–89 years). Thirteen percent (n = 2) of patients presented with FIGO stage I disease, 67% (10) with stage II, and 20% (3) with stage III. All patients had stage III–IV uterovaginal prolapse. Eleven patients were treated surgically (73%) including 9 who underwent vaginal hysterectomy. Among patients who underwent primary surgery, 7% (1) received adjuvant chemotherapy, 33% (5) adjuvant radiotherapy, and 21% (3) both adjuvant chemotherapy and radiation. Five (33%) surgical procedures addressed the pelvic organ prolapse (colpocleisis, 3; uterosacral suspension, 1; and anterior posterior repair, 1); there was no significant difference in survival among these patients. Two patients died from disease within 12 months; 1 patient died from other causes within 1 month; and the remainder of patients were free of disease at last reported follow-up (Table 1).

Conclusion: Cervical cancer in the setting of stage III–IV uterovaginal prolapse can be managed successfully with standard treatment strategies (primary surgery with adjuvant therapy as necessary versus chemoradiation). When patients are surgical candidates, techniques to address the underlying prolapse can be used for symptomatic improvement with no difference in overall outcomes.

Table 1. Systematic review data of published cases of carcinoma of the cervix associated with procidentia.

<table>
<thead>
<tr>
<th>Age</th>
<th>Histology</th>
<th>Stage</th>
<th>Surgery</th>
<th>Adjuvant Therapy</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>69</td>
<td>Squamous cell carcinoma</td>
<td>IIA</td>
<td>Radical vaginal hysterectomy with bilateral salpingo-oophorectomy</td>
<td>External Pelvic Radiotherapy (5000 cGy)</td>
<td>Free of disease at 2 years</td>
</tr>
<tr>
<td>73</td>
<td>Squamous cell carcinoma</td>
<td>IIA</td>
<td>Radical vaginal hysterectomy</td>
<td>External Pelvic Radiotherapy (5000 cGy)</td>
<td>Free of disease at 2 years</td>
</tr>
<tr>
<td>54</td>
<td>Clear cell adenocarcinoma</td>
<td>IB2</td>
<td>Laparoscopic radical hysterectomy with bilateral salpingo-oophorectomy, pelvic lymphadenectomy</td>
<td>Adjuvant chemoradiotherapy with 5-fluorouracil plus cisplatin</td>
<td>Free of disease at 10 months</td>
</tr>
<tr>
<td>77</td>
<td>Squamous cell carcinoma</td>
<td>IIB</td>
<td>Radical vaginal hysterectomy</td>
<td>External Pelvic Radiotherapy (6000 cGy)</td>
<td>Not reported</td>
</tr>
<tr>
<td>67</td>
<td>Squamous cell carcinoma</td>
<td>IIA2</td>
<td>Vaginal hysterectomy, salpingo-oophorectomy, uterosacral ligament suspension</td>
<td>Adjuvant Chemoradiation</td>
<td>Not reported</td>
</tr>
<tr>
<td>89</td>
<td>Squamous cell carcinoma (Verrucous)</td>
<td>IIA</td>
<td>Local excision of the mass</td>
<td>---</td>
<td>Free of disease at 6 months</td>
</tr>
<tr>
<td>79</td>
<td>Squamous cell carcinoma</td>
<td>IIB</td>
<td>---</td>
<td>Palliative Chemotherapy</td>
<td>Dead of disease at 3 months</td>
</tr>
<tr>
<td>60</td>
<td>Squamous cell carcinoma</td>
<td>IIB</td>
<td>---</td>
<td>---</td>
<td>Not reported</td>
</tr>
<tr>
<td>86</td>
<td>Squamous cell carcinoma</td>
<td>IIA</td>
<td>Vaginal hysterectomy</td>
<td>---</td>
<td>Died of pulmonary embolism before 1 month</td>
</tr>
<tr>
<td>74</td>
<td>Squamous cell carcinoma</td>
<td>IIB</td>
<td>Vaginal hysterectomy, iliopelvic lymphadenectomy</td>
<td>Pelvic external beam radiotherapy plus vaginal brachytherapy and chemotherapy with cisplatin. Disease progressed, palliative therapy with paclitaxel plus carboplatin</td>
<td>Dead of disease at 12 months</td>
</tr>
<tr>
<td>73</td>
<td>Squamous cell carcinoma</td>
<td>IIA</td>
<td>Vaginal hysterectomy, Colpocleisis</td>
<td>Adjuvant chemoradiotherapy with cisplatin</td>
<td>Free of disease at 5 years</td>
</tr>
<tr>
<td>81</td>
<td>Squamous cell carcinoma</td>
<td>IIA</td>
<td>Vaginal radical hysterectomy, salpingo-oophorectomy, laparoscopic pelvic lymphadenectomy, Colpocleisis</td>
<td>---</td>
<td>Not reported</td>
</tr>
<tr>
<td>87</td>
<td>Squamous cell carcinoma</td>
<td>IB2</td>
<td>Vaginal hysterectomy, colpoceisis</td>
<td>External Pelvic Radiotherapy</td>
<td>Free of disease at 1 year</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------</td>
<td>-----</td>
<td>---------------------------------</td>
<td>-----------------------------</td>
<td>-------------------------</td>
</tr>
<tr>
<td>68</td>
<td>Squamous cell carcinoma</td>
<td>IIB</td>
<td>---</td>
<td>---</td>
<td>Alive with disease at 8 months, lung metastasis</td>
</tr>
<tr>
<td>72</td>
<td>Squamous cell carcinoma</td>
<td>IIA2</td>
<td>Perineorrhaphy, cystocele, enterocele repair, Gellhorn pessary placement</td>
<td>External beam radiation therapy, vaginal brachytherapy. Chemotherapy with cisplatin</td>
<td>Free of disease at 15 months</td>
</tr>
</tbody>
</table>

355 - Poster Session
E-cadherin expression as a prognostic biomarker for cervical adenocarcinoma in situ (ACIS) and cervical adenocarcinoma (AC)
Weill Cornell Medical College, New York, NY, USA

**Objective:** E-cadherin is an important cell-cell adhesion molecule in epithelial tissues. Previous literature has demonstrated an association with E-cadherin deficiency and progression of different malignancies, including squamous cell carcinoma of the cervix. However, there have been no studies investigating the relationship between E-cadherin expression and adenocarcinoma in situ (ACIS) or adenocarcinoma (AC) of the cervix. We sought to determine whether E-cadherin immunohistochemistry (IHC) can be a valuable marker in screening for ACIS and AC.

**Method:** We conducted a single-institution, retrospective case-control pilot study. Women diagnosed with ACIS or AC of the cervix between 2007 and 2017 were included. Controls consisted of patients without the diagnosis of any pre-invasive or invasive lesions. Cervical tissue underwent immunohistochemistry (IHC) staining and was evaluated by 2 independent pathologists blinded to the clinical outcome. Grading was based on a semiquantitative formula (intensity score × proportion [0.0–1.0]): negative staining (0), weak (1), moderate (2), and strong (3).

**Results:** Twenty-nine patients were included in the study (9 control, 10 ACIS, 10 AC). Mean age at diagnosis was 41 years (range 24–68 years): control (42), ACIS (35), and AC (47). Among AC patients, 2 had stage IV disease, 1 stage III, 2 stage II, and 6 stage I. All 29 samples demonstrated positive staining; none received a score of 0. The mean score of controls was 2.89 (95% CI 2.63–3.15), ACIS 1.60 (95% CI 1.35–2.25), and AC 1.80 (95% CI 1.43–1.97). The mean score of ACIS and AC combined (ACIS + AC) was 1.70 (95% CI 1.43–1.97). Control specimens exhibited significantly greater E-cadherin expression than ACIS ($P < 0.0001$), AC ($P < 0.0002$), and AC + ACIS ($P < 0.0001$). Comparing ACIS to AC did not show a significant difference ($P = 0.44$). Advanced-stage AC demonstrated less expression (mean = 1.6) than controls ($P = 0.0004$). See Figure 1.

**Conclusion:** E-cadherin expression is significantly greater in normal cervical tissue than in AC or ACIS. Advanced-stage AC tumors demonstrated the most significant difference in E-cadherin expression. IHC staining for E-cadherin may be a useful tool in diagnosing both pre-invasive and invasive glandular lesions of the cervix. Further investigation is warranted to confirm findings in a larger cohort.
Fig. 1. Plot demonstrating mean E-cadherin immunohistochemistry (IHC) staining scores by diagnosis with 95% confidence intervals (CI). Adenocarcinoma (AC) 1.80 (95% CI 1.43–1.97); adenocarcinoma in situ (ACIS) 1.60 (95% CI 1.35-2.25) and control 2.89 (95% CI 2.63-3.15).

356 - Poster Session
Response of mTOR inhibitor associated with mutation of FBXW7 gene identified by comprehensive genomic profiling in cervical squamous cell carcinoma supports additional therapy opportunity for select patients with treatment-refractory, recurrent disease

aWomen & Infants Hospital, Brown University, Providence, RI, USA, bFoundation Medicine, Cambridge, MA, USA

Objective: More than 90% of patients with recurrent cervical squamous cell carcinoma (cSCC) die within 5 years. We describe 2 cases of prolonged clinical response of advanced recurrent cSCC to mTOR inhibitor (mTORi) monotherapy after genomic tumor testing indicated susceptibility. The FoundationOne tumor genomic database was queried to identify the frequency of such mutations in advanced cSCC.

Method: When inactivated, the tumor suppressor gene FBXW7 is associated with stabilization of proto-oncogenes including mTOR. Comprehensive genomic profiling (CGP) of tumor tissue can identify mutated FBXW7 (mutFBXW7), and mTORi have shown activity in animal models. Identification of mutFBXW7 in 2 patients with advanced cSCC led to treatment with an mTORi. Somatic tumor testing was done on 914 cases of advanced cSCC. CGP was performed for up to 324 genes from tumor specimens (FoundationOne/FoundationOneCDx). Microsatellite instability (MSI) and tumor mutational burden (TMB; mutations (mut) per Mb) were evaluated.

Results: A 65-year-old patient with FIGO stage IIIB cSCC was treated with chemoradiation; she experienced pelvic and inguinal lymph node recurrence after 31 months. She was treated with cisplatin/paclitaxel/bevacizumab. After 12 months on maintenance bevacizumab, imaging demonstrated progressive disease. Somatic CGP identified mutFBXW7, and she was treated with the mTORi everolimus. She has been on single-agent everolimus for 18 months and is without evidence of disease. The same mutation was identified in a second patient with treatment-refractory FIGO stage IV disease; she was also treated with everolimus and experienced a 6-month partial response. The FoundationOne cSCC tumor database was queried, and mutFBXW7 was identified in 12.9% of cSCC (median age 49 years, range 29–81 years); 4.7% of cases were MSI-high, 27% had TMB >10 muts/Mb. Similar to the index patients, 25% mutFBXW7 cSCC (3.3% of cohort) had no other mutations in targetable pathways.

Conclusion: Our cases demonstrate response to mTOR inhibition in advanced recurrent cSCC when a susceptibility mutation was identified on CGP. Further, this specific mutation was identified in 12.9% of cSCC cases within the FoundationOne database. If activity of
mTORi monotherapy is related to mutFBXW7-dependent increased mTOR signaling, approximately 1 in 8 advanced cSCC patients could similarly benefit. Thus this approach warrants further study.

---

**357 - Poster Session**  
Spillage and displacement of ICG-stained tissue from the uterine cervix to the pelvic peritoneum: A proof of concept study for colpotomic approach in minimally invasive surgery  
T.W. Kong, S. Kim, J. Kim, J.H. Shim, J.H. Son, J. Paek, S.J. Chang and H.S. Ryu. Ajou University School of Medicine, Suwon, South Korea

**Objective:** The aim of this study was to analyze peritoneal spillage and artificial displacement of indocyanine green (ICG)-stained tissues from the uterine cervix to the pelvis during intracorporeal and vaginal colpotomy in laparoscopic-assisted hysterectomy.

**Method:** In this prospective proof-of-concept study, 5 patients undergoing laparoscopic-assisted hysterectomy were included. All patients received hysterectomy due to benign uterine disease. Two patients underwent intracorporeal colpotomy, and 3 patients received vaginal colpotomy. Approximately 3 cm of resected round ligament from each patient was stained with intravenous endocyanic green (ICG) and was cut to 0.5 × 0.5 cm. Five fragments of ICG-stained tissue were placed on the uterine cervix in front of the vaginal occluder balloon before intracorporeal colpotomy and on the uterine cervix before vaginal colpotomy. During colpotomy, serial pictures under white and fluorescence light were taken to document peritoneal spillage and displacement of ICG-stained tissue to the pelvic peritoneum. All fragments of ICG-stained tissue were retrieved.

**Results:** Peritoneal spillage and displacement of ICG-stained tissue from the uterine cervix to the pelvic peritoneum were visualized in 2 patients undergoing intracorporeal colpotomy. In addition, contamination of the laparoscopic instrument occurred. In the 3 patients, however, peritoneal spillage and displacement of ICG-stained tissue to the pelvic peritoneum did not occur after vaginal colpotomy. There were no adverse events during and after surgery. See Figure 1.

**Conclusion:** Intracorporeal colpotomy in minimally invasive radical hysterectomy may itself be related to higher disease recurrence rates compared to abdominal radical hysterectomy. Therefore, in a minimally invasive radical hysterectomy, vaginal colpotomy can be a safer procedure than intracorporeal colpotomy.

---

**358 - Poster Session**  
Validation of National Comprehensive Cancer Network guideline adherence in early-stage cervical cancer  

**Objective:** The aim of this study was to validate National Comprehensive Cancer Network (NCCN) guidelines in early-stage cervical cancer and determine patient and hospital factors associated with guideline adherence.

**Method:** National Cancer Database (NCDB) patients treated for early-stage (IA1–IIB) cervical cancer from 2004 to 2016 were included. Guideline-adherent care was defined using NCCN guidelines corresponding to year of diagnosis. Guideline-adherent sequence was defined as a combination of surgery and/or radiation meeting NCCN guidelines. Multivariate Cox proportional hazards was used to determine the association between guideline-adherent surgery, radiation, and sequence with overall survival. Multivariate logistic
Results: A total of 34,505 patients were identified. After adjusting for confounding covariates, receipt of guideline-adherent sequence (aHR = 0.93, 95% CI 0.88–0.98, \( P = 0.01 \)) was independently associated with decreased mortality hazard. Guideline-adherent surgery was independently associated with decreased odds of positive margins (aOR = 0.34, 95% CI 0.30–0.39) and postoperative radiation (aOR = 0.43, 95% CI 0.37–0.51) and increased odds of positive lymph nodes (aOR = 2.35, 95% CI 2.09–2.63) and parametrial involvement (aOR = 1.35, 95% CI 1.18–1.55). Guideline-adherent sequence was independently associated with decreased risk of positive margins (aOR = 0.11, 95% CI 0.09–0.13), lymph vascular space invasion (aOR = 0.47, 95% CI 0.43–0.51), positive lymph nodes (aOR = 0.52, 95% CI 0.46–0.59), parametrial involvement (aOR = 0.39, 95% CI 0.34–0.45), and postoperative radiation (aOR = 0.07, 95% CI 0.06–0.08). Black race (aHR = 0.89, 95% CI 0.80–0.99) and older age decile (aOR = 0.86, 0.75, 0.66, 0.64, 0.53, respectively) were associated with decreased odds of receiving guideline-adherent sequence, while Asian race (aOR = 1.53 95% CI 1.01–2.35) and increasing hospital volume quartile (aOR = 1.33, 1.46, 1.49, respectively) were associated with higher odds of receiving guideline-adherent sequence (all \( P < 0.05 \)).

Conclusion: Guideline-adherent care was associated with decreased mortality and more favorable pathologic outcomes in early-stage cervical cancer. Black and older patients were less likely to receive guideline-adherent care, while Asian race and increasing hospital volume were associated with increased rates of guideline-adherent care.

Table 1. Outcomes associated with guideline-adherent surgery, radiation, and sequence in early stage cervical cancer.

<table>
<thead>
<tr>
<th>Time to Event Outcome</th>
<th>GA Surgery aHR (95% CI)</th>
<th>( P )</th>
<th>GA Radiation aHR (95% CI)</th>
<th>( P )</th>
<th>GA Sequence aHR (95% CI)</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality</td>
<td>0.97 (0.88 – 1.05)</td>
<td>0.4277</td>
<td>0.95 (0.89 – 1.00)</td>
<td>0.0703</td>
<td>0.93 (0.88 – 0.98)</td>
<td>0.0101</td>
</tr>
<tr>
<td>Secondary Outcome</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive Margins</td>
<td>0.34 (0.30 – 0.39)</td>
<td>&lt;0.0001</td>
<td>1.17 (1.03 – 1.33)</td>
<td>0.0140</td>
<td>0.11 (0.09 – 0.13)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>LVSI</td>
<td>0.96 (0.88 – 1.04)</td>
<td>0.3197</td>
<td>0.69 (0.62 – 0.77)</td>
<td>&lt;0.0001</td>
<td>0.47 (0.43 – 0.51)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Positive Lymph Nodes</td>
<td>2.35 (2.09 – 2.64)</td>
<td>&lt;0.0001</td>
<td>0.63 (0.55 – 0.72)</td>
<td>&lt;0.0001</td>
<td>0.52 (0.46 – 0.59)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Parametrial Involvement</td>
<td>1.35 (1.18 – 1.55)</td>
<td>&lt;0.0001</td>
<td>0.72 (0.63 – 0.83)</td>
<td>&lt;0.0001</td>
<td>0.39 (0.34 – 0.45)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Post-op radiation</td>
<td>0.43 (0.37 – 0.51)</td>
<td>&lt;0.0001</td>
<td>0.97 (0.83 – 1.14)</td>
<td>0.7278</td>
<td>0.07 (0.06 – 0.08)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Meets Peter’s Criteria</td>
<td>1.48 (1.35 – 1.63)</td>
<td>&lt;0.0001</td>
<td>0.47 (0.42 – 0.52)</td>
<td>&lt;0.0001</td>
<td>0.54 (0.50 – 0.57)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>30 day mortality</td>
<td>0.37 (0.12 – 1.10)</td>
<td>0.0724</td>
<td>1.42 (0.21 – 9.58)</td>
<td>0.7214</td>
<td>0.47 (0.16 – 1.38)</td>
<td>0.1699</td>
</tr>
<tr>
<td>90 day mortality</td>
<td>0.36 (0.18 – 0.73)</td>
<td>0.0045</td>
<td>0.17 (0.04 – 0.76)</td>
<td>0.0201</td>
<td>0.36 (0.17 – 0.76)</td>
<td>0.0077</td>
</tr>
</tbody>
</table>

aHR=adjusted Hazard Ratio; aOR=adjusted Odds Ratio; CI=confidence interval.

359 - Poster Session

Meta-analysis of high-quality non-randomized studies comparing oncologic outcomes after minimally invasive compared with open radical hysterectomy for early-stage cervical cancer

R. Nitecki\(^1\), J.A. Rauh-Hain\(^2\), P.T. Ramirez\(^2\), M. Frumovitz\(^2\), A.I. Tergas\(^2\), J.D. Wright\(^3\) and A. Melamed\(^4\), \(^1\)The University of Texas MD Anderson Cancer Center, Houston, TX, USA, \(^2\)New York-Presbyterian/Columbia University Medical Center, New York, NY, USA, \(^3\)Columbia University, New York, NY, USA

Objective: Despite evidence from the Laparoscopy for Cervical Carcinoma (LACC) trial, there remains debate regarding the surgical approach for early-stage cervical cancer. We evaluate evidence from nonrandomized studies comparing overall and recurrence-free survival after minimally invasive versus open radical hysterectomy for early-stage cervical cancer.

Method: Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methods were used to identify studies on PubMed (from May 2009 to September 2019) comparing minimally invasive (laparoscopic or robotic) to open radical hysterectomy as the primary treatment in patients with early-stage (IA1–IIA1 based on the FIGO 2009 staging system) cervical cancer. Studies that compared overall or disease-free survival and reported results in terms of hazard ratios (HR) were included for inclusion. Study quality was assessed using the Newcastle-Ottawa Scale, and studies considered to be at low risk of bias (≥6 points) were included in random-effects meta-analysis models to obtain pooled HR estimates and 95% confidence intervals.
**Results:** We identified 33 articles of which 12 were considered to be of high enough quality for inclusion in the meta-analysis. Of 7,377 patients included, 3,773 (51%) underwent minimally invasive surgery (1,907 laparoscopic; 1,856 robotic). There were 420 recurrences and 365 deaths reported. Pooling results from these studies demonstrated that minimally invasive surgery was associated with an increased hazard of death (HR = 1.47, 95% CI 1.07–2.03, \( P = 0.02 \)) with a low-moderate heterogeneity (\( I^2 = 32.1\% , \ P = 0.151 \)). Minimally invasive surgery was also associated with a lower rate of disease-free survival than open surgery (HR = 1.57, 95% CI 1.07–2.03, \( P = 0.007 \)) with moderate heterogeneity (\( I^2 = 52.8\% , \ P = 0.025 \)). See **Figure 1**.

**Conclusion:** Minimally invasive radical hysterectomy was associated with shorter overall and disease-free survivals than open surgery among women with early-stage cervical cancer. These results are consistent with a recent randomized trial.
Non-randomized studies comparing risk of recurrence

<table>
<thead>
<tr>
<th>Study</th>
<th>HR (95% CI)</th>
<th>Weight</th>
<th>Recurrences/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nam (2012)</td>
<td>1.28 (0.62, 2.64)</td>
<td>10.03</td>
<td>31/525</td>
</tr>
<tr>
<td>Bogani (2014)</td>
<td>0.31 (0.36, 1.80)</td>
<td>8.99</td>
<td>22/130</td>
</tr>
<tr>
<td>Ditto (2015)</td>
<td>0.42 (0.10, 2.00)</td>
<td>3.88</td>
<td>7/120</td>
</tr>
<tr>
<td>Sheh (2017)</td>
<td>1.90 (0.75, 3.43)</td>
<td>9.52</td>
<td>32/311</td>
</tr>
<tr>
<td>Wallin (2017)</td>
<td>2.13 (1.06, 4.26)</td>
<td>10.44</td>
<td>36/304</td>
</tr>
<tr>
<td>Kim (2019)</td>
<td>2.36 (1.21, 4.66)</td>
<td>13.19</td>
<td>74/593</td>
</tr>
<tr>
<td>Cusimano (2019)</td>
<td>1.97 (1.10, 3.50)</td>
<td>12.23</td>
<td>110/958</td>
</tr>
<tr>
<td>Doo (2019)</td>
<td>1.84 (0.08, 4.00)</td>
<td>8.05</td>
<td>20/105</td>
</tr>
<tr>
<td>Alfonzo (2019)</td>
<td>0.93 (0.56, 1.52)</td>
<td>13.63</td>
<td>55/464</td>
</tr>
<tr>
<td>Paik (2019)</td>
<td>2.74 (1.33, 5.65)</td>
<td>10.03</td>
<td>33/470</td>
</tr>
<tr>
<td>Overall (I-squared = 52.8%, p = 0.025)</td>
<td>1.57 (1.13, 2.17)</td>
<td>100.00</td>
<td></td>
</tr>
</tbody>
</table>

Non-randomized studies comparing risk of death

<table>
<thead>
<tr>
<th>Study</th>
<th>HR (95% CI)</th>
<th>Weight</th>
<th>Death/N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nam (2012)</td>
<td>1.46 (0.62, 2.64)</td>
<td>12.66</td>
<td>23/526</td>
</tr>
<tr>
<td>Bogani (2014)</td>
<td>0.63 (0.25, 1.59)</td>
<td>5.90</td>
<td>17/130</td>
</tr>
<tr>
<td>Ditto (2015)</td>
<td>0.50 (0.07, 3.77)</td>
<td>2.37</td>
<td>4/120</td>
</tr>
<tr>
<td>Shah (2017)</td>
<td>0.87 (0.23, 3.32)</td>
<td>5.00</td>
<td>13/311</td>
</tr>
<tr>
<td>Melamed (2018)</td>
<td>1.65 (1.22, 2.22)</td>
<td>27.23</td>
<td>164/2461</td>
</tr>
<tr>
<td>Cusimano (2019)</td>
<td>2.20 (1.15, 4.19)</td>
<td>14.57</td>
<td>88/958</td>
</tr>
<tr>
<td>Doo (2019)</td>
<td>2.50 (0.71, 8.33)</td>
<td>5.73</td>
<td>10/105</td>
</tr>
<tr>
<td>Alfonzo (2019)</td>
<td>1.00 (0.50, 2.00)</td>
<td>13.33</td>
<td>32/434</td>
</tr>
<tr>
<td>Paik (2019)</td>
<td>0.59 (0.07, 4.92)</td>
<td>2.15</td>
<td>7/475</td>
</tr>
<tr>
<td>NCRAS (2019)</td>
<td>4.00 (1.50, 11.10)</td>
<td>7.98</td>
<td>3/929</td>
</tr>
<tr>
<td>Overall (I-squared = 32.1%, p = 0.151)</td>
<td>1.47 (1.07, 2.03)</td>
<td>100.00</td>
<td></td>
</tr>
</tbody>
</table>

Fig. 1.
Survival outcomes comparing surgical and radiographic lymph node assessment in locally advanced cervical cancer: A propensity score-matched analysis


Objective: The aim of this study was to investigate progression-free survival (PFS) and overall survival (OS) between women who underwent surgical versus radiographic assessment of pelvic and paraaortic (PA) lymph nodes (LN) prior to chemoradiation therapy for locally advanced cervical cancer (LACC).

Method: In this multisite retrospective cohort analysis, patients with stage IB2–IIIB (FIGO 2009) squamous cell, adenocarcinoma, and adenosquamous carcinoma of the cervix who completed concurrent chemoradiation therapy (CCRT) between 2000 and 2017 from the Mayo Clinic Cancer Registry were identified. A 1:2 propensity score matching using staging, histology, and LN metastasis between surgical and imaging groups was performed, and PFS and OS were compared. Demographics, perioperative variables, complications, and chemoradiotherapy treatment characteristics were evaluated.

Results: A total of 148 patients were included (35 surgical, 113 imaging). After propensity score matching, 35 from the surgical group and 70 from the imaging group were included. There were no statistical differences in baseline characteristics. The median follow-up time was 41 months (range 7–218 months) for the surgical group and 51.5 months (range 7–198 months) for the imaging group. Five-year PFS was 62.6% for the surgical group and 72.4% for the imaging group (HR = 1.11, 95% CI 0.54–2.30, P = 0.77). Five-year OS was 70.2% for the surgical group and 70.5% for the imaging group (HR = 1.02, 95% CI 0.46–2.29, P = 0.96). FIGO stage, PALN metastasis, and parametrical involvement were found to be poor prognosticators for PFS and OS in univariate analysis. Only PALN metastasis significantly predicted unfavorable PFS (HR = 2.76, 95% CI 1.23–6.18, P = 0.01) and OS (HR = 3.46, 95% CI 1.40–8.55, P = 0.01) in multivariate analysis. There were no differences in locoregional recurrence and distant metastasis between the 2 groups (P = 0.33 and P = 0.59, respectively).

Conclusion: Patients who underwent radiographic assessment of pelvic and PALN had comparable PFS and OS to patients who underwent surgical assessment in LACC. Radiographic assessment of LN can be utilized for staging and treatment planning in patients with LACC.

Pelvic exenteration in gynecologic oncology: Analysis of short- and long-term surgical outcomes

M. Maruccio, A. Aloisi, V. Minicucci, C. Personeni, M. Palumbo, I. Betella, F. Multinu, S. Bogliolo, A.L. Garbi, M.T. Achilarre, G.D. Aletti, V. Zanagnolo, N. Colombo and A. Maggioni. *IEO, European Institute of Oncology IRCCS, Milan, Italy, †European Institute of Oncology and University of Milan-Bicocca, Milan, Italy, ‡European Institute of Oncology IRCCS and University of Milan-Bicocca, Milan, Italy

Objective: Pelvic exenteration is indicated when there are no other curative alternatives in advanced primary or recurrent gynecological cancer confined to the pelvis. Moreover, palliative exenteration can be considered when disease-related symptoms are uncontrollable with other therapeutic options. New surgical techniques and improved perioperative care have improved patient outcomes over the years. Our main objective is to assess the safety and feasibility of pelvic exenteration for gynecologic malignancies.

Method: All patients who underwent pelvic exenteration at our institution from June 1996 to March 2019 were retrospectively collected. Patient and perioperative data were recorded. We included all identified patients regardless of type of pelvic exenteration (anterior, posterior, or total). Dindo-Clavien classification was used to assess complications; 90-day mortality was also noted. Multivariate logistic regression analysis was performed to identify potential independently associated predictors of grade ≥3 complications or of 90-day mortality. Statistical significance was set at P > 0.05.

Results: We identified 208 patients; their characteristics and perioperative surgical outcomes are depicted in Table 1. Median age was 56 years. Median BMI was 24. The most common oncologic diagnosis was cervical cancer (n = 123, 59.1%), and the most frequent histology was squamous (n = 139, 66.8%). The most frequent indication for surgery was recurrent disease (55.3%). A total pelvic exenteration was performed in 106 (50.9%) cases, an anterior exenteration in 85 (40.9%), and a posterior in 17 (8.2%). Seventy-four (35.6%) patients experienced postoperative complications. The most common early complications were intestinal (27.1%). The most common late complications were urinary (63.2%). Eleven (5.3%) patients were readmitted within 30 days from surgery, and 12 (5.8%) patients died within 90 days from surgery. No variables were associated with major complications, while age (HR = 0.9, 95% CI 0.8–0.9, P = 0.03) and major complications (HR = 8.6, 95% CI 2.1–35.8, P = 0.003) were significantly associated with 90-day mortality at multivariate analysis.

Conclusion: Exenterative surgery appears to be safe. The incidence of mortality and complications is consistent with those reported in the literature. However, age and occurrence of a major complications can be related to unfavorable outcomes.
Table 1. Patients’ Characteristics and perioperative surgical outcomes (n = 208).

<table>
<thead>
<tr>
<th>Variable</th>
<th>median</th>
<th>range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>56</td>
<td>23-81</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>24</td>
<td>13-64</td>
</tr>
<tr>
<td>N%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Type of tumor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cervical</td>
<td>123</td>
<td>59.1</td>
</tr>
<tr>
<td>vulvar</td>
<td>21</td>
<td>10.1</td>
</tr>
<tr>
<td>vaginal</td>
<td>30</td>
<td>14.4</td>
</tr>
<tr>
<td>endometrial</td>
<td>18</td>
<td>8.6</td>
</tr>
<tr>
<td>other</td>
<td>16</td>
<td>7.6</td>
</tr>
<tr>
<td>Histotypes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>squamous</td>
<td>139</td>
<td>66.8</td>
</tr>
<tr>
<td>adenocarcinoma</td>
<td>46</td>
<td>22.1</td>
</tr>
<tr>
<td>adenosquamous</td>
<td>7</td>
<td>3.4</td>
</tr>
<tr>
<td>endometrioid</td>
<td>4</td>
<td>1.9</td>
</tr>
<tr>
<td>other</td>
<td>8</td>
<td>3.6</td>
</tr>
<tr>
<td>unknown</td>
<td>4</td>
<td>1.9</td>
</tr>
<tr>
<td>Reason for surgery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>persistent disease</td>
<td>83</td>
<td>39.9</td>
</tr>
<tr>
<td>recurrent disease</td>
<td>115</td>
<td>55.3</td>
</tr>
<tr>
<td>palliation</td>
<td>10</td>
<td>4.8</td>
</tr>
<tr>
<td>Preoperative treatment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>chemotherapy</td>
<td>45</td>
<td>21.6</td>
</tr>
<tr>
<td>radiotherapy</td>
<td>7</td>
<td>-</td>
</tr>
<tr>
<td>chemoradiation</td>
<td>3</td>
<td>-</td>
</tr>
<tr>
<td>Type of exenteration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>total</td>
<td>106</td>
<td>50.9</td>
</tr>
<tr>
<td>anterior</td>
<td>85</td>
<td>40.9</td>
</tr>
<tr>
<td>posterior</td>
<td>17</td>
<td>8.2</td>
</tr>
<tr>
<td>Stoma</td>
<td></td>
<td></td>
</tr>
<tr>
<td>temporary</td>
<td>112</td>
<td>52</td>
</tr>
<tr>
<td>permanent</td>
<td>27¥</td>
<td>24.1</td>
</tr>
<tr>
<td>Urinary diversion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>continent</td>
<td>191</td>
<td>51.9</td>
</tr>
<tr>
<td>incontinent</td>
<td>111</td>
<td>58.1</td>
</tr>
<tr>
<td>Intraoperative radiotherapy (IORT)</td>
<td>53</td>
<td>25.5</td>
</tr>
<tr>
<td>Tumor size (mean ± DS)</td>
<td>39.4 ± 24.2</td>
<td></td>
</tr>
<tr>
<td>Perioperative complication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Positive</td>
<td>62</td>
<td>29.8</td>
</tr>
<tr>
<td>Close (≤ 5mm)</td>
<td>21</td>
<td>10.1</td>
</tr>
<tr>
<td>negative</td>
<td>125</td>
<td>60.1</td>
</tr>
<tr>
<td>Pelvic lymph nodes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>positive</td>
<td>57</td>
<td>27.4</td>
</tr>
<tr>
<td>negative</td>
<td>126</td>
<td>60.6</td>
</tr>
<tr>
<td>not assessed</td>
<td>25</td>
<td>12</td>
</tr>
<tr>
<td>Adjuvant treatments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>chemotherapy</td>
<td>75</td>
<td>36.1</td>
</tr>
<tr>
<td>radiotherapy</td>
<td>59</td>
<td>-</td>
</tr>
<tr>
<td>chemoradiation</td>
<td>13</td>
<td>-</td>
</tr>
<tr>
<td>Perioperative complication</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early</td>
<td>48</td>
<td>-</td>
</tr>
<tr>
<td>Late</td>
<td>38</td>
<td>-</td>
</tr>
<tr>
<td>Early complications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>genitourinary</td>
<td>48</td>
<td>-</td>
</tr>
<tr>
<td>wound</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>medical</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>infective</td>
<td>11</td>
<td>-</td>
</tr>
<tr>
<td>gastrointestinal</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>Late complications</td>
<td></td>
<td></td>
</tr>
<tr>
<td>genitourinary</td>
<td>38</td>
<td>-</td>
</tr>
<tr>
<td>wound</td>
<td>24</td>
<td>-</td>
</tr>
<tr>
<td>medical</td>
<td>11</td>
<td>-</td>
</tr>
<tr>
<td>infective</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td>gastrointestinal</td>
<td>13</td>
<td>-</td>
</tr>
<tr>
<td>Readmission within 30 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>5.3</td>
<td></td>
</tr>
<tr>
<td>Death within 90 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>5.8</td>
<td></td>
</tr>
</tbody>
</table>

¥ only 17 patients were actually recanalized
* 74 patients some of whom experienced more than 1 complication
Objective: Pelvic exenteration has been recognized as potentially curative for selected patients with persistent or recurrent gynecologic malignancies confined in the pelvis. Our main objective is to determine disease-free survival (DFS), overall survival (OS), and factors associated with recurrence.

Methods: All patients who underwent pelvic exenteration at our institution from June 1996 to October 2018 were retrospectively collected. Patient and perioperative data were recorded. We included all identified patients regardless of type of pelvic exenteration (anterior, posterior, or total). Dates and sites of recurrence were identified. DFS and OS were calculated. Multivariate logistic regression was performed to identify factors associated with recurrence. Statistical significance was set at $P > 0.05$.

Results: We analyzed 134 patients. Patient characteristics and oncologic outcomes are depicted in Table 1. Median follow-up was 35 months. Three-year DFS and OS were 80.4% (SE ±3.5%) and 86% (SE ±3.2%), respectively. The most common diagnosis was cervical cancer (59.7%), and the most common histology was squamous (62.7%). Sixty-four (47.8%) patients developed a recurrence: 21 local, 20 distant, and 23 multisite. At univariate analysis, squamous histology (HR = 0.3, 95% CI 0.1–0.9, $P = 0.02$), positive lymph nodes (HR = 2.8, 95% CI 1.2–6.8, $P = 0.02$), and no adjuvant treatments (HR = 3.3, 95% CI 1.6–6.9, $P = 0.001$) were associated with recurrence. At multivariate analysis, factors associated with recurrence were tumor size (HR = 0.2, 95% CI 0.06–0.9, $P = 0.03$), positive lymph nodes (HR = 3.9, 95% CI 1.2–12.9, $P = 0.02$), and no use of adjuvant treatments (HR = 3.1, 95% CI 1.2–8.2, $P = 0.02$). When stratified by tumor size, the 3-year DFS for tumors ≤5 cm was 58.1% (SE ±5.1%) compared to 35.4% (SE ±10.3%) for tumors >5 cm ($P = 0.02$), and the 3-year OS was 73.7% (SE ±4.7%) compared to 73.6% (SE ±10.6%), respectively ($P = 0.5$). When stratified by lymph node status, the 3-year DFS was 33.1% (SE ±10.3%) for positive lymph nodes compared to 59.1% (SE ±5.5%) for negative ones ($P = 0.003$), and the 3-year OS was 83.9% (SE ±4.3%) compared to 47.8% (SE ±10.6%), respectively ($P < 0.001$).

Conclusion: Exenterative surgery may have a potentially curative role in well-selected patients. Tumor size and positive lymph nodes seem to be related to risk of recurrence, while use of adjuvant treatments seems to reduce risk of recurrence.

Table 1. Patients’ Characteristics and perioperative surgical outcomes (n = 134).

<table>
<thead>
<tr>
<th>Variable</th>
<th>median</th>
<th>range</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (years)</strong></td>
<td>56</td>
<td>31-81</td>
</tr>
<tr>
<td><strong>Body mass index (kg/m2)</strong></td>
<td>24</td>
<td>17-64</td>
</tr>
<tr>
<td>N (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Type of tumor</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>cervical</td>
<td>80</td>
<td>59.7</td>
</tr>
<tr>
<td>vulvar</td>
<td>12</td>
<td>8.9</td>
</tr>
<tr>
<td>vaginal</td>
<td>18</td>
<td>13.4</td>
</tr>
<tr>
<td>endometrial</td>
<td>13</td>
<td>9.7</td>
</tr>
<tr>
<td>other</td>
<td>11</td>
<td>8.3</td>
</tr>
<tr>
<td><strong>Histotypes</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>squamous</td>
<td>84</td>
<td>62.7</td>
</tr>
<tr>
<td>adenocarcinoma</td>
<td>34</td>
<td>25.4</td>
</tr>
<tr>
<td>adenosquamous</td>
<td>6</td>
<td>4.5</td>
</tr>
<tr>
<td>endometrioid</td>
<td>4</td>
<td>2.9</td>
</tr>
<tr>
<td>other</td>
<td>6</td>
<td>4.5</td>
</tr>
<tr>
<td><strong>Grade</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>15</td>
<td>11.1</td>
</tr>
<tr>
<td>2</td>
<td>38</td>
<td>28.4</td>
</tr>
<tr>
<td>3</td>
<td>34</td>
<td>25.4</td>
</tr>
<tr>
<td>unknown</td>
<td>47</td>
<td>35.1</td>
</tr>
<tr>
<td><strong>Reason for surgery</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>persistent disease</td>
<td>51</td>
<td>38.1</td>
</tr>
<tr>
<td>recurrent disease</td>
<td>83</td>
<td>61.9</td>
</tr>
<tr>
<td><strong>Preoperative treatment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>chemotherapy</td>
<td>28</td>
<td>20.9</td>
</tr>
<tr>
<td>radiotherapy</td>
<td>23</td>
<td>-</td>
</tr>
<tr>
<td>chemoradiation</td>
<td>4</td>
<td>-</td>
</tr>
<tr>
<td><strong>Type of exenteration</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>total</td>
<td>73</td>
<td>54.5</td>
</tr>
<tr>
<td>anterior</td>
<td>50</td>
<td>37.3</td>
</tr>
<tr>
<td>posterior</td>
<td>11</td>
<td>8.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stoma</th>
<th>temporary</th>
<th>76</th>
<th>32.9</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>permanent</td>
<td>51</td>
<td>67.1</td>
</tr>
<tr>
<td>Urinary diversion</td>
<td>123</td>
<td>57</td>
<td>66</td>
</tr>
<tr>
<td>continent</td>
<td>46.3</td>
<td>53.7</td>
<td></td>
</tr>
<tr>
<td>incontinent</td>
<td>25.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intraoperative radiotherapy (IORT)</td>
<td>53</td>
<td>39.4 ± 22.1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Margins</th>
<th>Positive</th>
<th>42</th>
<th>31.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Close (≤ 5mm)</td>
<td>18</td>
<td>13.4</td>
<td></td>
</tr>
<tr>
<td>negative</td>
<td>74</td>
<td>55.2</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pelvic lymph nodes</th>
<th>positive</th>
<th>30</th>
<th>22.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>negative</td>
<td>87</td>
<td>64.9</td>
<td></td>
</tr>
<tr>
<td>not assessed</td>
<td>17</td>
<td>12.7</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Adjuvant treatments</th>
<th>chemotherapy</th>
<th>45</th>
<th>42.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>radiotherapy</td>
<td>10</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>chemoradiation</td>
<td>2</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

| Relapse | 64 | 47.8 |

<table>
<thead>
<tr>
<th>Site of relapse</th>
<th>local</th>
<th>21</th>
<th>32.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>distant</td>
<td>20</td>
<td>31.3</td>
<td></td>
</tr>
<tr>
<td>multisite</td>
<td>23</td>
<td>35.9</td>
<td></td>
</tr>
</tbody>
</table>

¥ only 16 patients were actually recanalized.

---

**363 - Poster Session**

**Evaluation of folate receptor-mediated detection as an alternative diagnostic tool for cervical intraepithelial neoplasia 2+**

D.S. Moos. **GY Highland Biotech, Watchung, NJ, USA**

**Objective:** FRD® (folate receptor-mediated detection) has been proposed as a reliable method for screening cervical intraepithelial neoplasia 2+ (CIN2, CIN3, and cervical cancer). This study investigates the clinical significance of FRD by comparing the accuracy of FRD with that of HPV testing and thinprep cytology (TCT).

**Method:** From March 2019 to April 2019, 81 patients in the gynecology clinic of the Second Hospital of Jilin University received screening with FRD, TCT, and HPV examinations upon visiting the clinic. If any of the 3 tests provided a positive result, colposcopy was performed with biopsy being the gold standard for pathological diagnosis.

**Results:** The sensitivity of FRD, TCT, and HPV in the diagnosis of cervical intraepithelial neoplasia 2+ (CIN2, CIN3, cervical cancer) was 72.22%, 72.22%, and 83.33%, respectively. The specificity of FRD, TCT, and HPV in detection of CIN2+ was 65.07%, 60.31%, and 25.39%, respectively. The accuracy of FRD, TCT, and HPV in diagnosis of CIN2+ was 66.67%, 62.96%, and 38.27%, respectively. The positive predictive value (PPV) of FRD, TCT, and HPV in diagnosis of CIN2+ was 37.14%, 34.21%, and 38.27%, respectively, while the negative predictive value (NPV) was 89.13%, 88.37%, and 84.21%, respectively.

**Conclusion:** FRD provides high values of sensitivity, specificity, and accuracy. FRD has advantages in detection speed (<60 seconds), economic cost, and patient compliance. FRD can be an effective and advantageous tool for the primary screening of cervical intraepithelial neoplasia 2+ (CIN2, CIN3, cervical cancer), especially in regions with hard-to-reach patients. FRD could also provide significant value as a co-test with HPV testing.

---

**364 - Poster Session**

**Racial disparities in survival in patients with cervical cancer**

L.H. Matteia, D. Sighoko, N.K. Lee, D. Ansell, S.B. Dewdney. **aRush University Medical Center, Chicago, IL, USA, bMetropolitan Chicago Breast Cancer Task Force, Chicago, IL, USA, cThe University of Chicago Medicine, Chicago, IL, USA**

**Objective:** Cervical cancer mortality has decreased over the last 10 years; however, significant racial disparities persist. This study used the National Cancer Data Base (NCDB) to examine trends in cervical cancer mortality and to identify targets for intervention.

**Method:** De-identified NCDB data were obtained for non-Hispanic white, non-Hispanic black, and Hispanic women diagnosed with cervical cancer from 2004 to 2014. Stage was defined using American Joint Committee on Cancer (AJCC) staging. Subjects listed as stage
0 or unknown stage were excluded. The data were analyzed by using STATA.15. Mortality (in percentage) and survival from time of diagnosis were assessed by using the NCDB vital status and time to last contact or death.

**Results:** We identified 90,306 cases of invasive cervical cancer by using the above criteria. Non-Hispanic black patients had the highest mortality (42.13%) compared to non-Hispanic white patients (34.31%, \( P < 0.0001 \)). These differences persisted when examining trends in survival over 5 years from time of diagnosis: non-Hispanic black women had a lower percentage survival (44.66%) than non-Hispanic white and Hispanic women (50.08%, \( P < 0.0001 \); 58.00%, \( P < 0.0001 \), respectively). When examined by AJCC stage, 5-year survival did not differ between non-Hispanic white and non-Hispanic black patients with stage IV disease (\( P = 0.42 \)); however, there was a significant difference in 5-year survival between racial groups with stage I disease: 80.47% of non-Hispanic white and 82.75% of Hispanic patients were alive 5 years from diagnosis compared to 70.91% of non-Hispanic black patients (\( P < 0.0001 \)).

**Conclusion:** Data published by the CDC indicate that while the overall incidence of and mortality from cervical cancer are declining, as of 2013 non-Hispanic black women were still 2 times more likely to die of cervical cancer than non-Hispanic white women. Our data demonstrate that even in early-stage cervical cancer, non-Hispanic black women are more likely to die of their disease. Delays in initiation of treatment and deviations from standard-of-care approaches to treatment of early-stage disease are known to adversely affect survival. Although the cause of this disparity is not evaluated in this study, the racial disparity seen is concerning and needs further evaluation.

---

**365 - Poster Session**

**Management and outcomes of partial metabolic response on post-therapy positron emission tomography in cervical cancer patients treated with definitive radiation**

T.R. McKinnisha, M. Greenwadea, E. Rosenthalb, I. Wilkinson-Ryanb, J.K. Schwarzc, M.A. Powella, D.G. Mutcha and P.H. Thakera. aWashington University School of Medicine in St. Louis, St. Louis, MO, USA, bDartmouth Hitchcock Medical Center, Lebanon, NH, USA, cWashington University School of Medicine, St Louis, MO, USA

**Objective:** The aim of this study was to describe the management and analyze the outcomes of cervical cancer patients with a partial metabolic response on post-radiation \(^{18}\)F-fluorodeoxyglucose positron emissions tomography (FDG-PET) scan.

**Method:** Cervical cancer patients treated with definitive radiation between 1997 and 2015 with a partial response on first post-therapy FDG-PET were identified from a prospective database. Patient demographics and treatment modalities were summarized with descriptive statistics. Outcomes were compared with \( \chi^2 \) tests. Kaplan-Meier methods were used to assess overall survival (OS) and progression-free survival (PFS).

**Results:** Eighty-one women (median age 53 years) with stage IB1–IVB disease had evidence of partial metabolic response on first post-treatment FDG-PET. Initial therapy consisted of a mean radiation dose of 4,946 cGy to the pelvis with brachytherapy boost for a median of 49 (20–109) days. First post-therapy FDG-PET was performed a median of 103 (range 37–170) days after treatment completion. Sixty-six (81%) patients had cervical FDG-PET uptake, and 55 (68%) had uptake isolated to the cervix alone with no nodal involvement. Twelve patients underwent immediate cervical biopsy to confirm persistence, 8 (67%) of which were positive. One (12.5%) of these patients underwent hysterectomy and was NED after 1 year; all others recurred, and 10 (83%) died of disease. Eleven women underwent additional treatment immediately after diagnosis of partial response including 6 chemotherapy and/or radiation therapy and 5 surgery. No difference was observed in recurrence or survival rates between patients managed with surgery, chemotherapy, or chemotherapy and/or radiation therapy (\( P = 0.66 \)). A total of 46 (57%) patients died from disease; 5 (6%) died of another cause; 4 (5%) were alive with disease at last follow-up; 24 (30%) had no evidence of disease; and 3 (4%) were lost to follow-up. For all partial responders, median OS and PFS were 33.9 (16.7–73.7) and 12.3 (8.4–52.0) months, respectively. See Table 1.

**Conclusion:** Persistent disease on first surveillance FDG-PET predicts poor outcomes in cervical cancer patients. Surveillance FDG-PET is clearly indicated to detect partial response and recurrence. Lymphatic involvement and biopsy-proven disease portend a poor prognosis.

**Table 1.** Distribution of FDG avidity in initial surveillance FDG-PET demonstrating partial response to radiation + chemotherapy for cervical cancer and selected outcomes

<table>
<thead>
<tr>
<th>Nodes Negative</th>
<th>Nodes Positive</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>P only</td>
<td>PA only</td>
<td>SCV only</td>
</tr>
<tr>
<td>P + PA + SCV +</td>
<td>P + PA + SCV +</td>
<td></td>
</tr>
</tbody>
</table>

---
### Table 1. Reasons for incomplete cervical cancer treatment in HIV positive and HIV negative women.

<table>
<thead>
<tr>
<th></th>
<th>HIV+ (n=10/27)</th>
<th>HIV- (n=21/54)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reasons for incomplete treatment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social</td>
<td>4 (40%)</td>
<td>11 (52.4%)</td>
<td>1.00</td>
</tr>
<tr>
<td>Medical</td>
<td>4 (40%)</td>
<td>8 (38.1%)</td>
<td></td>
</tr>
<tr>
<td>Disease-related</td>
<td>1 (10%)</td>
<td>2 (9.5%)</td>
<td></td>
</tr>
</tbody>
</table>

Missing data: 1 HIV positive patient had unknown reason for incompletion.
Objective: Human papillomavirus (HPV) vaccination significantly reduced the incidence of cancerous/precancerous condition of the genital tract. The recent introduction of nonavalent vaccination improves coverage against HPV, covering 9 different HPV types. Here, we sought to investigate trends in prevalence among various HPV types in order to assess the unmet clinical needs of women affected by HPV-related disease.

Method: Data on consecutive patients undergoing sampling for HPV DNA testing from 1998 to 2018 were retrospectively identified. HPV types were classified at HR according to the classification of the International Agency for Research on Cancer (IARC). IARC identified 13 HR-HPV types: 7 covered by currently available nonavalent vaccines and 5 not yet covered by any available vaccine. We aimed to assess the prevalence of the latter group among the general population and women affected by genital dysplasia (vulvar, vaginal, and cervical dysplasia 2+).

Results: We enrolled 15,138 patients having HPV testing; 6,373 and 8,765 women were positive and negative, respectively, for the presence of at least 1 HR HPV type. Overall, 4,159 (65.3%), 1500 (23.5%), and 714 (11.2%) women had HPV types covered by nonavalent vaccination, not covered by nonavalent vaccination, and coinfections of HPV types of both groups, respectively. At least 1 HR-HPV type was detected in 1,241 patients with genital dysplasia: 832 (67.1%), 291 (23.4%), and 118 (9.5%) women had HPV types covered by nonavalent vaccination, not covered by nonavalent vaccination, and coinfections, respectively, of HPV types of both groups. Over the 20-year study period, the number of HPV types not covered by nonavalent vaccine increased dramatically (from 4% to 16%, \( P < 0.001 \)). Similarly, for patients with genital dysplasia, HR-HPV types not covered by nonavalent vaccine increased from 3% to 13% \( (P < 0.001) \).

Conclusion: Our data highlight that HPV types covered by nonavalent vaccines represent the main types associated with genital dysplasia. However, over the study period we observed an increasing prevalence of coinfections and HR-HPV types not covered by nonavalent vaccines, thus suggesting the development of more complete vaccines against HPV.

368 - Poster Session
Time to cervical cancer recurrence on maintenance bevacizumab
A.D. Borgstadt and C.A. Mathews. Women & Infants Hospital, Brown University, Providence, RI, USA

Objective: Patients with recurrent or metastatic cervical cancer have limited treatment options. GOG 240 found a 4-month improvement in overall survival (OS) with the addition of bevacizumab to standard chemotherapy in these patients. In clinical practice, single-agent bevacizumab is often continued after cytotoxic chemotherapy; the efficacy is unknown.

Method: A retrospective chart review of all patients who received maintenance bevacizumab following cytotoxic chemotherapy upon diagnosis of metastatic, persistent, or recurrent cervical cancer was conducted. Time to recurrence (PFS) and OS were evaluated with descriptive statistics. Secondary outcomes measured were quality of life determined by hospital admissions and recorded adverse effects.

Results: Twenty-one patients were found to be eligible via chart review. Of these patients, 3 (14.2%) continue bevacizumab maintenance, 2 additional patients (9.5%) remain progression free, and 12 patients (57%) are still living. Median PFS in our small cohort was 15.3 months; OS is 21.0 months. Among those who have progressed and those who are deceased, the PFS and OS are 14.0 months and 17.0 months, respectively. Historical data from GOG 240 found a PFS of 8.2 months and OS of 17.0 months when cytotoxic therapy was continued with bevacizumab. Of our population, 14 patients (67%) had recurrent and 7 patients (33%) had advanced metastatic disease. The average number of cycles of cytotoxic chemotherapy was 7 (range 3–11). The average number of single-agent bevacizumab cycles was 9 (range 2–24). The most common adverse side effects were fatigue, hypertension, and neuropathy. Average number of hospitalizations during treatment was 1 (range 0–6).

Conclusion: This small cohort of advanced or recurrent cervical cancer patients suggests the current practice of continuing single-agent bevacizumab is feasible. For further evaluation, a larger cohort is necessary, and additional institutions will be contacted to collect the appropriate amount of data to power our study.

369 - Poster Session
The impact of a universal HPV vaccination program on lower genital tract dysplasia and genital warts
M. Clark\textsuperscript{a}, N. Jembere\textsuperscript{b,c} and R. Kupets\textsuperscript{a,b,c}. \textsuperscript{a}University of Toronto, Toronto, ON, Canada, \textsuperscript{b}Cancer Care Ontario, Toronto, ON, Canada, \textsuperscript{c}Sunnybrook Cancer Centre/University of Toronto, Toronto, ON, Canada

Objective: The aim of this study was to assess the impact of Ontario’s school-based human papillomavirus (HPV) vaccination program targeting grade 8 girls on reducing rates of pre-invasive cervical dysplasia, utilization of colposcopy services and treatment rates for genital warts, cervical conization, cryotherapy and laser vaporization of lower-genital-tract pre-invasive dysplasia.
Method: Women born in 1995 in Ontario, Canada, were the first cohort of 8th grade female students to receive the quadrivalent vaccine. Uptake rates were approximately 60%. We followed these women from age 18–23 years (5 years) and identified low- and high-grade Pap test cytology results, referral and attendance at colposcopy, treatment of HPV-related warts, and treatment of lower-genital tract dysplasia using Ontario health care administrative databases. We compared the incidence of these outcomes to those in women born in 1985, followed during the same age period of 18–23 years, prior to access to the HPV vaccine (considered as the unvaccinated comparison group). We calculated relative risk ratios for all outcomes over the 5-year period for the unvaccinated group compared to the vaccinated group. Results were stratified at the income and geographic level.

Results: A total of 100,020 women were included in the vaccinated cohort and compared to 121,019 unvaccinated females. Among vaccinated women, 5.2% had cytologic abnormalities, and 2.7% required some form of treatment for pre-invasive disease or warts compared to 9.2% and 5.2%, respectively, among unvaccinated women over a 5-year period. The relative risk of developing a low-grade cytologic abnormality if unvaccinated was 1.69 and 3.74 for high-grade abnormalities. The relative risk of requiring colposcopy if unvaccinated was 1.94, and they were 6.15 times more likely to require treatment compared to the vaccinated cohort. There were no significant differences between socioeconomic groups and geographic regions.

Conclusion: Organized vaccination programs for adolescent females are effective at decreasing rates of cervical dysplasia, especially high-grade lesions, and lead to reduced need for colposcopy, treatment of HPV-related warts, and pre-invasive disease even at early ages. With the introduction of the nonavalent formulation, we anticipate even greater benefit.

---

### 370 - Poster Session

**Prognostic implications of the addition of nodal status to uterine cervix cancer staging**

S.E. Jordan, S. Yadegarynia, M.P. Schlumbrecht, J.M. Pearson, L. Portelance, A.H. Wolfson, B. Slomovitz and M. Huang. *University of Miami, Sylvester Comprehensive Cancer Center, Miami, FL, USA*

**Objective:** In 2018, the International Federation of Gynecology and Obstetrics (FIGO) revised cervical cancer staging. The revised staging includes an expansion of stage III to include a notation of pelvic and paraaortic lymph node (LN) positivity. Our objective was to compare outcomes in locally advanced cervical cancer stratified by LN status in a mostly minority patient population.

**Method:** Cervical cancer patients diagnosed and treated between 2012 and 2017 at a single institution were identified, and charts were abstracted. Based on 2009 FIGO clinical staging criteria, a cohort was selected including stage IB2–IVA disease treated in the first line at our institution. Data were analyzed using Fisher exact, \(\chi^2\), Cox regression, and Kaplan-Meier analyses.

**Results:** A total of 246 patients were identified, of which 151 locally advanced patients were included. Women were mostly white Hispanic (89, 58.9%); 28 (18.5%) were Afro-Caribbean or Afro-Latina; 23 (15.2%) were African American; and 11 (7.3%) were white non-Hispanic. Eighty-six (56.9%) patients had pelvic LN, and 40 (26.4%) had paraaortic LN positivity. Median age at diagnosis was 50 (range 24–82) years. Median follow-up was 28.3 (range 1.3–89.1) months. Survival statistics are presented in Table 1. Site of recurrence was not affected by LN status. Most patients with positive LNs (68.6% pelvic, 52.5% paraaortic) were treated with chemoradiation, chemoradiation with systemic chemotherapy (12.8% pelvic, 17.5% paraaortic), or systemic chemotherapy alone (8.1% pelvic, 17.5% paraaortic).

**Conclusion:** Accounting for nodal positivity in the initial staging of cervical cancer is prognostically valuable. Disease-free and overall survival are worse for women with locally advanced cervical cancer with LN-positive disease.

**Table 1.** Progression free and overall survival by LN status.

<table>
<thead>
<tr>
<th>2009 Stage(n)</th>
<th>Progression Free Survival</th>
<th>Overall Survival</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HR (95% CI)</td>
<td>HR (95% CI)</td>
</tr>
<tr>
<td></td>
<td>Pelvic + p</td>
<td>Para-Aortic + p</td>
</tr>
<tr>
<td>IB2-IVA (151)</td>
<td>4.71 (2.4-9.4) &lt;0.001</td>
<td>3.3 (1.9-5.6) &lt;0.001</td>
</tr>
<tr>
<td>IB2/IIA2 (26)</td>
<td>4.49 (0.82-24.6) 0.083</td>
<td>23.4 (1.47-375.7) 0.026</td>
</tr>
<tr>
<td>IIB (72)</td>
<td>19.2 (2.56-143.6) 0.004</td>
<td>4.83 (1.98-11.8) 0.001</td>
</tr>
</tbody>
</table>
**371 - Poster Session**

**FIGO 2009 versus 2018 staging for cervical cancer: A comparative study on prediction of survival based on stage**

C.R. Washington\(^a\), D. Zhao\(^a\) and K.N. Moore\(^b\). \(^a\)The University of Oklahoma Health Sciences Center, Oklahoma City, OK, USA, \(^b\)The University of Oklahoma Stephenson Cancer Center, Oklahoma City, OK, USA

**Objective:** Correct staging is the foundation in cancer treatment and has implications for prognosis and treatment planning. The FIGO staging for cervical cancer was revised in 2018. We have evaluated the revision to determine whether adjusting for patient staging, with a historic cohort, improves stratification for patient outcomes.

**Method:** Retrospective cohorts from 2009 to 2015 were assembled. Inclusion criteria were as follows: diagnosis of cervical cancer, appropriate documentation of staging, follow-up documented in the electronic medical record for treatment, and surveillance. The groups were assessed for differences in clinical characteristics and comorbid conditions, demographics, surgical and disease-specific treatment, and survival outcomes.

**Results:** A total of 394 women were identified from the clinical records from 2009 to 2015 and screened for inclusion; 272 women met inclusion criteria. There were 140 (52.2%) of women restaged based on the FIGO 2018 staging. Restaging increased the number of stage III cases from 35 to 87. The histological subtype was mainly squamous cell carcinoma (78.1%). Median age was 47.0 years. Median BMI was 32.4, and 137 (55.5%) were smokers. There were 119 (43.8%) patients who underwent some form of surgical treatment: 136 (50.0%) patients had chemoradiation, 8 (2.9%) patients had chemotherapy alone, and 7 (2.6%) patients had radiation alone. A total of 105 (39.3%) patients were enrolled on clinical trial. Progression-free survival (PFS) and overall survival (OS) were obtained for stage III–IV patients with stage III patients’ prognosis altered by restaging. For patients with stage III disease, from 2009 to 2018 staging, PFS was found to be 15.2 versus 38.1 months (\(P = 0.11\)) and OS was 34.3 versus 73.6 months (\(P = 0.04\)), respectively. FIGO 2018 PFS was noted to vary between patients within stage IIIA–B disease compared to stage IIIC disease with a PFS of 12.4 and 53.1 months (\(P = 0.03\)) and OS 34.3 and 83.9 (\(P = 0.04\)), respectively. PFS for patients with stage I–II disease was unable to be obtained because of the low number of recurrences in these groups.

**Conclusion:** The FIGO 2018 staging system for cervical cancer has improved the ability to provide more accurate prognostic information regarding survival. Patients with a diagnosis of stage IIIC diseases were shown to have an improved PFS and OS compared to patients with stage IIIA–B disease. Patients who will be categorized as stage IIIC using the FIGO 2018 staging system should continue to be aggressively treated. Further studies need to be performed with a larger cohort.

---

**372 - Poster Session**

**High expression of NANOG and CRY1 is involved with tumor progression and poor prognosis in patients with cervical cancer**

G.H. Han\(^a\), D.B. Chay\(^b\), H. Cho\(^bc\), S. Kim\(^d\) and J.H. Kim\(^a\). \(^a\)Gangnam Severance Hospital, Seoul, South Korea, \(^b\)Yonsei University College of Medicine, Seoul, South Korea, \(^c\)Gangnam Severance Hospital, Yonsei University College of Medicine, Seoul, South Korea

**Objective:** Nanog is a well-known transcription factor regulating embryonic stem cell maintenance. Recently, evidence has been accumulated that over-expression of Nanog is intimately involved in tumorigenesis. However, the role of Nanog in cervical cancer has not been elucidated. Here, we investigated the expression and clinical significance of Nanog in cervical cancer.

**Method:** In vitro assessment of cell functions by cell viability assay, cell migration, and invasion assay was evaluated using Nanog knockdown cervical cancer cell lines. To define the clinical significance of Nanos and CRY1, we performed immunohistochemistry on 170 cervical cancers and 263 cervical intraepithelial neoplasia (CIN) samples. The clinicopathologic variables, including the survival of cervix cancer patients, were compared to evaluate the clinical significance of Nanog and CRY1.

**Results:** Nanog and CRY1 expression was higher in cervical cancer tissues than in CIN tissues and normal epithelial tissues (both \(P < 0.001\)). Importantly, Nanog and CRY1 over-expression was associated with poor chemoradiation response (\(P < 0.035\) and \(P < 0.003\), respectively). Multivariate survival analysis revealed that over-expression of Nanog (HR = 0.016, 95% CI 1.25–9.27, \(P = 0.016\)) is an independent prognostic factor for overall survival. Also, the combination of high Nanog and CRY1 expression showed the highest hazard ratio (5.87, 95% CI 2.18–15.82, \(P < 0.001\)) for overall survival. In vitro results also demonstrated the knockdown of Nanog was associated with increased cell viability (\(P < 0.001\)), migration (\(P < 0.001\), and growth (\(P < 0.001\) supporting the oncogenic role of Nanog in cervical cancer.
**Conclusion:** Over-expression of Nanog could be a good biomarker for the prediction of chemoradiation response. The results of survival analysis suggest a strong association between Nanog over-expression as well as CRY1 expression and poor overall survival, indicative of the potential role of this combination as a prognostic marker in clinical assessment.

---

**373 - Poster Session**

**Microscopic parametrial compromise in surgically treated high-grade neuroendocrine cervical carcinoma**

G. Salvo, P. Ramalingam, N.R. Gonzales, G. Chisolm and M. Frumovitz. The University of Texas MD Anderson Cancer Center, Houston, TX, USA

**Objective:** Most patients with early-stage high-grade neuroendocrine cervical cancer (HGNECC) undergo radical hysterectomy and pelvic lymphadenectomy; however, most will receive postoperative radiation and chemotherapy. Our aim was to determine the incidence of parametrial involvement (PI) in patients with clinical early-stage HGNECC and to evaluate factors associated with parametrial compromise.

**Method:** In this retrospective study we abstracted data from a large, international tumor registry for women with HGNECC. Women who underwent radical hysterectomy and pelvic lymphadenectomy as the initial treatment were included. Patients were excluded if they underwent neoadjuvant chemotherapy and/or radiation prior to surgery or had tumors clinically >4 cm. Patients with positive PI were compared to patients with no PI in terms of tumor size, histology, lymph vascular space invasion (LVSI), depth of invasion, and node positivity.

**Results:** Seventy-six patients met inclusion criteria. Median age was 37 years (range 22–69 years). Most patients (64%) had small cell carcinoma with 25% having large cell and 3% with mixed small and large cell carcinoma. Clinical stage distribution was IA (13%) and IB (87%). Overall, 8 patients (11%) had microscopic PI. All patients (100%) with positive PI had positive LVSI, while only 51% of patients with negative PI had LVSI ($P = 0.045$). Most patients with positive PI had positive nodes (88%) compared to only 17% of patients with negative PI ($P = 0.0003$). Median depth of invasion for patients with positive PI was 11 mm (range 6–25 mm) versus 7 mm (range 0–15 mm) for patients with negative PI ($P = 0.001$).

**Conclusion:** Patients with HGNECC undergoing radical hysterectomy surgery have an 11% risk of microscopic PI. As all patients with positive PI had other high-risk factors necessitating postoperative radiation therapy, should gynecologic oncologists consider simple instead of radical hysterectomy for women with early-stage HGNECC?

---

**374 - Poster Session**

**Understanding of cancer risk differs based on FIGO stage in women with cervical cancer**


**Objective:** Cervical cancer is a preventable disease. Efforts are needed not only to improve HPV vaccine uptake and adherence to Pap screening, but also to educate women about their modifiable risk factors. We aimed to assess how knowledgeable women with cervical cancer were about common risk factors for cervical cancer as well as the purpose of Pap screening.

**Method:** We administered a 64-item survey to cervical cancer patients during an outpatient visit with their gynecologic oncologist at a single academic institution from February to April 2019. Knowledge of Pap screening, sexual health risk factors related to cervical cancer, cigarette smoking, and HPV were assessed. Pearson $\chi^2$ test or Fisher exact test were used to assess differences in understanding based on early stage (I) versus later stages (II–IV). Median scores for each knowledge category were compared across sociodemographic factors and compared using Student $t$ test.

**Results:** Of the 50 women surveyed (85% response rate), there was profound lack of knowledge regarding risk factors for cervical cancer with 46 (92%) patients scoring below 80%. Median age was 54 years; 42 (84%) were white; 25 (50%) were unemployed; and 23 (46%) had a high school education or less. Compared to patients with stage I cervical cancer, those with later stages had worse understanding about sexual health risk factors (57% vs 28%, $P = 0.04$) and HPV (75% vs 50%, $P = 0.04$) (Table 1). Specific questions driving this knowledge disparity were related to intercourse without a condom (79% vs 38%, $P = 0.01$), having multiple sex partners (79% vs 38%, $P = 0.01$), and a true/false question, “People with HPV can usually tell when they have it.” Analysis by knowledge category revealed that older women (above the median age of 54 years) had a significantly lower median score than their younger counterparts in areas of Pap screening ($P = 0.01$), sexual health ($P < 0.01$), and HPV knowledge ($P < 0.01$). Knowledge of HP was the only category that showed a significant difference based on education, favoring women who had attained education beyond high school ($P < 0.01$).
Conclusion: While later stage cervical cancer patients had worse understanding of sexual health risk factors and HPV, overall there was a profound lack of knowledge across all knowledge categories among all survey respondents. Women need increased awareness and education regarding risks related to cervical cancer if they are to effectively protect themselves against this preventable cancer.

Table 1. Knowledge assessment of cervical cancer patients regarding Pap screening and modifiable risk factors for their cancer.

<table>
<thead>
<tr>
<th>Survey Questions</th>
<th>Correct Responses, n (%)</th>
<th>Missing Data</th>
<th>Stage I (n = 27)</th>
<th>Stage II-IV (n = 23)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge of cervical cancer screening*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T/F: There is a screening for cervical cancer</td>
<td>80% (60%, 100%)</td>
<td>1</td>
<td>37 (76)</td>
<td>20 (74)</td>
<td>17 (77)</td>
</tr>
<tr>
<td>What part of the body does a Pap test check?</td>
<td>80% (60%, 100%)</td>
<td>6</td>
<td>29 (66)</td>
<td>17 (68)</td>
<td>12 (63)</td>
</tr>
<tr>
<td>What is the purpose of a Pap test?</td>
<td>80% (40%, 80%)</td>
<td>7</td>
<td>39 (91)</td>
<td>22 (96)</td>
<td>17 (85)</td>
</tr>
<tr>
<td>What does an abnormal Pap test mean?</td>
<td></td>
<td>0</td>
<td>40 (80)</td>
<td>24 (89)</td>
<td>16 (70)</td>
</tr>
<tr>
<td>T/F: Not getting a Pap makes a woman more likely to get cervical cancer</td>
<td>28% (14%, 57%)</td>
<td>5</td>
<td>28 (62)</td>
<td>15 (60)</td>
<td>13 (65)</td>
</tr>
<tr>
<td>Knowledge of sexual health risk factors*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T/F: Cervical cancer is a sexually transmitted disease</td>
<td></td>
<td>1</td>
<td>5 (10)</td>
<td>4 (15)</td>
<td>1 (5)</td>
</tr>
<tr>
<td>Having multiple sex partners</td>
<td>28% (14%, 57%)</td>
<td>6</td>
<td>28 (64)</td>
<td>16 (70)</td>
<td>12 (57)</td>
</tr>
<tr>
<td>Sex without a condom</td>
<td>57% (14%, 71%)</td>
<td>5</td>
<td>27 (60)</td>
<td>19 (79)</td>
<td>8 (38)</td>
</tr>
<tr>
<td>Sex early in life</td>
<td>57% (0%, 57%)</td>
<td>7</td>
<td>15 (35)</td>
<td>12 (55)</td>
<td>3 (14)</td>
</tr>
<tr>
<td>Oral sex</td>
<td>28% (14%, 71%)</td>
<td>7</td>
<td>9 (21)</td>
<td>7 (32)</td>
<td>2 (10)</td>
</tr>
<tr>
<td>Having an STI</td>
<td>28% (0%, 57%)</td>
<td>6</td>
<td>28 (64)</td>
<td>19 (79)</td>
<td>9 (45)</td>
</tr>
<tr>
<td>HIV</td>
<td>50% (25%, 100%)</td>
<td>6</td>
<td>21 (48)</td>
<td>12 (52)</td>
<td>9 (43)</td>
</tr>
<tr>
<td>Knowledge of HPV*</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T/F: People with HPV (human papillomavirus) are at higher risk for cervical cancer</td>
<td>50% (25%, 75%)</td>
<td>1</td>
<td>37 (76)</td>
<td>22 (82)</td>
<td>15 (68)</td>
</tr>
<tr>
<td>T/F: HPV can be cured with medication</td>
<td>75% (50%, 100%)</td>
<td>3</td>
<td>18 (30)</td>
<td>11 (44)</td>
<td>7 (32)</td>
</tr>
<tr>
<td>T/F: People with HPV can usually tell when they have it</td>
<td>50% (25%, 75%)</td>
<td>3</td>
<td>30 (64)</td>
<td>21 (84)</td>
<td>9 (41)</td>
</tr>
<tr>
<td>T/F: Condoms can keep HPV from spreading</td>
<td>28% (14%, 71%)</td>
<td>3</td>
<td>28 (60)</td>
<td>18 (72)</td>
<td>10 (45)</td>
</tr>
<tr>
<td>T/F: Cigarette smoking is a risk factor for cervical cancer</td>
<td>50% (25%, 75%)</td>
<td>3</td>
<td>20 (43)</td>
<td>10 (40)</td>
<td>10 (45)</td>
</tr>
</tbody>
</table>

T/F: True or false; Pap: Papanicolaou; HPV: human papillomavirus; STI: sexually transmitted infection; HIV: human immunodeficiency virus
*Reported as an overall median percentage (interquartile range) for the corresponding knowledge category.

375 - Poster Session
Trends in guideline-adherent fertility-sparing surgery for early-stage cervical cancer before and after the Affordable Care Act

Objective: The purpose of this study was to assess the impact of the Patient Protection and Affordable Care Act (ACA) on access to guideline-adherent fertility-sparing surgery (GA-FSS) for women with early-stage cervical cancer.

Method: National Cancer Data Base patients treated for stage IA1–IB2 squamous cell carcinoma or adenocarcinoma of the cervix from 2004 to 2016 were included. Patients were divided into 2 cohorts: pre-ACA (treated between January 1, 2004, and December 31, 2009, and post-ACA (treated between January 1, 2011, and December 31, 2016) implementation. Guideline-adherent care was defined using National Comprehensive Cancer Network guidelines corresponding to year of diagnosis. Multivariate logistic regression was used to determine the association between ACA implementation period (pre- vs post-) and receipt of GA-FSS and to identify patient and hospital factors independently associated with GA-FSS.
**Results:** Odds of receiving GA-FSS increased in the post-ACA compared to the pre-ACA cohort (aOR = 1.37, 95% CI 1.15–1.65). Top hospital volume decile was independently associated with increased odds of GA-FSS (aOR = 1.35, 95% CI 1.05–1.74). Pre-ACA, age >35 years, urban relative to rural residential status, and stages IA2, IB1, and IB2 relative to stage IA1 were significantly associated with decreased odds of GA-FSS, while no covariates of interest were associated with increased odds of GA-FSS receipt (Table 1). Post-ACA, increasing age group, urban relative to rural residence, Medicaid relative to private insurance, and stages IA2, IB1, and IB2 relative to stage IA1 were significantly associated with decreased odds of GA-FSS, while Asian/Pacific Islander race relative to white, and top hospital volume decile were significantly associated with increased odds of GA-FSS receipt.

**Conclusion:** Patients were more likely to receive GA-FSS after ACA implementation. Patients were more likely to receive GA-FSS at high-volume hospitals and with lower stage disease. Post-ACA, patients with Medicaid insurance were less likely to receive GA-FSS compared to those with private insurance.

<table>
<thead>
<tr>
<th>Table 1. Receipt of guideline-adherent fertility-sparing surgery, multivariate analysis of pre- and post-ACA cohorts.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>----------</td>
</tr>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>Age (years)</td>
</tr>
<tr>
<td>18 - &lt;25 (referent)</td>
</tr>
<tr>
<td>25 - &lt;30</td>
</tr>
<tr>
<td>30 - &lt;35</td>
</tr>
<tr>
<td>35 - &lt;40</td>
</tr>
<tr>
<td>40 - 45</td>
</tr>
<tr>
<td>Race</td>
</tr>
<tr>
<td>White (referent)</td>
</tr>
<tr>
<td>Black/AA</td>
</tr>
<tr>
<td>American Indian</td>
</tr>
<tr>
<td>Asian/Pacific Islander</td>
</tr>
<tr>
<td>Other</td>
</tr>
<tr>
<td>Unknown</td>
</tr>
<tr>
<td>Stage</td>
</tr>
<tr>
<td>IA1 (referent)</td>
</tr>
<tr>
<td>IA2</td>
</tr>
<tr>
<td>IB1</td>
</tr>
<tr>
<td>IB2</td>
</tr>
<tr>
<td>Income Quartile ($)</td>
</tr>
<tr>
<td>&lt;38k (referent)</td>
</tr>
<tr>
<td>38-48k</td>
</tr>
<tr>
<td>48-63k</td>
</tr>
<tr>
<td>63k+</td>
</tr>
<tr>
<td>Unknown</td>
</tr>
<tr>
<td>Location Type</td>
</tr>
<tr>
<td>Metropolitan (referent)</td>
</tr>
<tr>
<td>Urban</td>
</tr>
<tr>
<td>Rural</td>
</tr>
<tr>
<td>Unknown</td>
</tr>
<tr>
<td>Insurance Status</td>
</tr>
<tr>
<td>Not Insured</td>
</tr>
<tr>
<td>Private (referent)</td>
</tr>
<tr>
<td>Medicaid</td>
</tr>
<tr>
<td>Medicare</td>
</tr>
<tr>
<td>Other Government</td>
</tr>
<tr>
<td>Unknown</td>
</tr>
<tr>
<td>Hospital Volume</td>
</tr>
<tr>
<td>Top Decile</td>
</tr>
</tbody>
</table>

aOR=adjusted odds ratio; CI=confidence interval; bold P<0.05 statistically significant.

**376 - Poster Session**

**The effect of weight loss on oncologic outcomes in patients receiving primary chemoradiation**

J. Jou, E.A. Coulter, J. Mayadev and R.N. Eskander. **UCSD Rebecca and John Moores Cancer Center, La Jolla, CA, USA**
Objective: The purpose of this study was to examine the effect of weight loss on recurrence-free (RFS) and overall survival (OS) in patients with locally advanced cervical, vaginal, and vulvar cancer undergoing primary chemoradiation.

Method: Medical records of patients receiving definitive chemoradiation for the treatment of cervical, vaginal, or vulvar cancer between January 2010 and December 2015 were reviewed. Baseline demographics, treatment characteristics, and weight change were recorded. Weight loss was considered severe if greater or equal to 10% of total body weight. Descriptive statistics were performed. Survival curves were determined using the Kaplan-Meier method, and Cox proportional hazards model was used to evaluate confounding variables. A $P$ value < 0.05 was considered to be significant.

Results: A total of 122 patients were analyzed, 108 (88.5%) with cervical, 6 (4.9%) with vulvar, and 8 (6.6%) with vaginal cancer. Sixty-five (53.3%) patients were white, 41 (33.6%) were Hispanic, 12 (9.8%) were Asian, and 3 (2.5%) were black. The median age was 53 years. Twenty seven (22.1%) patients had stage IB2 disease; 54 (44.2%), stage 2A or 2B disease; 34 (27.9%), stage 3A or 3B disease; and 7 (5.7%), stage 4A or 4B disease. The majority (78.0%) had squamous histology, while 18.0% had adenocarcinoma and 4.1% had poorly differentiated carcinoma. During the treatment period, 71.2% of patients were able to complete >4 cycles of chemotherapy with the majority, 119 (97.5%) patients, receiving weekly cisplatin at 40 mg/m². Patients received a median of 45 Gy external beam radiation and 28 Gy vaginal brachytherapy. Median treatment duration was 52 days. Before treatment, the cohort had a median weight of 70.3 kg, BMI of 27.4 kg/m², and albumin of 4.1 g/dl. At the completion of treatment, the cohort had a median weight of 67.4 kg and BMI of 26.1 kg/m². At completion of treatment, 8.2% of patients had severe weight loss. After adjusting for stage, patients with severe weight loss had a significantly reduced OS (HR = 2.33, 95% CI 1.10–7.02, $P = 0.042$) (Figure 1) and a trend toward reduced PFS (HR = 2.48, 95% CI 0.92–6.68, $P = 0.106$). Of those with severe weight loss, 30.8% had a nutrition consultation.

Conclusion: After adjusting for stage, patients who had more than a 10% weight loss during primary chemoradiation had a significantly reduced OS.

![Fig. 1.](image)

---

377 - Poster Session
Cervical carcinomas that overexpress human trophoblast cell-surface marker (Trop-2) are highly sensitive to the antibody-drug conjugate sacituzumab-govitecan

Objective: Human trophoblast cell-surface marker (Trop-2) is a surface glycoprotein originally identified in human placental trophoblastic tissue and subsequently reported to be highly expressed by various types of human carcinomas, but rarely in normal adult tissues. We investigated the efficacy of sacituzumab govitecan, an antibody-drug conjugate (ADC) comprising a humanized anti-Trop-2 antibody, conjugated with active metabolite of irinotecan (SN-38), on Trop-2 positive cervical cancer cell lines and a xenograft model.
**Method:** Trop-2 expression was evaluated in 147 primary cervical tumors by immunohistochemistry, real-time polymerase chain reaction, and flow cytometry. For in vitro experiments, 2 Trop-2 positive (CVX-8, ADX-3) and 1 Trop-2 negative (ADX-2) cell lines were used. The in vivo antitumor activity was tested in xenografts models with strong Trop-2 expression (CVX-8).

**Results:** Out of 147 primary cervical tumors, 113 were squamous cell carcinomas (SCCs), and 34 were adenocarcinoma/adenosquamous carcinomas. Moderate to strong diffuse staining was seen in 95% (108/113) of SCCs, and 81% (29/34) of adenocarcinoma/adenosquamous cancers on immunohistochemistry. Trop-2 positive cell lines showed high sensitivity to sacituzumab govitecan in vitro, with IC50 values in the range of 0.18 to 0.26 nM (P = 0.02 and P = 0.04 for CVX-8 and ADX-3, respectively). In xenografts, twice-weekly intravenous administration of the drug for 3 weeks showed a significant tumor growth inhibition (P < 0.0001 and P = 0.001 for sacituzumab govitecan vs naked antibody and sacituzumab govitecan vs control-ADC, respectively). Overall survival at 90 days was significantly improved in the sacituzumab govitecan group (P = 0.014).

**Conclusion:** Sacituzumab govitecan may represent a novel class of active drugs for cervical cancer patients over-expressing Trop-2.

---

**378 - Poster Session**

**Type of hysterectomy and survival for FIGO stage IB cervical cancer: Is more radical surgery necessary?**


**Objective:** The aim of this study was to assess the use and outcomes of simple hysterectomy for stage IB cervical cancer.

**Method:** Patients diagnosed between 2004 and 2014 with clinical stage IB squamous, adenosquamous, and adenocarcinoma of the cervix with known tumor size who underwent primary hysterectomy with lymphadenectomy and did not have a history of another tumor were identified from the National Cancer Data Base. Tumor size was categorized as follows: <2, 2–3.9, >4 cm to reflect the new FIGO stage subclassification. Overall survival (OS) was compared between patients who underwent simple and radical hysterectomy following generation of Kaplan-Meier curves with the log rank test. A Cox model was constructed to evaluate survival after controlling for confounders.

**Results:** Of 9,275 patients identified, 2,961 (31.9%) underwent simple hysterectomy. An increase in the use of simple hysterectomy was noted from 26.9% for patients diagnosed between 2004 and 2009 to 35.4% for those diagnosed between 2010 and 2015. Patients who had simple hysterectomy were older (median 45 vs 43 years, *P < 0.001*) and more likely to have adenocarcinoma (41.5% vs 33.9%, *P < 0.001*), while the 2 groups were comparable in terms of race (*P = 0.49*), insurance status (*P = 0.37*), and the presence of comorbid conditions (*P = 0.76*). The rate of simple hysterectomy for patients with stage IB1, IB2, and IB3 disease was 33%, 31.7%, and 29.5%, respectively (*P = 0.06*). Patients who had simple hysterectomy had shorter hospital stay (median 2 vs 3 days, *P < 0.001*), less than a 30-day unplanned readmission (3.5% vs 4.5%, *P = 0.019*), comparable positive margins (4.6% vs 4.8%, *P = 0.67*), and similar 90-day mortality rate (0.3% vs 0.2%, *P = 0.25*). There was no difference in OS between patients who had simple and radical hysterectomy (*P = 0.16*); 5-year OS rates were 89.3% and 90.2%, respectively. There was also no difference in OS between simple and radical hysterectomy for patients with stage IB1 (*P = 0.19*), IB2 (*P = 0.34*), and IB3 (*P = 0.27*). After controlling for age, race, insurance status, comorbid conditions, histology, tumor size, and presence of positive lymph nodes, performance of simple hysterectomy was not associated with worse survival (*HR = 1.11, 95% CI 0.96—1.28*).

**Conclusion:** Approximately one-third of patients with stage IB cervical cancer underwent simple hysterectomy with lymphadenectomy, with no clear detrimental effect on survival.

---

**379 - Poster Session**

**Tumor histology as prognostic factor in locally advanced cervical cancer in a reference center**

D. Cantu de León, I.N. Gallardo-Alvarado, R. Ramirez, D. Perez-Montiel, R.A. Salcedo-Hernández, S.A. Barquet-Muñoz, M. Perez Quintanilla, F. Rivera-Buendia and S. Del Real. *Instituto Nacional de Cancerología de México, Mexico, DF, Mexico, Instituto Nacional de Perinatología, Mexico, DF, Mexico, Hospital General de Saltillo, Saltillo, CU, Mexico*

**Objective:** The aim of this study was to evaluate tumor histology as a prognostic factor in terms of treatment response, disease-free survival (DFS), and overall survival (OS) in a retrospective cohort of patients with locally advanced cervical cancer (LACC) in Mexican patients.

**Method:** Records of patients treated with concurrent chemoradiation and brachytherapy at Instituto Nacional de Cancerología of Mexico with cervical cancer stages IB2-IVA (FIGO 2009) were reviewed. Descriptive and comparative analyses were conducted. Treatment response was analyzed by χ² test; DFS and OS were calculated for each histology with the Kaplan-Meier method and compared with log rank test; results were considered statistically significant if *P < 0.05*.
**Results:** From 2005 to 2014 a total of 1,954 records were retrieved; we included 1,281 patients who completed standard treatment and had at least 3 cycles of concurrent chemotherapy. Clinical stages were IB2, 104 (8.1%); IIA1, 24 (1.9%); IIA2, 33 (2.6%); IIB, 739 (57.7%); IIIA, 38 (2.5%); IIIB, 311 (24.3%); and IVA, 32 (2.5%). Squamous cell carcinoma (SCC) accounted for 87.7% \((n = 1,124)\); 137 (10.7%) were adenocarcinoma (AC), and 20 (1.6%) adenosquamous carcinoma (ASC). Thirty-nine (3.1%) were well-differentiated, 926 (72.4%) moderately differentiated, and (23.1%) poorly differentiated neoplasms. Mean DFS was 117 months for SCC, 106 months for AC, and 106 months for ASC, without statistical difference \((P = 0.365)\). The same findings were observed for OS; median survival was 132 months, not finding statistical impact of histology \((P = 0.89)\). Well-differentiated tumors had OS of 97% at 5 years, which was statistically significant when compared with other tumor grades \((P = 0.032)\).

**Conclusion:** DFS and OS were similar among different tumor histologies and significantly better in well-differentiated tumors. Other factors should be considered, and histology continues to be a controversial predictor factor.

---

**380 - Poster Session**

**Accuracy of high-risk HPV testing compared with cervical cytology in postmenopausal women**

J.M. Kiff, M. Cotter, T.K. Morgan and A.S. Bruegl. Oregon Health & Science University, Portland, OR, USA

**Objective:** Cervical cytology in postmenopausal women is challenging because of atrophic changes that would be expected to lead to more false positive and false negative results compared with premenopausal patients; this raises the possibility that Pap smears may not be an accurate method to screen for high-grade cervical dysplasia (CIN2+) in these older women. Conversely, we hypothesize that high-risk HPV testing could be a more accurate predictor of CIN2+ than cytology.

**Method:** This was a retrospective case-control study of 961 postmenopausal women, age range 55–78 years, compared with a premenopausal cohort of 990 women (age range 18–54 years) with index cervical Pap smears, high-risk HPV testing, and documented 5-year clinical outcomes with repeated negative Pap smears and/or biopsies with p16+ confirmed CIN2+ diagnoses. Index Pap diagnoses prompting colposcopy (ASCUS or greater versus NIL) and high-risk HPV testing results were compared with gold standard 5-year outcomes.

**Results:** The prevalence of high-risk HPV in premenopausal and postmenopausal women was 52% and 13%, respectively \((P < 0.001)\). The sensitivity, specificity, and accuracy of the index Pap smear compared with high-risk HPV testing results and final clinical outcomes are shown in Table 1.

**Conclusion:** As expected, high-risk HPV testing does not improve diagnostic accuracy in young women before the age of 30 years, but it does lead to increased specificity and diagnostic accuracy in premenopausal women after the age of 30 years. Moreover, our data suggest further significant improvement in diagnostic accuracy in postmenopausal women. Surprisingly, index cytology in postmenopausal women was also more specific and accurate than in premenopausal controls.

---

**381 - Poster Session**

**The comprehensive analysis of PD-L1 expression in cervical cancer**

W. Jiang and H. Yang. Fudan University Shanghai Cancer Center, Shanghai, China

**Objective:** In our previous study, it was demonstrated that the aberration of PI3K/PTEN/AKT was common and PIK3CA was the oncogene with the highest mutation rate in cervical cancer. In the new era of immunotherapy, the study aimed to investigate the clinicopathological and prognostic relevance of PD-L1 over-expression and the association between PD-L1 over-expression with proliferation, apoptosis, as well as PI3K /AKT and hormone receptor pathway, which is of importance for the application of other therapy modes combined with immunotherapy in cervical cancer.

**Method:** In total, 876 patients (stage IB–IIA) were enrolled in the study. The mRNA expression of PD-L1, HPV16 and HPV18 infectious, and PIK3CA mutation status were detected. The expression of Ki67, p53, bcl2, and bax, as well as ER and PR, were analyzed as the indicator of proliferation, apoptosis, and hormone receptor pathway. Among the 876 patients, 122 patients were selected for PTEN loss, PD-L1 over-expression, AKT, and PTEN mutation analysis.

**Results:** PD-L1 mRNA over-expression occurred more commonly in older \((50.3 \text{ vs } 46.8 \text{ years}, P < 0.01)\) and postmenopausal women \((45.2\% \text{ vs } 34.2\%, P = 0.002)\). More patients with PD-L1 over-expression were concomitant with HPV16 than HPV18 infections \((27.5\% \text{ vs } 16.5\%, P = 0.016)\). PD-L1 over-expression was more commonly observed in squamous carcinoma of cervical cancer \((86\% \text{ vs } 14\%, P < 0.001)\). It was suggested that patients with PD-L over-expression had less relapse \((17.1\% \text{ vs } 26.5\%, P = 0.006)\). Furthermore, 11.9% of cervical cancer patients were found with hormone receptor positive \((ER 12.3\%, PR 4.6\%)\). PD-L1 over-expression occurred more
frequently in the presence of PIK3CA mutation (34.6% vs 23.5%, \( P = 0.007 \)) and hormone receptor (34.6% vs 23.8%, \( P = 0.017 \)). However, PD-L1 over-expression was not correlated with proliferation and apoptosis in our study. In the 122 cervical cancer patients, 16.4% were determined as PD-L1 positive. The patients with PD-L1 protein over-expression are prone to have at least 1 alteration of PI3K pathway (PIK3CA mutation, PTEN loss and mutation, AKT mutation) (23.0% vs 9.8%, \( P = 0.05 \)). The 5-year RFS was 85% for patients with PD-L1 positive and 80% for negative (\( P = 0.597 \)).

**Conclusion:** Patients with PD-L1 over-expression has distinct characteristics and a better prognosis. PD-L1 over-expression has strong correlation with PI3K and hormone receptor pathway, which will be of significance for optimizing combination treatments in cervical cancer.

**Table 1.** Retrospective study of CIN2+ five-year outcomes detected by index cervical cytology and hrHPV screening.

<table>
<thead>
<tr>
<th>Cohort</th>
<th>Sensitivity [95% CI] Cytology</th>
<th>Sensitivity [95% CI] hrHPV</th>
<th>Specificity [95% CI] Cytology</th>
<th>Specificity [95% CI] hrHPV</th>
<th>Accuracy [95% CI] Cytology</th>
<th>Accuracy [95% CI] hrHPV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Premenopausal, ≥30 to &lt;55 years (39 ± 6.9 years) (n=767)</td>
<td>96 [87-100]</td>
<td>100 [93-100]</td>
<td>30 [26-33]</td>
<td>57* [53-61]</td>
<td>34 [31-38]</td>
<td>60* [56-63]</td>
</tr>
<tr>
<td>Postmenopausal, ≥55 years (60 ± 3.7 years) (n=961)</td>
<td>100 [69-100]</td>
<td>100 [69-100]</td>
<td>70^ [67-73]</td>
<td>88^^ [86-90]</td>
<td>70^ [67-73]</td>
<td>88^^ [86-90]</td>
</tr>
</tbody>
</table>

\(^{*}P<0.05\) comparing cervical cytology to hrHPV testing

\(^{^\dagger}P<0.05\) comparing postmenopausal to premenopausal women

---

**382 - Poster Session**

**Patient outcomes following robotic radical hysterectomy in women with early stage cervical cancer: A retrospective analysis of outcomes from a high-volume robotic surgical program**

T.M. Hodgea, D.S. Metzingera, R. Piersona, J. Gaskinsb and S. Todd. aUniversity of Louisville, Louisville, KY, USA, bUniversity of Louisville School of Medicine, Louisville, KY, USA, cUniversity of Louisville Physicians James Graham Brown Cancer Center, Louisville, KY, USA

**Objective:** Recent data suggest that minimally invasive approaches to radical hysterectomy for early-stage (FIGO 2009 stages IA1, IA2, IB1, IB2) cervical cancer may be associated with decreased disease-free survival compared to the abdominal approach. The robotic approach is underrepresented in these investigations. Our study sought to determine disease-free survival and recurrence rates in patients with early-stage cervical cancer who underwent robotic radical hysterectomy at a high-volume robotic surgery center.

**Method:** In this retrospective case series, clinical data were abstracted from the medical records of all patients with early-stage cervical cancer who underwent robotic radical hysterectomy as sole treatment modality between 2010 and 2018 at a single institution. Because of a lack of progression events, data could not be analyzed using usual survival statistics. Survival rates were estimated at clinically important time points, and confidence intervals were estimated at each using the Agresti-Coull method, considering only those who were at risk at the particular time point.

**Results:** Of 74 robotic radical hysterectomies performed for cervical cancer, 37 were included in our study based on complete medical records and solely surgical management. To date, no recurrences have been identified in any of these patients within a mean of 2.5 years of follow-up. Stage IB1 cervical cancer was most common, and squamous cell (51%) and adenocarcinoma (46%) most common histologically; lymphovascular space invasion was noted in 19% of cases. Demographically, the majority of patients were Caucasian with a mean age of 40.9 years and BMI of 31.7. See Table 1.

**Conclusion:** In our study, no episodes of disease recurrence were identified, suggesting that a robotic approach to radical hysterectomy may not adversely affect patient outcomes when performed by an experienced robotic surgeon. Future studies incorporating data from other large-volume robotic centers are warranted prior to abandoning the robotic radical hysterectomy. Exploration of survival differences among patients undergoing radical hysterectomy via abdominal versus robotic approach from a mechanistic standpoint needs to be pursued to determine whether sacrificing the reduction in morbidity associated with the robotic approach is in the best interest of patients.
Table 1. Progression Free Survival at Designated Time Points Following Robotic Radical Hysterectomy for Early Stage Cervical Cancer.

<table>
<thead>
<tr>
<th>Time</th>
<th>n at risk</th>
<th>Estimate</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>34</td>
<td>100%</td>
<td>88%</td>
</tr>
<tr>
<td>1</td>
<td>25</td>
<td>100%</td>
<td>84%</td>
</tr>
<tr>
<td>2</td>
<td>15</td>
<td>100%</td>
<td>76%</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>100%</td>
<td>70%</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>100%</td>
<td>56%</td>
</tr>
</tbody>
</table>

*not computed in the usual way using Kaplan-Meier/survival methods
This is because all of these usual approaches require at least one event. Computed a 95% confidence interval at each fixed time point using the Agresti-Coull method.

383 - Poster Session
Five-year survival rates in women with cervical cancer who had previous normal cytology results: A Korean nationwide cohort study
H.P. Lee and Y.B. Kim. Soon Chun Hyang University Hospital, Seoul, Seoul National University Bundang Hospital, Seongnam-Si, South Korea

Objective: The purpose of this study was to evaluate the impact of consecutive normal results in cytology on cervical cancer incidence and mortality.

Method: The database of the National Health Insurance Service (NHIS) was used. We obtained all cytology results of women aged 30–79 years in the National Cancer Screening Program (NCSP) in 2011 and 2012, and analyzed 7-year cumulative incidences and 5-year survival rates of cervical cancer by consecutive normal results in cytology before cancer diagnosis.

Results: In 2,740,063 women, a total of 2,577,070 (94%) women had a normal cytology result in 2011 or 2012. The 7-year cumulative cases of cervical cancer was 2,779 in these women. It was significantly lower than those of 6,160,664 women who had never undergone cytology for 5 years (0.108% vs. 0.211%, HR = 0.512, 95% CI 0.491–0.533, p < 0.001). Compared to women with a normal cytology result only once, the 7-year cumulative incidences gradually decreased in women with 2 (1,168/1,352,226, 0.086%, HR = 0.801, 95% CI 0.748–0.858, P < 0.001) and 3 (675/962,156, 0.070%, HR = 0.651, 95% CI 0.604–0.715, P < 0.001) consecutive normal cytology results. However, the 5-year survival rates in women with 2 (80.0%, HR = 1.016, 95% CI 0.822–1.256, P = 0.885) and 3 (79.6%, HR = 1.021, 95% CI 0.774–1.347, P = 0.881) consecutive normal cytology results were not different from those with only a normal cytology result (81.3%).

Conclusion: As normal cytology results are consecutively repeated, the incidence of cervical cancer significantly decreases. However, consecutive normal cytology results before cancer diagnosis are not associated with improved survival outcomes in women with cervical cancer.

384 - Poster Session
The effect of multidisciplinary team integration on treatment completion disparities in women undergoing treatment for cervical cancer
A.L. Beavis, A.F. Rositch, A. Romero-Sackey, A. Viswanathan, A.N. Fader, R.L. Stone, S.L. Wethington and K. Levinson. Johns Hopkins Hospital, Baltimore, MD, USA, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD, USA, Johns Hopkins School of Medicine, Baltimore, MD, USA, Johns Hopkins Hospital, The Kelly Gynecologic Oncology Service, Baltimore, MD, USA

Objective: Cervical cancer disparities are often attributed to inadequate receipt of guideline-adherent care. In July 2016, our institution integrated radiation and gynecologic oncology to provide multidisciplinary team care (MTC). We sought to determine whether racial disparities in treatment completion improved after this practice change.

Methods: All black/African American and white/Caucasian women (race as reported in the medical chart) undergoing primary treatment for squamous, adeno-, or adenosquamous carcinoma from January 2011 to December 2017 were included. Demographic, clinical, and treatment characteristics, and treatment completion rates were compared pre- and post-MTC using Fisher exact tests. The effect of treatment completion on progression-free survival (PFS) and overall survival (OS) was evaluated with Kaplan-Meier curves and log rank tests.
Results: A total of 115 women were included; 70% (n = 80) pre- and 30% (n = 35) post-MTC. The median patient age was 45.7 years (IQR 37.7–56.1 years), and median BMI was 27 kg/m² (IQR 23.4–32.6); 35% (n = 40) were black, and 65% (n = 75) were white. Most had squamous histology (71%, n = 82). Fifty percent (n = 58) had early-stage, 39% (n = 45) locally advanced, and 10% (n = 12) metastatic disease. Characteristics did not differ pre- and post-MTC. Nearly all women (97%) received National Comprehensive Cancer Network (NCCN) guideline-concordant recommendations. Treatment type and stage did not differ pre- or post-MTC, but treatment completion rates were higher post-MTC (80% post vs 59% pre, P = 0.03). The racial disparity in treatment completion was most pronounced prior to MTC (77% white vs 32% black, P < 0.001) and was not significantly different post-MTC: 85% of white women completed treatment versus 67% of black women (P = 0.34). In women undergoing adjuvant or primary radiation (n = 48), treatment completion was 63% post-MTC compared to 43% MTC, although this did not reach statistical significance (P = 0.35). Incomplete treatment was associated with worse PFS (HR = 0.44, P = 0.05) and OS (HR = 0.21, P < 0.001) (Figure 1A and Figure 1B).

Conclusion: MTC improved treatment completion rates and disparities in women undergoing cervical cancer treatment at an NCCN cancer center, and should be further studied as a potential model to address disparities.

Fig. 1.

385 - Poster Session
Is there survival difference due to surgical method in patients with early cervical cancer less than 2 cm in pathologic tumor size?
K.B. Lee, K. Cho, S. Lim and S. Lee. Gachon University Gil Medical Center, Incheon, South Korea

Objective: The aim of this study was to analyze difference in survival between laparoscopic radical hysterectomy (LRH) and abdominal radical hysterectomy (ARH) in early-stage cervical cancer patients less than 2 cm in pathologic tumor size (PTS).

Method: We retrospectively obtained medical information of patients diagnosed with early-stage cervical cancer who underwent LRH or ARH with retroperitoneal lymphadenectomy between January 2010 and March 2018 at single medical center in Korea. Only those whose tumors were less than 2 cm in PTS were compared.

Results: A total of 116 patients were included in this study, 57 (49.1%) and 59 (50.9%) patients underwent LRH and ARH, respectively. The median ages of patients with LRH and ARH was 46 (range 33–77) and 44 (range 28–74) years, respectively (P = 0.097). In the patients with LRH, 22 (38.6%) were diagnosed as stage IA2 and 35 (61.4%) were diagnosed as stage IB1. In contrast, 14 (23.7%) and 45 (76.3%) patients with ARH were clinically staged as stage IA2 and IB1, respectively. There was no statistical difference between the LRH and ARH groups (P = 0.109). There was no difference in pathologic tumor size between the 2 groups (P = 0.068), but the number of retrieved lymph nodes in the ARH group was higher (P = 0.000). There was no statistical significance in lymphovascular space involvement, depth of stroma invasion ≥1/2, lymph node involvement, and parametrial involvement between the 2 groups (P = 0.095, P = 0.109, P = 0.207, and P = 1.000, respectively). Parametrial involvement was not found in either group. Six (10.5%) and 11 (18.6%) patients received adjuvant treatment followed by LRH and ARH, respectively. In the LRH group, 4 patients received only radiotherapy as adjuvant treatment, but in the ARH group, CCRT and chemotherapy only were performed in 7 and 4 patients, respectively (P = 0.295). Median follow-up of the LRH and ARH groups was 38 and 53 months, respectively (P = 0.492) (Table 1). There was no statistical difference in disease-free survival between the LRH (96.5%) and ARH (91.5%) groups within this period (P = 0.278) (Figure 1). Overall survival was 93.3% in the ARH group, which was lower than that of the LRH (100%) group, but there was no statistical significance (P = 0.074) (Figure 1).
Conclusion: In patients with cervical cancer of 2 cm or less in PTS, there was no difference in survival between LRH and ARH.

Table 1. General Characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>LRH (n=57)</th>
<th>ARH (n=59)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (median, range)</td>
<td>48 (38-77)</td>
<td>44 (28-74)</td>
<td>0.097</td>
</tr>
<tr>
<td>Stage</td>
<td></td>
<td></td>
<td>0.109</td>
</tr>
<tr>
<td>IA2</td>
<td>22</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>IB1</td>
<td>35</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Histologic type</td>
<td></td>
<td></td>
<td>0.169</td>
</tr>
<tr>
<td>Squamous</td>
<td>51</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>Adenocarcinoma</td>
<td>5</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Adenosquamous</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Pathologic tumor size cm (median, range)</td>
<td>0.5 (0-2.0)</td>
<td>0.8 (0-2.0)</td>
<td>0.068</td>
</tr>
<tr>
<td>Number of retrieved LN (median, range)</td>
<td>25 (7-53)</td>
<td>37 (10-71)</td>
<td>0.000</td>
</tr>
<tr>
<td>VFI</td>
<td></td>
<td></td>
<td>0.095</td>
</tr>
<tr>
<td>No</td>
<td>50</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>7</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Depth of stroma invasion</td>
<td></td>
<td></td>
<td>0.109</td>
</tr>
<tr>
<td>&lt;1/2</td>
<td>49</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>≥1/2</td>
<td>8</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Positive LN involvement</td>
<td></td>
<td></td>
<td>0.207</td>
</tr>
<tr>
<td>No</td>
<td>56</td>
<td>54</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>10</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Positive surgical resection margin</td>
<td></td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>97</td>
<td>98</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Positive parametral involvement</td>
<td></td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>59</td>
<td>57</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Adjuvant therapy</td>
<td></td>
<td></td>
<td>0.295</td>
</tr>
<tr>
<td>No</td>
<td>51</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>6</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Chemotherapy only</td>
<td>1</td>
<td>1</td>
<td>0.364</td>
</tr>
<tr>
<td>Radiotherapy only</td>
<td>4</td>
<td>0</td>
<td>0.055</td>
</tr>
<tr>
<td>CRT</td>
<td>1</td>
<td>7</td>
<td>0.061</td>
</tr>
</tbody>
</table>

Follow up months (median, range): LRH: 38 (12-87), ARH: 53 (12-108), P = 0.032.

Abbreviation: LRH: laparoscopic radical hysterectomy; ARH: abdominal radical hysterectomy; LN: lymph node; VFI: vaginal fundal invasion; CRT: Chemotherapy and Radiotherapy.

386 - Poster Session
Protein overexpression of c-MET has a significant impact on survival in patients with uterine cervical adenocarcinoma

Objective: The aim of this study was to compare c-MET protein over-expression and the gene copy number (GCN) in uterine cervical cancer and to assess their prognostic roles.

Method: We reviewed all patients who were diagnosed as having uterine cervical cancer and who underwent standard treatment from August 2005 to August 2018. To manufacture a tissue microarray (TMA) for silver in situ hybridization (SISH), we included patients with FIGO stage IB1 to IIA2 who underwent radical hysterectomy. Immunohistochemical staining was performed on 3-μm-thick sectioned TMA slides with a rabbit anti-Total c-MET (SP44) monoclonal antibody using an autoimmunostainer. Alterations in MET gene copy number were assessed via automated dual-color SISH using a Ventana BenchMark GX system. A Jonckheere–Terpstra test was used to assess correlations between increased MET protein expression or MET GCN and patient prognosis, and a least significance test using ranks was applied for multiple comparisons among the histotype groups. The prognostic significance of SISH and IHC results and clinicopathologic indicators was analyzed using Cox proportional analysis.

Results: MET protein expression and GCN status were determined using immunohistochemistry (IHC) and SISH, respectively, in 117 cervical cancers comprising 83 squamous cell carcinomas (SCCs), 23 adenocarcinomas (ACs), 7 adenosquamous cell carcinomas (ASCs), and 4 other types. All patients had been operated on and followed up at a single institution in Seoul, Korea. MET protein overexpression was observed in 45 of 117 (38.5%) cervical cancers, with IHC 2+ in 40 patients and IHC 3+ in 5 patients. The over-expression rates in SCCs, ACs, ASCCs, and other types were 31.3%, 73.9%, 14.3%, and 25.0%, respectively. IHC 3+ MET protein over-expression was only observed in ACs and was correlated with worse overall survival (OS) (P = 0.001) and progression-free survival (PFS) (P = 0.000). High polysomy (HP) of chromosome 7 and gene amplification (GA) were found in 6 (5.1%) and 0 of the 117 cervical cancers, respectively. Among the 6 cases, 3 were SCCs and the other 3 were ACs. However, GCN was not applicable in 16 (13.7%) of 117 patients.
Cervical cancer patients with negative MET SISH tended to be associated with better prognosis compared with HP cases but without statistical significance (OS, $P = 0.307$; PFS, $P = 0.184$).

**Conclusion:** MET IHC may serve as a biomarker for poor prognosis in patients with cervical cancer.

---

**387 - Poster Session**  
**The effect of race and histology on survival in patients with cervical cancer**  
L.H. Mattei, D. Sighoko, N.K. Lee, D. Ansell and S.B. Dewdney, aRush University Medical Center, Chicago, IL, USA, bMetropolitan Chicago Breast Cancer Task Force, Chicago, IL, USA, cThe University of Chicago Medicine, Chicago, IL, USA

**Objective:** Despite advances in screening and treatment of cervical cancer, significant racial disparities exist. In this study, data from the National Cancer Data Base (NCDB) were used to examine trends in cervical cancer mortality to elucidate possible underlying causes of these disparities.

**Method:** We obtained data from the NCDB for non-Hispanic white, non-Hispanic black, and Hispanic women diagnosed with cervical cancer from 2004 to 2014. Stage was defined using the American Joint Committee on Cancer (AJCC) staging. Subjects listed as stage 0 or unknown stage were excluded. Histology was determined using ICD-O-3 codes for squamous cell carcinoma (SCC) and adenocarcinoma (AC). NCDB vital status and time to last contact (or death) were used to determine mortality (in percentage) and survival from time of diagnosis. The data were analyzed using STAT v15.

**Results:** We identified 52,852 cases of SCC and 16,832 cases of AC. Non-Hispanic black patients had the highest mortality from SCC (40.62%) and AC (43.97%). The disparity between non-Hispanic black and non-Hispanic white patients was greatest in patients with AC (relative risk ratio of 1.90, 95% CI 1.77–2.04). Non-Hispanic black women with stage I SCC had higher mortality (SCC, 19.44%; AC, 17.56%) compared to non-Hispanic white (SCC, 14.00%, $P < 0.0001$; AC, 8.80%, $P < 0.0001$) and Hispanic women (SCC, 11.57%, $P < 0.0001$; AC, 8.38%, $P < 0.0001$). No difference in mortality was seen between non-Hispanic black and non-Hispanic white patients with stage IV SCC ($P = 0.68$), but was seen among non-Hispanic black and non-Hispanic white patients with stage IV AC (86.59% vs 77.48%, $P = 0.001$). Last, when examining trends in mortality 5 years from diagnosis among patients with stage I CCA, non-Hispanic black patients had a higher percentage mortality (SCC, 28.4%, AC, 25.75%) compared to non-Hispanic white (SCC, 20.81%, $P < 0.0001$; AC, 13.07%, $P < 0.0001$) or Hispanic patients (SC, 12.60%, $P < 0.0001$; AC, 2.33%, $P < 0.0001$).

**Conclusion:** These results indicate that race/ethnicity continues to play a role in cervical cancer outcomes. Among patients with SCC and AC, non-Hispanic black women had the highest mortality and the lowest 5-year survival. The disparities between groups were greatest in patients with AC, highlighting the importance of access to cervical cancer screening and quality colposcopy. Our data show that non-Hispanic black women with early-stage disease still experience the highest mortality regardless of histologic subtype. Further research needs to be done to elucidate the cause of these disparities.

---

**388 - Poster Session**  
**Role of human papillomavirus status after conization for high-grade cervical intraepithelial neoplasia**  
C.H. Lai, H.J. Huang, H.J. Tung, L.Y. Yang, W.Y. Chang, C.C. Huang, A. Chao and R.C. Wu, aChang Gung Memorial Hospital and Chang Gung University, Kueishan, Taoyuan, Taiwan, bChang Gung Memorial Hospital, Linkou Branch and Chang Gung University, Taoyuan, Taiwan, Taoyuan, Taiwan, cChang Gung Memorial Hospital, Linkou Branch and Chang Gung University, Kueishan, Taiwan, 4Chang Gung Memorial Hospital, Taipei, Taiwan

**Objective:** We aimed to conduct an observational study for long-term outcomes and their relation to HPV genotype changes after conization for high-grade cervical intraepithelial neoplasia (HG-CIN).

**Method:** We conducted a prospective observational study among patients with newly diagnosed HG-CIN before conization (group new) and those who had undergone conization without hysterectomy and were willing to participate from the point of signing informed consent (group previous). HPV testing was performed before conization for group new, and cervical cytology and HPV testing were performed every 6 months for all study patients. All the results of cervical histology/cytology and HPV tests before enrollment were retrieved from medical records of group previous. The long-term outcomes were analyzed. Hospital database was retrieved for all other patients who had undergone conization during the study period for HG-CIN. Those eligible but not enrolled for this study were designated as nonstudy group.

**Results:** A total of 494 patients (group new, $n = 187$; group previous, $n = 307$) were enrolled between 2008 and 2014. For the study cohort, the median age was 40.9 years (range 20.2–78 years), and the median follow-up was 74.1 months (0–275.5 months). Eighty-four patients had recurrences of CIN grade 2 or more severe (CIN2+) (a 5-year cumulative recurrence/progression rate of 14.8%), of which 6 were invasive. The median time between initial HG-CIN diagnosis and recurrence/progression was 19.8 months (3.3–162.2 months),

**Conclusion:**
and 23.8% had recurrent CIN2+ >5 years after conization. HPV was detected in 94.1% in the tissue of HG-CIN. Of the 84 with paired HPV results, 46 (54.8%) had type-specific persistent HPV infection, while 14 (16.7%) harbored new high-risk HPVs in the recurrence/progression specimens. Of the 7,397 nonstudy cohort (5-year cumulative recurrence/progression rate of 15.6%, \( P = 0.219 \)), 57 were invasive, with more advanced stages than the study group (\( P = 0.033 \)). See Table 1.

**Conclusion:** Active surveillance might reduce the severity of those progressed to invasive cancer. Since new oncogenic HPV infections are a significant threat, vaccination against the remaining high-risk HPV could be considered. Because 54.8% of those with recurrence/progression had persistent type-specific HPV infections, therapeutic vaccines are still an unmet medical need.

<table>
<thead>
<tr>
<th>Table 1. Distribution of FIGO stages by study group and non-study group.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td>FIGO stage</td>
</tr>
<tr>
<td>IA1</td>
</tr>
<tr>
<td>IA2</td>
</tr>
<tr>
<td>IB1</td>
</tr>
<tr>
<td>IB2</td>
</tr>
<tr>
<td>IB3</td>
</tr>
<tr>
<td>IIA1</td>
</tr>
<tr>
<td>IIA2</td>
</tr>
<tr>
<td>IIB</td>
</tr>
<tr>
<td>IIIB</td>
</tr>
<tr>
<td>IIIIC1</td>
</tr>
<tr>
<td>IIIIC2</td>
</tr>
<tr>
<td>IVA</td>
</tr>
<tr>
<td>IVB</td>
</tr>
<tr>
<td>FIGO stage</td>
</tr>
<tr>
<td>1A-IB1</td>
</tr>
<tr>
<td>IB2-IV</td>
</tr>
</tbody>
</table>

*Fisher’s Exact Test

---

**389 - Poster Session**

**The role of surgical intervention in the treatment of rhabdomyosarcoma of the uterine corpus or cervix among teens and young adults, specifically from a fertility-sparing perspective**

L.A. Moukarzel\(^a\), P. Cybulsk\(^b\), L.H. Wexler\(^a\), T.E. Heaton\(^a\) and N.R. Abu-Rustum\(^a\). \(^a\)Memorial Sloan Kettering Cancer Center, New York, NY, USA, \(^b\)University of Toronto, Toronto, ON, Canada

**Objective:** The objective of this study is to elucidate the use and outcomes of fertility-sparing surgery and other fertility-sparing approaches in the treatment of rhabdomyosarcoma (RMS) of the uterine corpus and cervix in young women.

**Method:** We retrospectively identified all women between ages 8 and 25 years diagnosed with uterine or cervical RMS who underwent surgical intervention at a comprehensive cancer center between January 2000 and 2018. Institutional Review Board approval was obtained, and data were extracted from the medical record.

**Results:** A total of 8 cases of RMS were identified. The median patient age was 19 years (range 12–25 years): 1 prepubertal patient (age <13), 3 adolescents (age range 13–19 years), and 4 young adults (age range 20–25 years). Five (62.5%) cases originated in the cervix, while 3 (37.5%) cases originated in the uterus. All cases were of the embryonal histology. All cases were stage I (favorable site, nonmetastatic) at diagnosis, of which their clinical group categorizes into 3 (37.5%) group I (complete resection, negative margins), 2 (25%) group IIa (complete resection, positive margins), and 3 (37.5%) group III (gross residual). Fertility preservation was addressed with all 8 patients (100%). This included 4 (50%) cases of fertility-sparing surgery (2 CKC, 2 trachelectomies). One patient was offered trachelectomy; however, she declined. Two patients declined oocyte preservation. One patient was on leuprolide during chemotherapy for fertility preservation goals. There was one recurrence among a patient with group IIa disease who had undergone fertility-sparing surgery with CKC, who then underwent oocyte retrieval followed by a radical hysterectomy with bilateral salpingo-oophorectomy; this
patient remains alive and without evidence of disease recurrence 20 months from relapse and 9 months out from the completion of retrieval therapy.

**Conclusion:** The treatment of RMS in this young population requires an additional level of surgical consideration given that some patients would like to pursue fertility-sparing modalities. In addition, the location of the tumor poses a unique challenge to the surgical pursuit of fertility-sparing surgery. However, as seen here, surgical options are available and have been successfully implemented in the treatment of RMS.

---

**390 - Poster Session**

**U.S. population-based trends in cervical cancer: Young white women disproportionately account for rising adenocarcinoma incidence rates, but blacks and women over 60 for poorer survival**

J.R. Jorgensen, Y.J.A. Chen, D.Y.S. Kuo and H.O. Smith. University of Connecticut Health Center, Farmington, CT, USA, BronxCare Health System, Icahn School of Medicine at Mount Sinai, Bronx, NY, USA, Albert Einstein College of Medicine/Montefiore Medical Center, New York, NY, USA

**Objective:** The aim of this study was to examine trends in cervical cancer incidence and survival rates and to clarify the impact of race, age at diagnosis, stage, and histology on these trends.

**Method:** Surveillance Research Program, National Cancer Institute, SEER 18 Regs Research data, November 2018 Sub (1975–2016) was used, restricted to 9 original sites, to calculate age-adjusted incidence rates (AAIRs) per 100,000 woman-years and 2-year average estimated annual percentage change (APC) using the weighted least squares method for all invasive cervical cancer (ALL), squamous cell (SCC), adenocarcinoma (ADC), and other/unknown cell types (other), stratified by stage, historic race (black, white, other/unknown), and age at diagnosis. Survival analyses were restricted to histologically confirmed first primary cases, excluding cases with no survival time or death/autopsy only data. Relative survival (RS) and 95% confidence intervals (CI) were produced (comparison cohort SCC) using the Ederer II method; Cox regression analysis was performed in SAS.

**Results:** The 1975–2020 16 AAIRs for ALL, SCC, ADC, and other were 8.9, 6.2, 1.9, and 1.1, and declined by 54.9%, 62.6%, and 75% for ALL, SCC and OTHER, but for ADC increased by 20.1% (Table 1). In white patients, AAIRs for SCC decreased by 59%, but for ADC increased by 38.8%; whereas in black patients AAIRs for SCC decreased by 80.4% and ADC decreased by 49.6%. For other, SCC decreased by 70.7%, but ADC increased by 1.9%. In whites, the greatest increase in AAIRs for ADC were in women 30–39 years old (143.8%, APC +2.0), but were also increased in women 0–29 and 40–59 years (all P < 0.05). Five-year RS was higher for SCC, 68.8% (95% CI 68.2–69.4) than ADC 65.1% (95% CI 63.6–66.6). RS was higher for ADC in white versus black patients (66.9%, 95% CI 65.2–68.5% vs 48.9%, 95% CI 44.2–53.3), and lower for age 60 years and advanced-stage disease (all P < 0.05). In the Cox regression model, histology, race, age, and stage remained statistically significant (P < 0.0001). After accounting for age, histology, and stage, black patients remained at increased risk for poorer survival compared with white patients (HR = 1.26, 95% CI 1.22–1.31).

**Conclusion:** AAIRs for ADC continue to rise, especially in young white women, and lower survival rates among black women persist, especially for ADC. Factors accounting for higher ADC rates, especially in younger women, for whom fertility is paramount, and poorer survival rates in blacks deserve further investigation.

**Table 1.** Age adjusted incidence rates, percent change, annual percent change and relative survival in invasive cervical cancer by histology, race, and age at diagnosis.

| Age adjusted incidence rates (AAIR) and percent change by histology |  |
|---|---|---|---|
| N | AAIR | Percent change (PC) | Annual percent change (APC) |
| ALL | 47,532 | 8.9 | -54.9 | -1.9 |
| SCC | 33,379 | 6.2 | -62.6 | -2.5 |
| ADC | 10,109 | 1.9 | 20.1 | +0.5 |
| Other | 5,633 | 1.1 | -75.0 | -2.9 |

| AAIR and PC by race, age, and histology |  |
|---|---|---|---|---|---|---|
| | SCC | ADC | Other |  |
| N | AAIR | PC | APC | N | AAIR | PC | APC | N | AAIR | PC | APC |
| White | 24,350 | 5.7 | -59.0 | -2.3 | 8,064 | 1.9 | 38.8 | +0.9 | 4,146 | 1.0 | -73.9 | -2.7 |
| 0-19 | 28 | 0 | -100.0 | - | 21 | 0 | 23.7 | - | 23 | 0 | - | - |
| 20-29 | 1,927 | 3.1 | -43.2 | -1.8 | 527 | 0.8 | 25.7 | +1.5 | 482 | 1.8 | -85.9 | -3.3 |
| 30-39 | 5,369 | 8.8 | -47.0 | -1.5 | 1,932 | 3.2 | 143.8 | 2.0 | 915 | 1.5 | -80.3 | -2.6 |
| 40-49 | 5,265 | 9.4 | -46.4 | -1.5 | 2,025 | 3.6 | 64.8 | +1.2 | 788 | 1.4 | -68.1 | -2.5 |
| 50-59 | 4,348 | 9.0 | -66.1 | -2.7 | 1,364 | 2.8 | 44.3 | +0.8 | 609 | 1.3 | -69.7 | -2.3 |
391 - Poster Session

Radiation treatment at multiple centers and treatment delays during definitive chemoradiation for treatment of cervical cancer

S.E. Paraghamian, E.M. Davies and A.A. Weiner. University of North Carolina at Chapel Hill, Chapel Hill, NC, USA

Objective: Previous research has demonstrated that completion of definitive chemoradiation for treatment of cervical cancer within 8 weeks is critical for overall survival as well as local tumor control, and that differential rates of timely treatment contribute to health disparities. We examined the association between receiving treatment at multiple centers and treatment delays.

Method: This is a retrospective analysis of all patients undergoing chemoradiation for definitive treatment of squamous cell, adenosquamous, or adenocarcinoma of the cervix from November 2009 through December 2017 at a tertiary referral center. We included patients who received external beam radiation (EBRT) at an outside facility and returned to our institution for brachytherapy (multiple centers) as well as patients who completed all treatment at our institution (single center). Patients were excluded if treatment dates were not clearly documented in the electronic medical record. Demographic, clinical, and pathological data were obtained by chart review. Bivariate comparisons were performed using the $\chi^2$ test or Fisher exact test for categorical variables. The t test or Mann–Whitney U test was used to compare continuous variables when normally or not normally distributed.

Results: Of the 145 women who met inclusion criteria, 141 (97.2%) completed treatment in a median of 61 days (range 38–168 days). Forty-four (31.2%) completed treatment within 56 days, while 97 (68.8%) were delayed. Eighty-six (59.3%) received treatment at a single institution, while 59 (40.7%) were treated at multiple centers. There was no association between age, race, insurance status, or living within 50 miles of our treatment center and timely completion of therapy. Compared to patients treated at a single center, patients receiving treatment at multiple centers showed longer time between end of EBRT and initiation of brachytherapy (median 6 vs 0 days, $P < 0.0001$), with 39% of patients experiencing a delay of greater than 1 week prior to start of brachytherapy compared to 18.3% ($P = 0.006$). There was not a significant difference in overall treatment time (median 64 vs 59 days, $P = 0.242$) between the 2 groups.
Conclusion: Given these findings, focused efforts to improve coordination of care may decrease treatment delays and increase the rate of patients completing treatment within 56 days.

392 - Poster Session
Pap smear outcomes in HIV-positive women ≥65 years and HIV-negative matched controls
K.L. Klein, A.R. Goron, G. Taylor and D.M. Roque. The University of Maryland School of Medicine, Baltimore, MD, USA

Objective: The aim of this study was to evaluate the incidence of cervical/vaginal cancer and abnormal Pap smears in human immunodeficiency virus (HIV)+ women age 65 years or older compared to HIV-matched controls.

Method: This retrospective cohort included patients who underwent screening at the University of Maryland between January 2003 and April 2019. Controls were matched by age, year, and smoking status at time of initial Pap collection. Primary outcome was development of cervical/vaginal cancer. Secondary outcomes included cytology result, high-risk human papilloma virus (HRHPV) status, performance of indicated colposcopy, colposcopic impression, cytology progression, age at HIV diagnosis, AIDS-defining disease, mode of HIV acquisition, viral load (VL), CD4 count, and prescription for antiretrovirals. Data were analyzed using Fisher exact test for categorical variables and Mann-Whitney or unpaired t test for continuous data.

Results: The HIV+ and HIV− groups (n = 70 each) underwent a total of 140 and 151 Pap results, respectively. The groups differed significantly across many factors (Table 1). Among HIV+ women, 29% exhibited abnormal Pap results. Compared to HIV+ women with normal Pap results, they were less likely to have had serially negative Pap tests prior to age 65 years (P = 0.03) and more likely to endorse EtOH use (P = 0.013). In both the HIV+ and HIV− groups, 1.4% developed cervical cancer. No individuals developed vaginal cancer. The frequency of abnormal Pap was higher in HIV+ than in HIV− groups (31% vs 10%, P < 0.0001) as was HRHPV status (43% vs 19%, P = 0.0233). HIV+ status conferred a relative risk (RR) of 3.2 for an abnormal Pap and 2.3 for HRHPV (95% CI 1.9–5.4 and 1.2–4.6, respectively). Cytology in HIV+ women was 71% NILM, 14% ASC-US, <1% ASC-H, 11% LSIL, 2% HSIL, and <1% carcinoma; among HIV− women, 86% NILM, 7% ASC-US, 0% ASC-H, 7% LSIL, 0% HSIL, and <1% carcinoma. The RR of an abnormal Pap was 2.6 for VL >1,000 copies/mL (95% CI 1.1–4.2) and 0.4 for a CD4 count of >200 cells/μL (95% CI 0.2–0.7). No individuals with an initial normal Pap progressed to an abnormal result, over a mean of 42.5 and 43.5 months in the HIV+ and HIV− groups, respectively.

Conclusion: HIV+ status was associated with a higher rate of abnormal Pap and HRHPV in the elderly; however, this did not translate into a significant difference in subsequent cervical or vaginal cancer diagnosis. Elevated VL and low CD4 count were associated with greater risk for an abnormal Pap.

Table 1. Demographic and socioeconomic characteristics.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>All Women</th>
<th>HIV-positive Women</th>
<th>HIV-negative Women</th>
<th>P</th>
<th>Normal Pap</th>
<th>Abnormal Pap</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>66 (65-68)</td>
<td>66 (65-68)</td>
<td>Controlled</td>
<td>.760</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic black</td>
<td>68 (97.1)</td>
<td>36 (51.4)</td>
<td>49 (98.0)</td>
<td>19 (95.0)</td>
<td>.0015</td>
<td>.343</td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic white</td>
<td>1 (1.4)</td>
<td>32 (45.7)</td>
<td>0 (0)</td>
<td>1 (5.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>0 (0)</td>
<td>1 (1.4)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Native American</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>1 (1.4)</td>
<td>0 (0)</td>
<td>1 (2.0)</td>
<td>0 (0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>0 (0)</td>
<td>1 (1.4)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary insurance</td>
<td></td>
<td></td>
<td></td>
<td>.015</td>
<td>.343</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uninsured</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td>0 (0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medicare/Medicaid</td>
<td>64 (91.4)</td>
<td>52 (74.3)</td>
<td>45 (90.0)</td>
<td>19 (95.0)</td>
<td>.015</td>
<td>.343</td>
<td></td>
</tr>
<tr>
<td>Ryan White Grant</td>
<td>2 (2.9)</td>
<td>0 (0)</td>
<td>2 (4.0)</td>
<td>0 (0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private</td>
<td>3 (4.3)</td>
<td>16 (22.9)</td>
<td>3 (6.0)</td>
<td>0 (0)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>1 (1.4)</td>
<td>2 (2.9)</td>
<td>0 (0)</td>
<td>1 (5.0)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Parity*</th>
<th>3 (2-4.8)</th>
<th>2 (1-3)</th>
<th>2 (2-4)</th>
<th>3 (2-7)</th>
<th>.339</th>
</tr>
</thead>
<tbody>
<tr>
<td>BMI (kg/m²)</td>
<td>.0062</td>
<td>.052</td>
<td>.0764</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;18.5</td>
<td>5 (7.1)</td>
<td>0 (0)</td>
<td>2 (4.0)</td>
<td>3 (15.0)</td>
<td></td>
</tr>
<tr>
<td>18.5-24.9</td>
<td>21 (30.0)</td>
<td>10 (14.3)</td>
<td>12 (24.0)</td>
<td>9 (45.0)</td>
<td></td>
</tr>
<tr>
<td>25.0-29.9</td>
<td>17 (24.3)</td>
<td>19 (27.1)</td>
<td>15 (30.0)</td>
<td>2 (10.0)</td>
<td></td>
</tr>
<tr>
<td>30.0-39.9</td>
<td>22 (31.4)</td>
<td>25 (35.7)</td>
<td>18 (36.0)</td>
<td>4 (20.0)</td>
<td></td>
</tr>
<tr>
<td>40.0+</td>
<td>2 (2.9)</td>
<td>11 (15.7)</td>
<td>1 (2.0)</td>
<td>1 (5.0)</td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>3 (4.3)</td>
<td>5 (7.1)</td>
<td>2 (4.0)</td>
<td>1 (5.0)</td>
<td></td>
</tr>
<tr>
<td>Tobacco use</td>
<td>Controlled</td>
<td>.113</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>18 (25.7)</td>
<td>18 (25.7)</td>
<td>14 (28.0)</td>
<td>4 (20.0)</td>
<td></td>
</tr>
<tr>
<td>Former</td>
<td>24 (34.3)</td>
<td>24 (34.3)</td>
<td>20 (40.0)</td>
<td>4 (20.0)</td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td>28 (40.0)</td>
<td>28 (40.0)</td>
<td>16 (32.0)</td>
<td>12 (60.0)</td>
<td></td>
</tr>
<tr>
<td>Alcohol use</td>
<td>.0006</td>
<td>.0129</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>50 (71.4)</td>
<td>66 (94.3)</td>
<td>40 (80.0)</td>
<td>10 (50.0)</td>
<td></td>
</tr>
<tr>
<td>Former</td>
<td>15 (21.4)</td>
<td>4 (5.7)</td>
<td>9 (18.0)</td>
<td>6 (30.0)</td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td>5 (7.1)</td>
<td>0 (0)</td>
<td>1 (2.0)</td>
<td>4 (20.0)</td>
<td></td>
</tr>
<tr>
<td>Drug use</td>
<td>&lt;.0001</td>
<td>.152</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>41 (58.6)</td>
<td>67 (95.7)</td>
<td>32 (64.0)</td>
<td>9 (45.0)</td>
<td></td>
</tr>
<tr>
<td>Former</td>
<td>15 (21.4)</td>
<td>2 (2.9)</td>
<td>11 (22.0)</td>
<td>4 (20.0)</td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td>14 (20.0)</td>
<td>1 (1.4)</td>
<td>7 (14.0)</td>
<td>7 (35.0)</td>
<td></td>
</tr>
<tr>
<td>Hysterectomy for benign indication</td>
<td>32 (45.7)</td>
<td>13 (18.6)</td>
<td>.001</td>
<td>24 (48.0)</td>
<td>8 (40.0)</td>
</tr>
<tr>
<td>History of abnormal Pap at age &lt;65</td>
<td>.0024</td>
<td>.292</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>23 (32.9)</td>
<td>30 (42.9)</td>
<td>19 (38.0)</td>
<td>4 (20.0)</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>35 (50.0)</td>
<td>16 (22.9)</td>
<td>22 (44.0)</td>
<td>13 (65.0)</td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>12 (17.1)</td>
<td>24 (34.3)</td>
<td>9 (18.0)</td>
<td>3 (15.0)</td>
<td></td>
</tr>
<tr>
<td>Serially negative Pap tests‡</td>
<td>1 (0-3.5)</td>
<td>2 (1-5)</td>
<td>.0281</td>
<td>1 (1-5)</td>
<td>1 (0-1)</td>
</tr>
</tbody>
</table>

HIV, human immunodeficiency virus; BMI, body mass index.  
Data are median (interquartile range), n (%), or mean±SD unless otherwise specified.  
Abnormal Pap result defined as one for which colposcopy was indicated.  
Fisher exact test was used for categorical variables; Mann-Whitney or unpaired t test were used for continuous data.  
* Data unknown in 6 HIV-positive (5 with normal Pap, 1 with abnormal Pap) and 10 HIV-negative women.  
† Data unknown in 21 HIV-positive (16 with normal Pap, 5 with abnormal Pap) and 24 HIV-negative.

---

**393 - Poster Session**

**From Pap to colposcopy: Delay in care in the evaluation and treatment of cervical dysplasia**  
J. Huntly, S. Holtzman and O. Afzal. Icahn School of Medicine at Mount Sinai, New York, NY, USA

**Objective:** The current cytology-based model for cervical cancer screening requires patients to attend multiple visits within a timely manner to be evaluated and treated for cervical dysplasia. The objective of this study was to investigate whether patients are receiving colposcopy and treatment within an appropriate period of time according to ASCCP guidelines of 56 days from Pap to colposcopy, in a clinic where low socioeconomic status predominates.

**Method:** This study was a retrospective review of appointment outcomes for patients referred to colposcopy at a large tertiary care hospital from 2017 to 2018. A further descriptive retrospective review of patient referrals from January to July 2018 was performed to assess demographics, Pap result, and time intervals from Pap to colposcopy, colposcopy results, and treatment visits. Sign tests were performed for comparison of median intervals to recommended ASCCP guidelines.
**Results:** A total of 2,546 colposcopy referral visits between 2017 and 2018 were evaluated with 46% of visits completed, 4.2% canceled, 18.7% rescheduled, and 31.1% not attended. A total of 323 charts were analyzed further from January to July 2018; 45% of all patients and 50.7% of patients with high-grade cytology present to their originally scheduled colposcopy visits. The median time from Pap to eventual colposcopy was 94 days for all patients (\(P < 0.001\)) and 80.5 days for high-grade cytology patients (\(P = 0.011\)), differing significantly from recommended referral time. There were a total of 47 patients with high-grade lesions (CIN2 or greater) on colposcopy, and 51% received treatment and 44% did not or opted for close follow-up. The percentage of those never reached for counseling was 12.8%. Median time from Pap to eventual treatment was 208 days. See Table 1.

**Conclusion:** This study demonstrates that there are significant delays from Pap smear to colposcopy evaluation and treatment for patients at this urban tertiary care center. Such data suggest that there may be a role for alternative methods of screening to reduce the number of required visits and thus time to follow-up. With new technology allowing for potentially rapid HPV testing and recent guidelines exploring primary HPV screening as an alternative to cytology screening, implementation of revised algorithms could be considered in settings where compliance with multiple clinic visits is a limiting factor to receiving care.

**Table 1.** Time intervals (in days) from pap smear to colposcopy, results visit, and treatment.

<table>
<thead>
<tr>
<th>Time Interval (Days)</th>
<th>Time from Pap to Originally Scheduled Colposcopy Appointment (All Patients)</th>
<th>Time from Pap to Eventual Colposcopy Appointment (High Grade Cytology)</th>
</tr>
</thead>
<tbody>
<tr>
<td>n = 323</td>
<td>Mean and Std: 83.25 (65.29)</td>
<td>Mean and Std: 143.08 (197.31)</td>
</tr>
<tr>
<td>Median and IQR: 76.00 (46.00, 96.00)</td>
<td>139.75 (142.42)</td>
<td>80.50 (49.50, 147.50)</td>
</tr>
<tr>
<td>Min and Max: 2.00, 561.00</td>
<td>6.00, 1253.00</td>
<td>(17.00, 1253.00)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time Interval (Days)</th>
<th>Time from Pap to Eventual Results Visit (All Patients)</th>
<th>Time from Pap to Eventual Results Visit (High Grade Lesions)</th>
<th>Time from Pap to Eventual Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>n = 247</td>
<td>Mean and Std: 178.02 (159.31)</td>
<td>Mean and Std: 169.50 (147.55)</td>
<td>Mean and Std: 304.58 (318.53)</td>
</tr>
<tr>
<td>Median and IQR: 131.00 (86.00, 210.00)</td>
<td>168.50 (149.00, 253.50)</td>
<td>208.50 (149.00, 354.00)</td>
<td></td>
</tr>
<tr>
<td>Min and Max: 31.00, 1474.00</td>
<td>(40.00, 559.00)</td>
<td>(58.00, 1687.00)</td>
<td></td>
</tr>
</tbody>
</table>

---

**394 - Poster Session**

**Trends in mortality after surgery for early-stage cervical cancer in the United States after introduction of minimally invasive radical hysterectomy: An interrupted time series analysis**

A. Melamed, J.A. Rauh-Hain, N.L. Keating, P.T. Ramirez, R. Nitecki, M. del Carmen, and J.D. Wright. New York- Presbyterian/Columbia University Medical Center, New York, NY, USA, The University of Texas MD Anderson Cancer Center, Houston, TX, USA, Dana-Farber Cancer Institute, Boston, MA, USA, Harvard Medical School, Boston, MA, USA, Massachusetts General Hospital, Boston, MA, USA

**Objective:** The aim of this study was to examine trends in 4-year all-cause mortality among women undergoing radical hysterectomy for cervical cancer during the period of rapid adoption of minimally invasive radical hysterectomy (MIRH), and to compare these trends with those of other surgically treated solid tumor malignancies.

**Method:** The frequency of MIRH for cervical cancer was estimated from the National Cancer Data Base in 2010–2012 and the Premier database for 2006–2009. Using the Surveillance Epidemiology and End Result 18 registries data file to calculate 4-year all-cause mortality, we fit piecewise regression models to conduct an interrupted time series analysis of mortality trends. We tested whether 4-year mortality increased over time among women undergoing radical hysterectomy for early-stage cervical cancer between 2006 and 2012 (when MIRH increased rapidly) compared with 2000–2006 trends. To evaluate whether trends in cervical cancer mortality were unusual compared to other malignancies, we calculated observed-to-expected ratios for 4-year all-cause mortality, based on 2000–2006 trends, for 20 of the most common surgically treated solid tumor malignancies.

**Results:** We identified 7,327 women who underwent radical hysterectomy and lymphadenectomy for early-stage cervical cancer between 2000 and 2012. From 2000 to 2006, the 4-year all-cause mortality declined from 9.8% (95% CI 7.7%–12.5%) to 7.7% (95% CI 5.7%–10.4%), \(P_{\text{trend}} = 0.06\). There was a significant change in trend beginning in 2006 \((P = 0.007)\), coinciding with the rapid adoption of MIRH (Figure 1A). As the share of radical hysterectomies performed by minimally invasive technique increased from 2% in 2006 to 52% in 2012, 4-year all-cause mortality rose by 6.2% per year (95% CI 2.6%–9.8%), reaching 11.7% (95% CI 9.0–15.1%) in 2012, a level 77% higher than expected based on the pre-2006 trend (relative risk 1.77, 95% CI 1.21–2.57). Compared with patients who underwent surgery for other solid malignancies, women undergoing radical hysterectomy for cervical cancer after 2006 demonstrated the greatest increase in 4-year all-cause mortality relative to expected trends (Figure 1B).
**Conclusion:** Among women undergoing radical hysterectomy for early-stage cervical cancer, 4-year all-cause mortality increased concurrently with adoption of MIRH. This trend was an outlier among surgically treated solid tumor malignancies.

**Fig. 1A.** Interrupted time series analysis of the association between adoption of minimally invasive radical hysterectomy and 4-year all-cause mortality. Annual four-year all-cause mortality rates among women undergoing radical hysterectomy and lymphadenectomy for cervical cancer by any surgical approach (diamonds) and 95% confidence intervals (error bars) are plotted against the left axis, while annual frequencies of minimally invasive surgery (circles) are plotted against the right. Adoption of minimally invasive radical hysterectomy was associated with a change in mortality trend \((P = 0.0007)\), and increasing four-year mortality rates starting in 2006. **Fig. 1B.** Comparison of four-year all-cause mortality trends among the 20 most common surgically-treated solid tumor malignancies. Ratio of observed to expected mortality rates were calculated using predictions based on 200-2006 trends in mortality rates. Compared to patients who underwent surgery for other malignancies, women undergoing radical hysterectomy for cervical cancer after 2006 demonstrated the greatest increase in mortality.

**395 - Poster Session**
**Prediction of disease recurrence according to surgical approach of primary radical hysterectomy in patients with early-stage cervical cancer using machine learning methods**

S.I. Kim, S. Lee, C.H. Choi, M. Lee, J.W. Kim and Y.B. Kim. "Seoul National University Hospital, Seoul, South Korea, Samsung Medical Center, Sungkyunkwan University School of Medicine, Seoul, South Korea, Seoul National University Hospital, Seoul National University College of Medicine, Seoul, Seoul National University College of Medicine, Seoul, Korean Gynecologic Oncology Group (KOGG), Seoul, Seoul National University Bundang Hospital, Seongnam-Si, South Korea"

**Objective:** Determination of the appropriate surgical approach for radical hysterectomy in each cervical cancer patient without compromising survival outcome is an important issue. Thus, we aimed to develop models predicting disease recurrence according to the surgical approach in early-stage cervical cancer.

**Method:** We retrospectively identified patients with FIGO stage IB1–IB2 cervical cancer who underwent either primary open radical hysterectomy (ORH) or laparoscopic radical hysterectomy (LRH) at 3 tertiary institutional hospitals between 2000 and 2018. Patients’ clinicopathologic and survival data were collected. We also obtained initial serum tumor markers and image findings (e.g., parametrial invasion and lymph node metastasis). Considering only the variables that could be obtained before surgery, we constructed predictive models for the 3-year progression-free survival (PFS) rate using a novel approach that combines both statistical and machine learning-based prediction models.

**Results:** In total, 1,141 patients were included; 578 and 563 received ORH and LRH, respectively. The median length of observation was 57.6 months during which 157 patients (13.8%) experienced disease recurrence. Various prediction models were developed. To adjust hospital-wise effects and possibility of overfitting, we performed proportional sampling and 5-fold cross-validation. Using an ensemble
model of statistical and 4 machine learning-based prediction methods, AUCs of models achieved 0.82 and 0.77 before and after adjustment, respectively.

**Conclusion:** We developed models predicting disease recurrence according to the surgical approach in early-stage cervical cancer. These machine learning-based models are expected to be useful in choosing ORH or LRH in individualized counselling practices.

---

### 396 - Poster Session

**Response to immune checkpoint inhibitor treatment in a mixed group of patients with platinum-sensitive and refractory cervical cancer**  
K.R. Shieh and Y. Xu. Maimonides Medical Center, New York, NY, USA

**Objective:** Immune checkpoint inhibitor therapy is approved for platinum-refractory cervical cancer, which yields a response rate (PR) of 12% and stable disease (SD) of 18% in the Keynote 158 phase II study. We hypothesized that the response rate in patients with platinum-sensitive disease may be higher, and aimed at analyzing individual characteristics associated with response.

**Method:** This is a retrospective study, and all consecutive patients with cervical cancer who received pembrolizumab or nivolumab were eligible. Electronic medical records were searched to collect demographics, treatment history, and response.

**Results:** Ten patients were identified. Median age was 63 years (range 46 to 79 years); 9 received pembrolizumab and 1 received nivolumab. All had squamous cell carcinoma, with 1 transformed to small cell. PD-1 TPS score varied from 2 to 100, 0 in the small cell tumor. Nine patients had recurrent disease, while 1 had de novo metastatic disease. Seven patients received prior platinum-based chemoradiation, including 5 in the primary and 2 in the adjuvant setting. Four patients were treated at second recurrence, and they all received chemotherapy followed by chemoradiation with curative intent at their first recurrence. At the time of immune checkpoint inhibitor treatment, sites of disease were lymph nodes only (n = 5), pelvic organs (n = 4), and visceral metastasis (n = 3). Immune checkpoint inhibitor therapy was first-line treatment after recurrence for 2 patients, second line for 6, and third line for 2 patients. Immune checkpoint inhibitor therapy was used following immediate progression of disease from chemotherapy in 4 patients, and a mixed response in 2 patients. Only 4 patients were clearly platinum-refractory. Among 8 evaluable patients, there were 5 PR, 1 SD, 1 mixed response (predominantly PR), and 1 PD (small cell). At a median follow-up of 5 months, the median duration of treatment was 5 cycles (range 4–8 cycles, every 3 weeks) or 5 months (range 1–11 months), and 9 patients were continuing treatment. Four patients had continued for >6 months.

**Conclusion:** The response rate to immune checkpoint inhibitor treatment in cervical cancer was much higher than published data in this small cohort of community-based patients with a mixture of platinum-sensitive and -refractory disease. This result suggests that the response rate can be higher in patients with platinum-sensitive disease.

---

### 397 - Poster Session

**Discrepancy between clinical staging and pathological findings on operative stage IB cervical cancer**  
S. Dunk, B.M. Roane and K.H. Kim. University of Alabama at Birmingham, Birmingham, AL, USA

**Objective:** The aim of this study is to analyze the discrepancy between clinical staging and pathological measurements in patients with stage IB1 cervical cancer primarily treated with radical hysterectomy and to evaluate whether outcomes were adversely affected by noncongruent findings.

**Method:** We collected retrospective data on 149 patients who underwent radical hysterectomy for early-stage cervical cancer between January 2010 and July 2016. A total of 112 patients were diagnosed with stage IB (2014 FIGO staging) based on clinical examination. Final tumor size based on pathology report was compared to the clinical staging and tumor size from the preoperative examination.

**Results:** Of 112 patients with stage IB cervical cancer, 100 were diagnosed with stage IB1 (89.2%) and 12 were stage IB2 (10.7%) based on clinical examination. Overall concordance between clinical stage and pathological findings was 79.4%. Fifteen patients (13.4%) had an overestimation, while 8 (7.1%) had an underestimation. Other pathologic findings were similar between patients with congruent and noncongruent pathological findings. There was no positive parametral involvement on any final specimens, consistent with preoperative examination. In both groups, 15% had positive lymph node involvement (P = 0.37), and there was no statistically significant difference between number of patients receiving adjuvant therapy between the groups (20% vs 35%, P = 0.17). When comparing rates of recurrence, 23% of patients with noncongruent findings recurred, while 17.9% of patients with congruent findings experienced recurrence (P = 0.69). Median progression-free survival was not affected by discordant staging and pathological findings (22.6 vs 27.5 months, HR = 0.872, 95% CI 0.738–1.112).
**Conclusion:** During a time period of prominence for minimally invasive surgery for early-stage cervical cancer, there was a moderate amount of discrepancy in preoperative clinical staging versus final pathologic tumor size, particularly in upstaging. This did not appear to have an impact on outcomes in these patients following radical hysterectomy. However, with changes in staging IB cervical cancer, discrepancies between subgroups may become more prevalent and warrant further research to ensure that this does not negatively affect patient outcomes. Preoperative MRI imaging may also help to identify more accurate tumor size and clinical staging.

**398 - Poster Session**

**Effect of obesity on cervical cancer screening and outcomes**


**Objective:** The aim of this study was to identify whether obese women are less often appropriately screened for cervical cancer prior to diagnosis and to explore related cancer outcomes.

**Method:** We retrospectively reviewed all cervical cancer patients at a single institution between 1986 and 2016 and collected demographic information including age, stage, BMI, screening information, and cancer outcomes. Morbid obesity was defined as BMI ≥40, obesity as BMI 30 to <40, and nonobese as BMI <30. $\chi^2$, Fisher exact, and Wilcoxon rank sum tests used to compare variables between BMI categories. Cox regression models were used to evaluate recurrence-free (RFS) and overall survival (OS).

**Results:** A total of 1,080 patients were reviewed of whom 311 (29%) were obese and 107 (10%) morbidly obese. We found a significant difference in screening depending on BMI with morbidly obese women screened inappropriately 64% of the time, obese women screened inappropriately 52% of the time, and nonobese women 46% of the time ($P < 0.01$). Morbidly obese women were more likely to be African American ($P < 0.01$) and more likely to have a minimally invasive surgery ($P = 0.01$) than their obese or nonobese counterparts. There was no difference in presence of symptoms at presentation ($P = 0.12$) or stage ($P = 0.06$) between BMI categories. In multivariate analysis of cancer outcomes, increasing BMI was associated with worse OS with a HR of 1.24 (95% CI 0.93–1.66) for obese women and HR of 2.11 (95% CI 1.46–3.04) for morbidly obese women, but RFS did not differ for either group ($P = 0.25$). There was no difference in OS between different races ($P = 0.15$). In light of recent data, there were no RFS or OS differences between open and minimally invasive hysterectomy ($P = 0.48$ and $P = 0.26$, respectively).

**Conclusion:** Our study strengthens evidence that obese and morbidly obese women have disproportionate inappropriate screening prior to cervical cancer diagnosis. We also saw worse OS for the morbidly obese patients in our cohort. Attention should be paid to these screening disparities and their possible causes including stigma and access issues.

**399 - Poster Session**

**Is the age of cervical cancer diagnosis changing over time?**


**Objective:** Current cervical cancer guidelines recommend discontinuing screening after the age of 65 years; however, with decreasing hysterectomy rates, aging women are more likely to retain their uterus and cervix, and this may affect risk of cervical cancer. The objective of this study was to determine whether there has been an increase in the age of diagnosis of cervical cancer over time or in the proportion of patients older than 65 years diagnosed with cervical cancer.

**Method:** A retrospective review of a single institution was conducted including all cervical cancer patients seen between 1986 and 2016. Data included demographic variables including age of diagnosis, last cervical cancer screening, and cancer information. Cochran-Armitage test was used to assess temporal trends in the proportion of patients diagnosed older than 65 years.

**Results:** We reviewed 1,019 patients with cervical cancer of whom 116 were older than 65 years. We found a significant increase in age of diagnosis over time by 0.19 years per calendar year with an average age of diagnosis of 43.7 years in 1986 versus 49.5 years in 2016 ($P < 0.01$). We did not find a difference in the proportion of patients diagnosed with cervical cancer older than 65 years (17.2% in 1986 vs 14.8% in 2016, $P = 0.39$). There was an average of 6.93 years to last Pap smear prior to diagnosis, and 66.2% of individuals presented with symptoms, not as a part of routine screening. Regardless of age, 40.3% of individuals had nonguideline-adherent screening prior to diagnosis. In our study, 19.0% of women diagnosed with cervical cancer older than 65 years developed cancer despite being screened out appropriately according to guidelines prior to diagnosis.

**Conclusion:** In our cohort, the age of diagnosis of cervical cancer increased over time; however, up to this point, there was still no significant difference in the percentage of women diagnosed with cervical cancer. Given that almost 20% of older women were diagnosed with cancer despite being screened out appropriately, there may be utility in screening women over this age and a need to
In the case of HPV16 E6* degradation in cervical cancer, while CCDC106 promotes the proliferation and migration of cervical cancer by regulating p53 levels, even of CCDC106. Importantly, over-expression of CCDC106 can still induce p53 degradation in E6*. The opposite expression pattern and effect were observed by upregulating the expression of E6*. A total of 178 cervical carcinoma samples (169 HPV-positive and 9 HPV-negative) were included from TCGA dataset, with gene aberrations and gene expression data for comprehensive reanalysis. Therapeutic models of mTOR inhibitors (Temsirolimus or Rapamycin) were evaluated in C-33-A, a mutation HPV-negative cervical carcinoma cell line, in vitro and in vivo. We found that PTEN nonsynonymous coding variants were relatively more frequent in HPV-negative cervical carcinoma (P = 0.000735), even for PTEN gene aberrations (including coding variants and copy number variations) (P = 0.0001). The overall survival of patients with PTEN gene aberrations in the HPV-negative group was worse than that in the HPV-positive cervical carcinoma group (P = 0.0073, HR = 8.10). In addition, the PI3K-AKT-mTOR pathway was strongly activated not only in PTEN gene aberrations patients of HPV-negative cervical carcinoma, but in C-33-A cells compared to HaCaT cells in RNA-sequencing. In vitro and in vivo assays, mTOR inhibitors reduced tumor cell proliferation independently as well as in combination with cisplatin by regulating the p53 signalling pathway. However, mTOR inhibitors showed no response in SiHa cells in vitro and in vivo. More importantly, mTOR inhibitors decreased tumor cell migration and invasion in vitro, especially the rate of lymph node metastasis through down-regulation of Rho-GTPases (RhoA/Rock2 pathway) in vivo. We identified that PTEN gene aberrations were more frequent in HPV-negative cervical carcinoma, which corresponded to poor cancer survival in this group. In addition, the PI3K-AKT-mTOR pathway was strongly activated in PTEN gene aberrations patients, especially in cervical carcinoma. In vitro and in vivo assays validated that mTOR inhibitors (Temsirolimus or Rapamycin) could be beneficial for cervical carcinoma patients with PTEN gene aberrations.

**Conclusion:** We set out to analyze the gene aberrations of phosphatase and tensin homolog (PTEN) in HPV-negative cervical carcinoma, and to identify the gene dysregulation in PI3K-AKT-mTOR pathway from The Cancer Genome Atlas (TCGA) dataset compared to HPV-positive cervical carcinoma. It remained to be determined whether HPV-negative cervical carcinoma with PTEN gene aberrations could be a candidate for treatment with mTOR inhibitors.

**Method:** A total of 178 cervical carcinoma samples (169 HPV-positive and 9 HPV-negative) were included from TCGA dataset, with gene aberrations and gene expression data for comprehensive reanalysis. Therapeutic models of mTOR inhibitors (Temsirolimus or Rapamycin) were evaluated in C-33-A, a mutation HPV-negative cervical carcinoma cell line, in vitro and in vivo. Results: We found that PTEN nonsynonymous coding variants were relatively more frequent in HPV-negative cervical carcinoma (P = 0.000735), even for PTEN gene aberrations (including coding variants and copy number variations) (P = 0.0001). The overall survival of patients with PTEN gene aberrations in the HPV-negative group was worse than that in the HPV-positive cervical carcinoma group (P = 0.0073, HR = 8.10). In addition, the PI3K-AKT-mTOR pathway was strongly activated not only in PTEN gene aberrations patients of HPV-negative cervical carcinoma, but in C-33-A cells compared to HaCaT cells in RNA-sequencing. In vitro and in vivo assays, mTOR inhibitors reduced tumor cell proliferation independently as well as in combination with cisplatin by regulating the p53 signalling pathway. However, mTOR inhibitors showed no response in SiHa cells in vitro and in vivo. More importantly, mTOR inhibitors decreased tumor cell migration and invasion in vitro, especially the rate of lymph node metastasis through down-regulation of Rho-GTPases (RhoA/Rock2 pathway) in vivo.

**Conclusion:** We identified that PTEN gene aberrations were more frequent in HPV-negative cervical carcinoma, which corresponded to poor cancer survival in this group. In addition, the PI3K-AKT-mTOR pathway was strongly activated in PTEN gene aberrations patients, especially in cervical carcinoma. In vitro and in vivo assays validated that mTOR inhibitors (Temsirolimus or Rapamycin) could be beneficial for cervical carcinoma patients with PTEN gene aberrations.

**Objective:** Previous studies have found a hot HPV integration site, CCDC106, in a 61 cervical intraepithelial neoplasia (CIN) cohort, with high expression of CCDC106 caused by HPV-CCDC106 integration in the Hi-C dataset. We then found that all the transcription of HPV16 E6 was the form of E6 splice (E6*I) in these carcinoma samples. HPV16 E6 promoted the development of cervical cancer, but the effect of E6 splices, especially E6*I, on cervical cancer was known to be controversial. The effect of high expression of CCDC106 accompanying the expression of E6*I in cervical carcinogenesis is not clear.

**Method:** Hi-C and RNA-sequencing data were analyzed in the HPV-CCDC106 integration samples. Immunohistochemistry was performed to analyze correlation of CCDC106 and p53 in 100 cervical cancer samples. The proliferation and migration of cells were detected in SiHa-CCDC106, SiHa-E6*I, or SiHa-CCDC106-E6*I considering the expression status of CCDC106 or HPV16 E6*I independently as well as simultaneously in vitro and in vivo. Results: We identified high expression of CCDC106 and complete expression of HPV16 E6*I in the HPV-CCDC106 integration sample. And there was negative correlation between CCDC106 and p53 in 100 cervical samples. In addition, HPV16 E6*I showed contrary function from E6 oncoprotein. E6*I prevented p53 from degradation and increases cell adhesion by the activation of β-integrin signaling and over-expression of E-cadherin. After downregulating the expression of CCDC106, the expression level of p53 increased, and the proliferation and migration of cells decreased. The opposite expression pattern and effect were observed by upregulating the expression of CCDC106. Importantly, over-expression of CCDC106 can still induce p53 degradation in E6*I spliced status.

**Conclusion:** The expression of CCDC106 and p53 was negatively correlated in cervical cancer samples. E6*I prevented p53 from degradation in cervical cancer, while CCDC106 promotes the proliferation and migration of cervical cancer by regulating p53 levels, even in the case of HPV16 E6*I spliced status.
**402 - Poster Session**

**Effect of the number of removed lymph nodes on recurrence and survival in FIGO stage IB–IIA cervical squamous cell carcinoma following radical surgery: Evidence from a single center**

Q. Guo, Y. Wu, X. Ju and X. Wu. **Fudan University Shanghai Cancer Center, Shanghai, China**

**Objective:** The purpose of this study was to determine whether the number of removed lymph nodes is associated with recurrence and survival in patients of FIGO stage IB–IIA cervical squamous cell carcinoma following radical hysterectomy with pelvic lymphadenectomy (RHPL).

**Method:** The medical records of 3,732 FIGO stage IB–IIA cervical squamous cell carcinoma patients who underwent RHPL in our center between 2006 and 2014 were retrospectively reviewed. Patients were classified into 5 groups according to the number of removed lymph nodes. The impact of removed lymph nodes, analyzed as both continuous and categorical variables, on overall survival (OS) and progression-free survival (PFS), was analyzed using multivariate Cox proportional hazards models. Separate analyses were performed for lymph node-positive and -negative patients.

**Results:** Among 3,732 women, 96 (2.6%) had 1–10 nodes, 1,555 (41.7%) had 11–20 nodes, 1,524 (40.8%) had 21–30 nodes, 471 (12.6%) had 31–40 nodes, and 86 (2.3%) had >40 nodes removed. The mean number of removed lymph nodes was 22.62 (range 1–70 nodes), and positive lymph nodes were found in 928 (24.87%) patients. In all patients and lymph node-negative patients, the number of removed lymph nodes was associated with both OS \((P = 0.041\) and \(P = 0.031\), respectively) and PFS \((P = 0.031\) and \(P = 0.016\), respectively). However, the number of removed lymph nodes was not associated with OS \((P = 0.504)\) and PFS \((P = 0.501)\) in lymph node-positive patients. Moreover, in multivariate analysis, number of removed lymph nodes was not an independent prognostic factor for OS and PFS in all patients, lymph node-positive, and -negative patients.

**Conclusion:** If standardized meticulous RHPL is performed, the number of removed lymph nodes was not an independent prognostic factor for recurrence and survival of patients in FIGO stage IB–IIA cervical squamous cell carcinoma, per se.

---

**403 - Poster Session**

**Factors associated with delay in treatment initiation of locally advanced cervical cancer**

S.S. Lee, A.A. Berger, O. Ishaq, J.P. Curtin, G.M. Salama, B. Pothisiri, P.B. Schiff, L.R. Boyd and S. Lymberis. **aNew York University School of Medicine, New York, NY, USA, bChristus St Michael, Texarkana, TX, USA**

**Objective:** We aimed to explore the disparities associated with the delay of initiating chemoradiation therapy (CRT) and brachytherapy (BT) beyond the recommended 8 weeks for patients with cervical cancer and the effect on outcomes.

**Method:** Patients with FIGO stage IB2–IVA cervical cancer treated at an academic medical center and an urban public hospital by the same team of gynecologic and radiation oncologists with definitive CRT and BT from July 2009 to September 2017 were included. Patients received CRT followed by BT \((7 \text{ Gy} \times 4 \text{ fractions})\) delivered via 2 insertions 1 week apart with image-guided CT/MR delineation. Patients who initiated CRT within 8 weeks from diagnosis as recommended (rCRT) were compared across demographic and cancer outcomes to patients who received delayed CRT after 8 weeks (dCRT). Disease-free survival (DFS) and overall survival (OS) were analyzed using adjusted Cox regression analysis \((P < 0.05)\).

**Results:** In our cohort of 97 patients, 72 (75.0%) had rCRT and 24 (25.0%) had dCRT. At a median follow-up of 31.5 months, overall local control was achieved in 94.8% of patients. Patients with dCRT were more likely to be African-American \((37.5\% \text{ vs } 17.8\%, \ P = 0.046)\) and be uninsured or on Medicaid \((87.5\% \text{ vs } 61.6\%, \ P = 0.023)\). There were no differences in stage and grade. Patients with dCRT were more likely to recur or progress \((\text{OR} = 2.65, 95\% \text{ CI } 1.02–6.86)\). Of those who recurred, 35.0% of rCRT patients had locoregional recurrence versus 66.7% of dCRT patients \((P = 0.144)\). When controlling for age, race, insurance, referring hospital, and stage, patients with dCRT had lower DFS than patients with rCRT \((50.6 \text{ vs } 63.2 \text{ months}, \text{aHR} = 6.11, 95\% \text{ CI } 2.00–18.62)\). However, there were no differences in OS.

**Conclusion:** Patients receiving delayed CRT tended to have worse recurrence and DFS than those initiating CRT by 8 weeks from diagnosis. African-American and uninsured patients were more likely to experience a delay in care. Navigator and social work services may help improve access to treatments for these patients.

---

**404 - Poster Session**

**Cost of care for the initial management of cervical cancer**

M.F. Blanco, L. Chen, A. Melamed, A.I. Tergas, J.Y. Hou and J.D. Wright. **aNew York-...**
**Objective:** Little is known about the drivers of cost for newly diagnosed cervical cancer treatment and the cost-sharing that women experience. The objective of our study was to examine the cost of care during the first year after diagnosis of cervical cancer, estimate the sources of cost, and explore the out-of-pocket costs.

**Method:** We performed a retrospective, cohort study of women with newly diagnosed cervical cancer from 2008 to 2016 recorded in the MarketScan database. The database includes patients covered by commercial insurance sponsored by more than 100 employers in the United States. Patients were classified based on primary treatment as either surgery (hysterectomy with or without adjuvant therapy) or radiation. Medical expenditures for a 12-month period beginning on the date of first treatment adjusted for inflation were estimated. Payments were divided into expenditures of inpatient care, outpatient care (including chemotherapy), and outpatient pharmacy costs. Descriptive statistics were used to examine drivers of cost, differences in cost based on treatment, and out-of-pocket expenses.

**Results:** A total of 4,495 patients including 3,014 (67%) who underwent surgery and 1,481 (33%) who underwent primary radiotherapy were identified. The median total expenditures per patient during the first year after diagnosis was $56,250 (IQR $25,767–$109,753). The median total expenditure for patients with primary surgical treatment was $37,222 (IQR $20,957–$75,555). Inpatient services accounted for $15,145 (IQR $0–$26,898) in expenditures, outpatient services for $18,430 (IQR $5,354–$4,804), and outpatient pharmacy costs for $628 (IQR $141–$1,847). Median cost rose from $26,164 for those who did not require adjuvant therapy to $89,760 in women treated with adjuvant radiation. The median total expenditure for patients treated with primary radiotherapy was $101,266 (IQR $63,155–$160,760). Outpatient services were $84,148 (IQR $52,313–$129,287), and outpatient pharmacy costs $1,187 (IQR $295–$3,187). The median out-of-pocket expense per all patients was $2,253 (IQR $1,137–$3,990), in the primary surgical treatment group $2,033 (IQR $982–$3,634) and in the primary radiotherapy group $2,766 (IQR $1,479–$4,714).

**Conclusion:** The average cost of care for women with cervical cancer in the first year following initial treatment is approximately $56,000, and the average cost with primary radiotherapy is approximately 2.7 times greater than that with surgery. Patients bear approximately 4% of these costs in the form of out-of-pocket expenses.

---

**405 - Poster Session**

**Utilization of vaginal brachytherapy in locally advanced cervical cancer**

L. Scanlon, B. Bustamante, A. Nizam, A. Sakaris and G.L. Goldberg, Zucker School of Medicine at Hofstra/Northwell, New Hyde Park, NY, USA

**Objective:** The standard of care for locally advanced cervical cancer, FIGO stage IB2–IVA, is external beam radiation therapy with concurrent chemotherapy followed by brachytherapy. Brachytherapy has been shown to improve survival; however, it appears to be underutilized. The aim of our study was to identify the differences in patient characteristics with advanced cervical cancer who received and did not receive brachytherapy at our institution.

**Method:** An Institutional Review Board-approved study identified all our patients with locally advanced cervical cancer between January 2011 and May 2018. Demographics were obtained from medical records and tumor registry. Potential discriminating factors between groups were studied including age, stage, histological subtype, insurance status, and types of treatment received. Recurrence and survival data were also collected.

**Results:** A total of 160 patients were identified. Seventy-six patients (47.5%) with locally advanced disease received at least 1 brachytherapy treatment. The remaining 84 patients did not receive brachytherapy. The patients who received brachytherapy were younger by 7 years on average than those who did not, 56.1 years old compared to 63.1 years old (P < 0.05). A majority of patients in both groups were stage IIIb, 52% and 53% in the respective groups. Patients who did not receive brachytherapy were more likely to have stage IB2 or IVA disease; 23% of patients fell into these combined stages. There was no statistical significance in brachytherapy utilization when compared by race or by histologic subtype. Twenty-six (31%) patients who did not receive brachytherapy were described as never having been disease free. As expected, patients who did not receive brachytherapy were noted to have decreased recurrence-free and overall survival, with median recurrence-free survival of 29 months and overall survival of 33 months in the no brachytherapy group (P < 0.05). See Figure 1.

**Conclusion:** Our data show that the utilization of brachytherapy is low at our institution especially among patients with stages IB2 and IVA disease. Brachytherapy was more commonly utilized in younger women and those with cervical adenocarcinoma. Regardless of stage or histologic subtype, women with advanced cervical cancer who received brachytherapy had longer progression-free survival and were less likely to recur or die from their disease. To improve overall survival, it is important to further evaluate the patient, provider, and systems based barriers to the utilization of brachytherapy in women with advanced cervical cancer.
Objective: Locally advanced cervical cancer (LACC) is a health problem around the world. Age at presentation is more common between 40 and 60 years of age, considering FIGO stage as the most important prognostic factor. Age as a prognostic factor in patients with LACC is still controversial but can be influential in treatment toxicity, treatment response, and overall survival when comparing young (<40 years) and geriatric (>65 years) patients. The aim of this study was to compare the response to treatment, disease-free survival (DFS), and overall survival (OS) among young versus geriatric patients diagnosed with LACC treated with concurrent chemoradiation.

Method: In this retrospective study 266 patients younger than 40 years and 203 patients older than 65 years with LACC treated with concurrent chemoradiation from 2005 to 2014 were analyzed. A descriptive, comparative, and survival analysis was conducted adjusted by age at diagnosis.

Results: All cases were stage matched IB2-IVA LACC; there were no differences in histology, squamous cell carcinoma being the most common, 88% in the young and 93.6% in the geriatric group. One hundred and twelve (90.3%) of the group of geriatric patients were illiterate compared to only 4.5% (n = 12) of the young patients (P = 0.001). Sixty-five (24.4%) young patients and 27 (13.3%) geriatric patients did not reach complete response to treatment (P = 0.003). Forty-six percent of young patients required blood transfusions before or during treatment, and only 16% of geriatric patients received transfusions (P = 0.0001). Recurrences were documented in 58 (28.7%) and 51 (29.9%) of young and geriatric patients, respectively, with no differences in DFS. Mean OS was 127 for the young and 138 for the geriatric patients (P = 0.037).

Conclusion: In this specific group of patients in a reference center in Mexico, age seems to be an important factor with regard to response to treatment and overall survival, with no impact of age on DFS. Prospective studies with larger numbers of patients are mandatory to identify the real role of age in LACC.

406 - Poster Session
Do the young have a worse prognosis in comparison to the geriatric patients with locally advanced cervical cancer?
L.N. Gallardo-Alvarado, D. Cantu de León, R. Ramírez, S.A. Barquet-Muñoz, R.A. Salcedo-Hernández, D. Perez-Montiel, F. Rivera-Buendia, S. Del Real, M. Perez Quintanilla and J.A. Perez-Marquez. aInstituto Nacional de Cancerología de México, México, DF, Mexico, bHospital General de Saltillo, Saltillo, CU, Mexico, cInstituto Nacional de Perinatología, Mexico, DF, Mexico, dUniversidad Autonoma de Baja California, Mexicali, BJ, Mexico
Objective: As sentinel lymph node (SLN) biopsy is evolving to an accepted standard of care, clinicians are being faced with more frequent cases of small-volume nodal metastatic disease. The objective of this study was to describe the management and measure the effect on recurrence rates of nodal micrometastasis and isolated tumor cells (ITC) in patients with early-stage cervical cancer at 2 high-volume centers.

Method: We conducted a review of prospectively collected patients with surgically treated cervical cancer who were found to have micrometastasis or ITCs on ultrastaging of the SLN. Patients were followed for 5 or more years postoperatively at either our center or another cancer center closer to home.

Results: A total of 19 patients with small-volume disease were identified between 2006 and 2018. Median follow-up was 62 months. Ten (53%) had nodal micrometastatic disease, while 9 (47%) had ITCs detected in the SLN. Seven patients (37%) underwent completion hysterectomy and 4 of them also had paraaortic lymphadenectomy, and there were no positive non-SLNs. The majority (74%) received adjuvant treatment, mostly driven by tumor factors. We observed 2 recurrences. RFS was comparable with historical cohorts of node-negative patients, and adjuvant treatment did not seem to have an impact on recurrence rate (P = 0.37). See Table 1.

Conclusion: Given the uncertainties around the prognostic significance of small-volume nodal disease in cervical cancer, a large proportion of patients receive adjuvant treatment. We found no positive non-SLNs, suggesting that PLND or PALND may not be of benefit in patients diagnosed with small-volume nodal metastases. RFS in this group did not seem to be affected. However, given the small numbers of patients and lack of level 1 evidence, decisions should be individualized in accordance with patient preferences and tumor factors.

Table 1. Management and outcomes of patients with small volume disease in the SLN.

<table>
<thead>
<tr>
<th>Age</th>
<th>FIGO stage (2018)</th>
<th>Surgical treatment</th>
<th>PLND</th>
<th>PALND</th>
<th>SLN+</th>
<th>Size of metastasis</th>
<th>Tumor size (mm)</th>
<th>Depth of invasion (mm)</th>
<th>Parametrial invasion</th>
<th>LVSI</th>
<th>Adjuvant treatment</th>
<th>Recurrence</th>
<th>Follow up (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>34</td>
<td>IB2</td>
<td>No</td>
<td>No</td>
<td>Micro</td>
<td>1.0 mm</td>
<td>20</td>
<td>16.5</td>
<td>1 positive parametral node</td>
<td>Yes</td>
<td>Chemo + Rads (Pelvic+Brachy)*</td>
<td>Yes - pelvis</td>
<td>69.8</td>
</tr>
<tr>
<td>2</td>
<td>37</td>
<td>IA2</td>
<td>No</td>
<td>No</td>
<td>Micro</td>
<td>0.3 mm</td>
<td>5</td>
<td>3</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>64.8</td>
</tr>
<tr>
<td>3</td>
<td>35</td>
<td>IB2</td>
<td>No</td>
<td>No</td>
<td>Micro</td>
<td>0.25 mm</td>
<td>24</td>
<td>17</td>
<td>No</td>
<td>Yes</td>
<td>Chemo + Rads*</td>
<td>No</td>
<td>64.1</td>
</tr>
<tr>
<td>4</td>
<td>26</td>
<td>IB1</td>
<td>No</td>
<td>No</td>
<td>ITC</td>
<td>2 cells</td>
<td>10</td>
<td>9</td>
<td>No</td>
<td>Yes</td>
<td>Chemo</td>
<td>No</td>
<td>62</td>
</tr>
<tr>
<td>5</td>
<td>36</td>
<td>IB1</td>
<td>Unilateral</td>
<td>Yes</td>
<td>Micro</td>
<td>1 mm</td>
<td>14</td>
<td>4</td>
<td>No</td>
<td>Yes</td>
<td>Chemo + Rads*</td>
<td>No</td>
<td>94.4</td>
</tr>
<tr>
<td>6</td>
<td>31</td>
<td>IB3</td>
<td>No</td>
<td>No</td>
<td>ITC</td>
<td>0.1 mm</td>
<td>44</td>
<td>20</td>
<td>No</td>
<td>Yes</td>
<td>Chemo + Rads (Pelvic+Brachy)*</td>
<td>No</td>
<td>79.2</td>
</tr>
<tr>
<td>7</td>
<td>34</td>
<td>IB1</td>
<td>No</td>
<td>No</td>
<td>ITC</td>
<td>0.1 mm</td>
<td>12</td>
<td>2.5</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>62</td>
</tr>
<tr>
<td>8</td>
<td>60</td>
<td>IB2</td>
<td>Unilateral</td>
<td>Yes</td>
<td>Micro</td>
<td>0.8 mm</td>
<td>18</td>
<td>105</td>
<td>No</td>
<td>Yes</td>
<td>Chemo + Rads*</td>
<td>No</td>
<td>76.9</td>
</tr>
<tr>
<td>9</td>
<td>32</td>
<td>IB1</td>
<td>Bilateral</td>
<td>No</td>
<td>Micro</td>
<td>1 mm</td>
<td>10</td>
<td>6</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>61.5</td>
</tr>
<tr>
<td>10</td>
<td>51</td>
<td>IB1</td>
<td>Bilateral</td>
<td>Yes</td>
<td>Micro</td>
<td>1.5 mm</td>
<td>10</td>
<td>5.5</td>
<td>No</td>
<td>Yes</td>
<td>Chemo + Rads</td>
<td>No</td>
<td>57.4</td>
</tr>
<tr>
<td>11</td>
<td>59</td>
<td>IA1</td>
<td>Bilateral</td>
<td>No</td>
<td>Micro</td>
<td>0.7 mm</td>
<td>2.5</td>
<td>0.8</td>
<td>No</td>
<td>No</td>
<td>Rads</td>
<td>No</td>
<td>58.5</td>
</tr>
<tr>
<td>12</td>
<td>57</td>
<td>IB2</td>
<td>No</td>
<td>No</td>
<td>ITC</td>
<td>2 cells</td>
<td>30</td>
<td>12</td>
<td>No</td>
<td>Yes</td>
<td>Chemo + Rads*</td>
<td>No</td>
<td>39.6</td>
</tr>
<tr>
<td>13</td>
<td>31</td>
<td>IB2</td>
<td>Unilateral</td>
<td>Yes</td>
<td>Micro</td>
<td>1 mm</td>
<td>25</td>
<td>6</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>46.1</td>
</tr>
<tr>
<td>14</td>
<td>42</td>
<td>IB1</td>
<td>Simple hysterectomy</td>
<td>No</td>
<td>No</td>
<td>ITC</td>
<td>200 cells</td>
<td>1</td>
<td>1</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
<td>24</td>
</tr>
<tr>
<td>15</td>
<td>26</td>
<td>IB2</td>
<td>No</td>
<td>No</td>
<td>ITC</td>
<td>&quot;few&quot; cells</td>
<td>25</td>
<td>7</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>Yes - lower uterine segment</td>
<td>17.4</td>
</tr>
<tr>
<td>16</td>
<td>28</td>
<td>IB2</td>
<td>No</td>
<td>No</td>
<td>ITC</td>
<td>50 cells</td>
<td>37</td>
<td>13</td>
<td>Yes</td>
<td>Yes</td>
<td>Chemo + Rads*</td>
<td>No</td>
<td>13.3</td>
</tr>
<tr>
<td>17</td>
<td>26</td>
<td>IB1</td>
<td>Bilateral</td>
<td>No</td>
<td>ITC</td>
<td>2 cells</td>
<td>10</td>
<td>9</td>
<td>No</td>
<td>Yes</td>
<td>Chemo</td>
<td>No</td>
<td>62</td>
</tr>
<tr>
<td>18</td>
<td>28</td>
<td>IB2</td>
<td>Bilateral</td>
<td>No</td>
<td>Micro</td>
<td>Micro*</td>
<td>23</td>
<td>8.8</td>
<td>No</td>
<td>Yes</td>
<td>Chemo + Rads*</td>
<td>No</td>
<td>65</td>
</tr>
<tr>
<td>19</td>
<td>45</td>
<td>IB1</td>
<td>No</td>
<td>No</td>
<td>ITC</td>
<td>&quot;ITCs*&quot;</td>
<td>23</td>
<td>12.5</td>
<td>No</td>
<td>Yes</td>
<td>Chemo + Rads*</td>
<td>No</td>
<td>20</td>
</tr>
</tbody>
</table>

*Meet intermediate risk (Sedlis) criteria for post-operative adjuvant radiation treatment.

408 - Poster Session
Prognostic value of tumor budding and large cell nesting in cervical cancer
Y.S. Lee*, Y.H. Lee*, H.J. Lee* and G.O. Chong*, *Kyungpook National University Chilgok Hospital, Daegu, South Korea, #Kyungpook National University Medical Center, Daegu, South Korea

Objective: The aim of this study was to evaluate the prognostic value of tumor budding and large cell nesting in cervical cancer.
**Method:** A total of 136 cervical cancer patients who had undergone radical hysterectomy with pelvic and/or paraaortic lymphadenectomy were included. We assessed the status of tumor budding and large cell nesting in all available H&E-stained specimens, and evaluated the clinicopathologic significance. Tumor budding was defined as an isolated single cell or small clusters composed of <5 tumor cells found in the leading area of invasion (peritumoral tumor budding), and within the intervening stroma between tumor cells (intratumoral tumor budding) using a maximum estimation per 1 high-power field (HPF, x20 objective lens). Large cell nesting was defined as clustered tumor cells ≥ 5 tumor cells at the invasive margin (peritumoral large cell nesting) and within the intratumoral stroma (intratumoral large cell nesting) using a 3-tiered grading system. Total tumor budding and large-cell testing were defined as the sum of peritumoral and intratumoral parameters.

**Results:** Univariate analysis revealed that age, stage, tumor size, lymphovascular invasion, parametrial invasion, lymph node metastasis, peritumoral tumor budding, intratumoral tumor budding, total tumor budding, peritumoral large cell nesting, intratumoral large cell nesting, and total large cell nesting correlated significantly with disease-free survival (DFS). Among these parameters, age (HR = 2.50, 95% CI 1.14–5.48, \(P = 0.0222\)), tumor size (HR = 2.63, 95% CI 1.14–6.10, \(P = 0.024\)), and intratumoral tumor budding (HR = 3.13, 95% CI 1.18–8.29, \(P = 0.0215\)) were found to be determinants of DFS in multivariate analysis. Only intratumoral tumor budding was an independent prognostic factor among pathologic parameters.

**Conclusion:** Tumor budding and large-cell nesting could be determinant prognostic clues for prediction of disease progression in cervical cancer.

---

**409 - Poster Session**

**Does the association between minimally invasive hysterectomy and all-cause mortality differ between women undergoing simple or radical hysterectomy for early-stage cervical cancer?**

**T.Y. Sia, C.M. St. Clair, J.Y. Hou, A.I. Tergas, F. Khoury Collado, J.D. Wright and A. Melamed. aColumbia University College of Physicians and Surgeons, New York, NY, USA, bNew York-Presbyterian/Columbia University Medical Center, New York, NY, USA**

**Objective:** Among women undergoing radical hysterectomy for early-stage cervical cancer, minimally invasive surgery (MIS) is associated with higher all-cause mortality than laparotomy. This study evaluates whether MIS is also associated with increased mortality among women undergoing simple hysterectomy for early-stage cervical cancer.

**Method:** Women who underwent radical hysterectomy or simple hysterectomy for stage IA1–IB1 cervical cancer between 2010 and 2015 were identified in the National Cancer Data Base. We used propensity score inverse probability of treatment weighted (IPTW) Kaplan-Meier and Cox models to compare all-cause mortality among women who underwent hysterectomy by MIS or laparotomy but were otherwise similar on observed covariates. The primary hypothesis, that the association between MIS and mortality differed between those treated by radical hysterectomy and those treated with simple hysterectomy, was tested by including an MIS by simple hysterectomy interaction in the IPTW Cox model.

**Results:** We identified 6,744 women undergoing a hysterectomy for stage IA1-IB1 cervical cancer, of whom 3,765 (56%) underwent MIS (77% on a robotic platform). Patients who had MIS were more often white, privately insured, and from socioeconomically advantaged zip codes, and had smaller, lower grade, tumors, which were more often adenocarcinomas. All covariates were balanced in the IPTW pseudo-cohort. After a median follow-up of 48 months, we observed 260 deaths among women who underwent MIS and 177 deaths in the laparotomy group. Risk of death was higher among women undergoing MIS versus laparotomy (5-year mortality 10% vs 7.0%, HR = 1.42, 95% CI 1.16–1.73, \(P = 0.001\)). While the risk of death associated with MIS was lower among women who underwent simple hysterectomy compared with radical hysterectomy (HR = 1.21, 95% CI 0.86–1.71, vs HR = 1.53, 95% CI 1.20–1.96, respectively), the difference was not statistically significant (\(P_{interaction} = 0.28\)). See **Figure 1**.

**Conclusion:** While MIS hysterectomy increased the overall risk of death in our cohort, we are unable to determine whether MIS increases the risk of death among women undergoing simple hysterectomy for early-stage cervical cancer.
Fig. 1. Survival curves among women undergoing hysterectomy for stage IA1–IB1 cervical cancer. Among women undergoing radical or simple hysterectomy, minimally invasive surgery was associated with an increased risk of death (hazard ratio [HR] = 1.42; 95% confidence interval [CI] = 1.16-1.73). While the risk of death associated with minimally invasive surgery was lower among women who underwent simple hysterectomy (HR = 1.21; 95% CI = 0.86-1.71) than those who underwent radical hysterectomy (HR = 1.53; 95% CI 1.20-1.96), this difference did not reach statistical significance ($P_{\text{interaction}} = 0.28$).

410 - Poster Session
Factors associated with cervical intraepithelial neoplasia III in a cohort of women age 35 and under after changes in standard of care guidelines
T. Kuhn, C. Finneran, G. Pinho, E.B. Wang, A. Kohuta, D. Jodry and L. Flowers. aEmory University Hospital, Atlanta, GA, USA, bRutgers New Jersey Medical School, Newark, NJ, USA

Objective: The aim of this study was to determine factors associated with cervical intraepithelial neoplasia (CIN) III in a cohort of women age 35 years and younger at our institution since the 2012 cervical cancer screening recommendations.

Method: This study was conducted at a large, urban, safety net hospital in the southern United States. All charts of women younger than 35 years with biopsy-proven CIN III from 2013 to 2019 were reviewed retrospectively. Demographic variables were extracted including age, race, BMI, insurance status, HIV status, STI status, smoking history, parity, and vaccination status. Patients were then classified by documented initiation of Pap test by age 22 years or later. Unadjusted $X^2$ and ANOVA tests were performed at $\alpha = 0.05$ to identify significant associations.

Results: A total of 185 patients meeting criteria were identified. The sample was predominantly black/African-American (71.4%), uninsured (60.0%), HIV-negative (86.0%), unvaccinated against HPV (90.8%), and nonsmokers (67.0%). Overall, 75.7% had not received an initial Pap test by age 22 years. Mean age at first Pap test was 25.3 (± 5.3) years overall, 18.3 (± 1.7) years for patients who initiated Pap smears by age 22 years, and 27.6 (± 4.0) for patients who had not initiated Pap smears by age 22 years ($P < 0.001$). Uninsured women ($P < 0.005$), non-black/African-American women ($P < 0.009$), and women with later ages at CIN III diagnosis ($P < 0.001$) were significantly less likely to have received an initial Pap test by age 22 years. Patients with delayed initiation of Pap test also were significantly more likely to present with an initial Pap test showing low-grade dysplasia (67.7%) or high-grade dysplasia (96.9%) than controls (59.6%) ($P < 0.001$).

Conclusion: The average age of Pap test initiation was significantly delayed among a cohort of high-risk women younger than 35 years with CIN III, and a plurality of these patients had significant dysplasia on their first Pap test. Failure to comply with current guidelines is associated with failure to timely identify burden of disease in these young women.

411 - Poster Session
P16INK4a ELISA on fresh cervical samples as an adjunct to cervical cancer screening
S.O.A. Leung, S. Feldman and K.M. Elias. Brigham and Women’s Hospital and Harvard Medical School, Boston, MA, USA

Objective: Cost-effective, rapid tests are needed to allow for efficient use of colposcopic resources. Although HPV testing offers greater sensitivity than Pap smears, HPV testing alone has lower specificity for high-grade dysplasia and may increase colposcopy referral rates without increasing high-grade dysplasia detection rates. We investigated the feasibility of p16INK4a ELISA testing on fresh cervical smears as an adjunct to current screening modalities.
**Method:** Cervical smears were prospectively collected from 100 patients referred to colposcopy or radiation oncology clinic or undergoing gynecologic procedures. A rapid, 90-minute processing protocol was developed to measure p16INK4a by enzyme-linked immunosorbent assay (ELISA), and the performance of ELISA in detecting CIN2+ was compared to that of cytology and HPV testing. Histology was used as the gold standard for comparison. In a subset of study samples, the ELISA results were compared to Western blot or immunohistochemistry from paired specimens.

**Results:** Ninety-three (93%) patients had full clinical data including HPV (45% positive), cytology (30% HSIL+), and histology (26% CIN2+). Patients with CIN2+ had significantly higher p16INK4a levels (3.654 ng/mL) compared to patients with <CIN2 (0.335 ng/mL, P < 0.001). p16INK4a ELISA (PPV 60.7%, NPV 80.4%) had higher specificity than either HPV testing (PPV 39.3%, NPV 87.5%) or Pap testing (PPV 47.9%, NPV 90.3%) alone, with only slightly lower sensitivity. Overall, there was a trend toward increasing p16INK4a concentration with increasing p16IHC score and a positive correlation between the percentage of lesional epithelium staining positive and the p16INK4a concentration ($R^2 = 0.2887$). See Figure 1.

**Conclusion:** p16INK4a concentration is a feasible adjunct to HPV screening. With validation in a larger patient cohort and further refinement of the assay, p16INK4a ELISA has potential to improve the efficiency of colposcopic referral patterns.

---

**Fig. 1.** (A) Receiver operator characteristic (ROC) analysis of p16INK4a ELISA cut-off levels. The graph shows ROC analysis of the detection of biopsy-proven high-grade dysplasia. (B) IHC scores of 0, 1+, 2+, and 3+ and corresponding p16INK4a concentration. (C) High-grade dysplasia p16INK4a positive by ELISA demonstrating IHC staining of 3+.

---

**412 - Poster Session**

**Regional trends of minimally invasive radical hysterectomy for cervical cancer and exploration of perioperative outcomes**

S. Holtzman, M. Finkelstein, J. Huntly, V. Kolev and K. Zakashansky. *Icahn School of Medicine at Mount Sinai, New York, NY, USA*

**Objective:** Radical hysterectomy with bilateral pelvic lymph node dissection is the standard treatment for early-stage cervical cancer. Until recently, in addition to the standard open approach, the procedure was frequently performed by a minimally invasive (MIS) approach. Randomized control trial data presented in 2018 demonstrated that patients who underwent MIS radical hysterectomy had higher rates of disease recurrence and worse overall survival when compared to open radical hysterectomy. The aim of this study was to examine practice trends in New York state. Secondary outcomes included perioperative outcomes and hospital costs.

**Method:** Using the Statewide Planning and Research Cooperative System Database, patients undergoing radical hysterectomy for early-stage cervical cancer in New York state between 2007 and 2015 were identified and categorized based on the approach: open or minimally invasive. Continuous and categorical variables were compared between cohorts using the Mann-Whitney-Wilcoxon test and Pearson X² test, respectively. Multivariate regression analysis was conducted to assess the impact of hysterectomy approach on outcomes.

**Results:** Women with cervical cancer undergoing radical hysterectomy ($n = 6,209$) were identified and categorized to open ($n = 3,684$) and MIS ($n = 2,345$) radical hysterectomy. An increase in the MIS approach was seen, from 25.7% in 2007 to 48.3% in 2015. MIS radical hysterectomy provided an 85% reduction in hospital stay when compared to open hysterectomy. In patients undergoing MIS radical hysterectomy, 30-day and 90-day readmission rates were reduced by 40% and 42%, respectively, and hospital costs were reduced by 10% when compared to patients undergoing open radical hysterectomy. See Figure 1.

**Conclusion:** The number of cervical cancer patients treated with the MIS approach almost doubled over the period from 2007 to 2015 in New York state. Close to 50% of radical hysterectomies performed in New York state were done by the MIS approach in 2015. The MIS technique allowed for reduction in hospital stay, readmission rates, and costs. Despite these benefits, several centers have stopped performing MIS radical hysterectomy based on newly presented data reporting inferior oncological outcomes with MIS radical hysterectomy. We postulate that this can have a significant impact on gynecologic practice affecting perioperative outcomes, cost, and surgical training.
Objective: The aim of this study was to evaluate the clinical outcomes in women with mucinous cervical carcinoma (MCC) and assess the prognostic impact of clinical, pathological, and molecular characteristics.

Method: We identified 310 patients from Princess Margaret Cancer Centre registry database diagnosed with mucinous gynecologic malignancies between January 2008 and August 2018. Patients with uncertain histology and extra-cervical origin were excluded; 59 patients with confirmed MCC were found. Median follow-up was 5 years.

Results: Median age at diagnosis was 49 (31–73) years. HPV status was available in 30 patients (HPV+, 57%; HPV−, 43%); all gastric type MCC were HPV−. p16 expression was associated with improved OS (p16− 3 years, 56%, 95% CI 27–28, vs p16+, 81% 95% CI 56–92, P = 0.03) and PFS (p16− 3 years, 33%, 95% CI 11–58, vs p16+, 64%, 95% CI 42–82, P = 0.03). At diagnosis, 76% of patients had early stage (stage I–II), with a 3-year OS of 90% (95% CI 75–96) and 3-year PFS of 75% (95% CI 59–86); 24% had advanced stage (III–IV); 3-year OS was 57% (95% CI 28–78) and 3-year PFS 50% (95% CI 23–72). Treatment of choice at diagnosis was surgery (stage I), chemoradiation (stage II), surgery and chemoradiation (stage III), and platinum-based chemotherapy (stage IV). Twenty patients (34%) relapsed (early stage, 27%; advanced stage, 57%); 1-year OS from relapse was 56% (95% CI 30–75). Thirty percent (6/20) had a single-site recurrence (lung or pelvis confined) treated with definitive treatment. Twenty percent (4/20) of relapsed patients had central nervous system (CNS) metastases. Preferred treatment at first progression was platinum-based chemotherapy, with 67% clinical benefit, and at second progression, clinical trials. Twenty-five percent (5/20) participated in clinical trials, and 10% (2/20) received targeted treatment. Two patients had ERBB2 overexpression by IHC; 1 received trastuzumab, with progressive disease as best response. Tumor molecular profiling was performed in 55% (11/20) of relapsed patients. TP53 was the most frequent alteration (36%), only found in HPV− or gastric subtype. KRAS mutation was found in 18%; all patients with alterations had intestinal subtype, HPV16+. Among others, alterations in DNA repair genes, CDKN2A, CTNNB1, ERBB3, SMAD4, and STK11 were detected. No PIK3CA alterations were found in this cohort. See Figure 1.

Conclusion: MCC requires multidisciplinary management. Prognosis is poor at relapse, and CNS metastases might be common. Molecular profiling may offer treatment options.
ZNF582 methylation level may predict radiotherapy efficacy and radiotherapy inhibits cervical cancer cell proliferation by demethylation of ZNF582

X. Zhang, J. Cai, L. Sun, N. Wu and J. Wang. aHunan Cancer Hospital, The Affiliated Cancer Hospital of Xiangya School of Medicine, Central South University, Changsha, China, bQingdao Central Hospital Affiliated to Qingdao University, Qingdao, China

Objective: The treatment of advanced cervical cancer is mainly based on radiotherapy and chemoradiotherapy, but there are individual differences in efficacy. There is no effective biomarker predicting the efficacy of radiotherapy. Our previous study found that the methylation of ZNF582 in cervical exfoliated cells was associated with the prognosis of cervical cancer and may affect the sensitivity of chemoradiotherapy in cervical cancer cells. The aim of this study was to investigate the relationship between the methylation level of ZNF582 in cervical cytological specimens and the efficacy of radiotherapy in cervical cancer patients, and to study the molecular mechanism of ZNF582 affecting the efficacy of radiotherapy.

Method: This study was a prospective, multicenter study of 102 patients with newly diagnosed cervical cancer stage (IIB and above) between October 1, 2017, and May 1, 2019. Cervical cytological specimens were collected before, during (24 GY, 30 GY, 36 GY, 48 GY, respectively), and after radiotherapy of each patient. The methylation level of ZNF582 was detected by quantitative methylation-specific polymerase chain reaction (PCR). Kaplan-Meier method was used to evaluate the efficacy of radiotherapy for cervical cancer according to the Response Evaluation Criteria in Solid Tumors (RECIST) criteria. Proliferation of cervical cancer cell lines was tested by single-cell cloning and MTT assay. Proliferation in vivo was detected by subcutaneous tumor formation in nude mice. QPCR and WB detected the expression of genes and proteins.

Results: Patients with high levels of ZNF582 methylation before treatment had better radiotherapy outcomes than patients with low levels of ZNF582 methylation (P < 0.05). The degree of ZNF582 methylation in the partial response (PR) group was significantly higher than that in the stable disease (SD) group (P < 0.05). It was also found that radiotherapy can decrease the methylation level of ZNF582 and upregulate the expression of ZNF582 mRNA in cervical cancer cell lines. In vivo and in vitro experiments showed that ZNF582 gene over-expression could inhibit cell proliferation by inhibiting the PI3K/AKT pathway.

Conclusion: The level of ZNF582 methylation in Pap smear before treatment and the changes in ZNF582 methylation levels were related to the efficacy of radiotherapy. Radiotherapy can upregulate its mRNA expression by demethylation of ZNF582, and the high expression of ZNF582 gene can inhibit the proliferation of cervical cancer cells by inhibiting the PI3K/AKT signaling pathway.

Yield of loop electrosurgical excision procedure (LEEP) among patients with and without known high-grade cervical dysplasia

S.O.A. Leung, A. Vitonis and S. Feldman. aBrigham and Women’s Hospital and Harvard Medical School, Boston, MA, USA, bBrigham and Women’s Hospital, Boston, MA, USA
Objective: Loop electrosurgical excision procedure (LEEP) is recommended for high-grade cervical dysplasia diagnosed on cytology and/or colposcopic biopsies (i.e., therapeutic LEEP). However, the management of persistent low-grade abnormalities or human papillomavirus (HPV) positivity is not as well defined. The reported rate of occult high-grade dysplasia in a diagnostic LEEP (i.e., no preceding high-grade diagnosis) is variable (2%–18%), and often risk factors such as historical HPV status and cytology are not available. The objective of this study was to determine the rate of occult high-grade in diagnostic LEEPs compared with therapeutic LEEPs and further risk-stratified based on prior history.

Method: A retrospective cohort study of women who were referred to the colposcopy clinic between 2008 and 2018 and who underwent a LEEP procedure was performed. Patients were categorized into 4 groups: (1) persistent mild abnormalities (>2 years) but no history of high-grade abnormalities and no history of HPV 16/18 (group 1, low-risk diagnostic LEEP), (2) prior history of high-grade abnormalities or HPV 16/18 positive but now with low-grade results (group 2, high-risk diagnostic LEEP), (3) newly diagnosed high-grade lesion treated with a LEEP (group 3, low-risk therapeutic LEEP), and (4) prior history of high-grade abnormalities now with new diagnosis of high-grade (group 4, high-risk therapeutic LEEP).

Results: There were 897 LEEP procedures recorded. The overall rates of high-grade abnormalities were 13%, 22%, 61%, and 65% among groups 1 to 4 (Table 1). Although those with biopsy-proven high-grade cervical dysplasia have the highest yield on LEEPs, those with persistent mild abnormalities and no history of high-grade abnormalities nor HPV 16/18 positivity still had a greater than 10% risk of occult high-grade on diagnostic LEEP. Furthermore, there was a statistically significant difference in the yield of low-risk therapeutic LEEP (group 3) by age (P = 0.001), with the youngest women having the highest rate of high-grade cervical dysplasia; a similar trend was observed within the other groups.

Conclusion: Persistent low-grade abnormalities or HPV positivity is associated with a significant risk of occult high-grade dysplasia of greater than 10%. This risk is further increased in the younger patient and in the patient with a prior history of high-grade dysplasia.

Table 1. LEEP results by group.

<table>
<thead>
<tr>
<th>LEEP pathology result</th>
<th>Group 1 (n = 126)</th>
<th>Group 2 (n = 100)</th>
<th>Group 3 (n = 492)</th>
<th>Group 4 (n = 179)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cancer</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>3 (0.6%)</td>
<td>1 (0.6%)</td>
</tr>
<tr>
<td>ACIS</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
<td>7 (1.4%)</td>
<td>5 (2.8%)</td>
</tr>
<tr>
<td>SILHG</td>
<td>16 (12.7%)</td>
<td>22 (22.0%)</td>
<td>291 (59.1%)</td>
<td>111 (62.0%)</td>
</tr>
<tr>
<td>SILLG</td>
<td>51 (40.5%)</td>
<td>33 (33.0%)</td>
<td>59 (12.0%)</td>
<td>18 (10.1%)</td>
</tr>
<tr>
<td>Normal</td>
<td>59 (46.8%)</td>
<td>45 (45.0%)</td>
<td>132 (26.8%)</td>
<td>44 (24.6%)</td>
</tr>
<tr>
<td>Yield of LEEP by age (High Grade &lt;)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-30</td>
<td>15% (5/33)</td>
<td>21% (4/19)</td>
<td>69% (128/185)</td>
<td>65% (46/71)</td>
</tr>
<tr>
<td>31-50</td>
<td>12% (8/67)</td>
<td>23% (12/53)</td>
<td>60% (153/256)</td>
<td>70% (64/92)</td>
</tr>
<tr>
<td>51-65</td>
<td>14% (3/21)</td>
<td>17% (4/24)</td>
<td>41% (18/44)</td>
<td>50% (7/14)</td>
</tr>
<tr>
<td>&gt;65</td>
<td>0% (0/5)</td>
<td>50% (2/4)</td>
<td>28% (2/7)</td>
<td>0% (0/2)</td>
</tr>
<tr>
<td>Overall</td>
<td>13% (16/126)</td>
<td>22% (22/100)</td>
<td>61% (301/492)</td>
<td>65% (117/179)</td>
</tr>
</tbody>
</table>

416 - Poster Session
Validation of the prognostic value in various lymph node staging systems for cervical squamous cell carcinoma following radical surgery: A single-center analysis of 3,732 patients
Q. Guo, J. Zhu, Y. Wu, X. Ju and X. Wu, Fudan University Shanghai Cancer Center, Shanghai, China

Objective: The purpose of this study was to investigate the prognostic value of 6 lymph nodes (LN) staging systems: TNM pN stage, 2018 FIGO stage, the number of positive lymph nodes (PLN), number of negative lymph nodes (NLN), metastatic lymph node ratio (LNR), and log odds of positive lymph nodes (LODDS) in patients with cervical squamous cell carcinoma following radical surgery.

Methods: The records of 3,732 cervical squamous cell carcinoma patients who underwent radical surgery between 2006 and 2014 were retrospectively reviewed. Tree-based recursive partitioning was applied to split variables (PLN, NLN, LNR, and LODDS) into different groups. The log rank test was used to compare survival curves, and Cox regression analysis was performed to identify prognostic factors. The relative discriminative abilities of different staging systems were assessed using the Akaike Information Criterion (AIC) and the Harrell concordance index (C index).

Results: All of the 6 staging systems had significant influence on patients’ 5-year OS, and univariate analysis showed that all these staging systems were significant prognostic factors for OS (all P < 0.001). Multivariate analysis demonstrated that all the other 5 staging methods were independent prognostic factors for OS, but not NLN classifications. LNR was noted to have somewhat the best prognostic performance (AIC 34228.7; C index 0.675). See Figure 1.
**Conclusion:** The pN, 2018 FIGO stage, PLN, LNR, and LODDS methods appeared to better predict survival than the NLN in patients of cervical squamous cell carcinoma undergoing radical surgery. Moreover, LNR seems to be the most accurate and predictive LN staging system.

![Figure 1](image.png)

Fig. 1.

### 417 - Poster Session
Comparative proteomic profiles of paired cervical cancer and paracancerous tissue and the effects of DUSP7 over-expression on SIHA cell line through inhibiting RAS pathway

X. Jiang, H. Bai, J. Li and S. Wang, *Beijing Chaoyang Hospital, Beijing, China*

**Objective:** The aim of this study was to investigate the association of the selected differentially expressed protein (DEP) in cervical cancer and paracancerous tissues with the prognosis of patients and the potential mechanisms.

**Methods:** Proteomic profiles were detected and compared through quantitative proteomics. A DUSP7 plasmid was inserted into pWSLV-08 vector with GFP (green fluorescent protein) as the reporter gene. The lentiviral particles containing DUSP7 gene were transfected into SIHA cells (DUSP7-SIHA). ELISA (enzyme linked immunosorbent assay)-VEGF assay kits were used to determine the VEGF level in the supernatant of cell cultures. DUSP7 DNA and NC plasmids were transfected transiently in human umbilical vein endothelial cells (HUVECs), and the ability of HUVECs to form endothelial tube was evaluated and compared. DUSP7-SIHA and NC-SIHA were injected subcutaneously into the left and right backs of nude mice to compare the ability of tumor formation in vivo.

**Results:** A total of 129 proteins were found to be differentially expressed in the 3 pairs of samples, and 97 out of 129 DEPs were analyzed to be associated with tumor progression. HRAS, DUSP7, and PLD1, as well as ERK1/2, participating in RAS pathway, were selected for verification. HRAS, ERK1/2, and PLD1 were increased, whereas DUSP7 was decreased in cervical cancer compared with the paired paracancerous tissues. In addition, the decreased DUSP7 and increased PLD1 were significantly associated with a tumor size >2 cm and parametrical infiltration and were adversely related to tumor relapse and patient survival. The expression of HRAS, p-ERK1/2, Bcl-2, and vimentin was decreased, whereas caspase-3, Bedin 1, LC3B, and E-cadherin were increased in DUSP7-SIHA cells compared to NC-SIHA cells. The VEGF secreted in the supernatant of DUSP7-SIHA cultures and the ability of HUVECs to form endothelial tube was decreased when transfected with DUSP7 DNA plasmid. After subcutaneous injection, DUSP7-SIHA tumors were observed much later than NC-SIHA tumors and also were significantly smaller than NC-SIHA tumors.

**Conclusion:** The decreased DUSP7 in cervical cancer might indicate a more malignant cervical cancer and an adverse outcome of cervical cancer patients. Over-expression of DUSP7 had a potential role in inhibiting the anchorage-independent growth viability of the cervical cancer cells, possibly through dephosphorylating of the ERK1/2 and inactivation of the RAS pathway.

### 418 - Poster Session
Attributable risk of endometrial ablation on subsequent atypical glandular cells on Papanicolau smear

N.B. Gaulin, S. Munns, B. Prairie and M. Klein-Patel, *Western Pennsylvania Hospital, Pittsburgh, PA, USA*
**Objective:** Our objective was to determine the attributable risk of antecedent endometrial ablation on future atypical glandular cell (AGC) pathology on Pap smear. In addition, we sought to determine the risk of future surgical procedures secondary to inability to obtain sufficient endometrial sampling in the office.

**Method:** A retrospective chart review was performed, and all patients with prior history of AGC Pap smears were identified using the Slicer/Dicer tool from the Epic electronic medical record. Attributable risk was calculated using the formula, \((I_E - I_U) / I_E\). \(I_E\) represents patients with AGC Pap smear and prior history of endometrial ablation, and \(I_U\) represents patients with AGC Pap smear who did not undergo prior endometrial ablation.

**Results:** A total of 506 patient charts were analyzed. The average age of the total patient population was 48 years. Thirty-two patients had an antecedent endometrial ablation, accounting for 6% of the study population. The known baseline prevalence of AGC Pap smear is 0.3%; thus, a prior endometrial ablation confers a 95% increased risk of future AGC pathology. Of the 32 patients with prior endometrial ablation and AGC Pap smear, a total of 15 patients required further diagnostic testing and treatment in the operating room. Dilation and curettage was performed in 8 patients, and hysterectomy was performed in 7 patients. Finally, 5% of patients were diagnosed with cancer; of the cancers diagnosed, 75% were endometrial adenocarcinoma, 21% cervical adenocarcinoma, and 0.4% clear cell ovarian cancer.

**Conclusion:** Antecedent endometrial ablation confers an increased risk on future abnormal cervical and endometrial pathology. Given various challenges with endometrial sampling after ablation, several patients required procedures in the operating room. Utilizing other medical and surgical options for management of abnormal uterine bleeding may decrease future risk of AGC Pap smear.

---

**419 - Poster Session**

**Hemoglobin levels during treatment as prognostic factors in locally advanced cervical cancer in Mexican patients**

L.N. Gallardo-Alvarado, D. Cantu de León, R.A. Salcedo-Hernández, R. Ramírez, S.A. Barquet-Muñoz, D. Isla-Ortiz, F. Rivera-Buendia, D. Perez-Montiel, M. Perez Quintanilla and S. Del Real. Instituto Nacional de Cancerología de México, México, DF, Mexico; Instituto Nacional de Perinatología, Mexico, DF, Mexico; Hospital General de Saltillo, Saltillo, CU, Mexico

**Objective:** Anemia is frequent in locally advanced cervical cancer (LACC) patients, concurrent chemoradiotherapy (CRT) being the standard of care. The antitumor activity of radiation is mediated via interaction with oxygen, and the presence of anemia prior or during the treatment may decrease the oxygen-carrying capacity of the blood and result in tumor hypoxia with the consequence of a lower response rate to treatment. The aim of this study was to explore the role of anemia as a predictor of complete clinical response, disease-free survival (DFS), and overall survival (OS) in patients with LACC treated with CRT in a reference center in México.

**Method:** This retrospective study includes data about basal, nadir, and final hemoglobin levels in LACC patients treated with CRT from 2005 to 2014. A descriptive, comparative, and survival analysis was conducted.

**Results:** A total of 1,263 records were obtained; clinical stages were IB2, 103 (8.2%); IIA1, 24 (1.9%); IIA2, 32 (2.5%); IIB, 734 (58.1%); IIIA, 37 (2.9%); IIIB, 305 (24.1); IVA, 28 (2.2%); of which 1,106 (87.6%) had squamous cell carcinoma, 137 (10.8%) adenocarcinoma, and 20 (1.6) adenosquamous carcinoma. Most were moderately differentiated tumors in 912 (72.2%) patients. Complete response occurred in 1,015 patients (80.4%). Persistent or progressive disease occurred in 27.4% with initial hemoglobin less than 11 gr/dl in comparison to 13.9% who had hemoglobin >11 (OR = 2.5). DFS was 63.7% for final hemoglobin <11 and 71.6% for hemoglobin >11 \((P = 0.02)\). OS was 72.3% for final hemoglobin <11 and 84.4% for hemoglobin >11 \((P = 0.01)\). Hemoglobin levels of 11 or greater at diagnosis, nadir, and the end of CRT are associated with complete response \((P = 0.001)\).

**Conclusion:** Our study shows that hemoglobin levels prior to and during CRT are associated with response to treatment. Both are associated with better OS, but nadir and final hemoglobin level are associated with earlier recurrence in those patients with complete clinical response. Having hemoglobin levels above 11 gr/dl seems to be important and should be one of the goals during CRT. This is important because international guidelines do not include blood cell counts as routine for follow-up when complete response in cervical cancer has been achieved.

---

**420 - Poster Session**

**Indocyanine green-incorporating nanoparticles for cervical cancer imaging**

S. Park, K.H. Han and S. Lee. Yonsei University Wonju College of Medicine, Wonju, South Korea

**Objective:** For cancer diagnosis and treatment, indocyanine green (ICG) has been considered as a promising agent. However, ICG has some limitations including short half-life, poor hydrolytic stability, nonspecific targeting, and concentration-dependent aggregation. Recent studies have focused on overcoming these limitations by protecting and enhancing the fluorescent properties of ICG by
encapsulation within delivery carriers. In the present study, CD44 receptor-targeted ICG-incorporating nanoparticles (NPs) were developed using hyaluronic acid (HA) ligands for cervical cancer near-infrared (NIR) fluorescence imaging.

**Method:** After synthesizing PEI (polyethylenimine)-PLGA(poly(D,L-lactide-co-glycolide))-ICG NPs, HA was covalently grafted onto PEI-PLGA-ICG NPs. Targeted NPs were developed for in vitro evaluation on SiHa cells.

**Results:** HA conjugation on the NPs was confirmed by zeta potential (−1.0 ± 5.67 mV). The hydrodynamic diameter of HA-NPs, measured by dynamic light scattering (DLS), represented 200 ± 48.83 nm. The cytotoxicity test of HA-NPs up to 0.06 mg/mL did not show serious toxicity. HA-NPs showed 3 times higher internalization effects than bare NPs in HA-positive SiHa cells ($P < 0.01$). In addition, HA blocking to SiHa cells represented 10 times lesser internalization effect ($P < 0.01$), showing the importance of HA ligands. See Figure 1.

**Conclusion:** This study reported the successful application of HA-conjugated PEI-PLGA NPs as a nanocarrier system to deliver ICG into cervical cancer cells for improved efficacy of NIR fluorescence imaging. We are planning further study for in vivo application of the HA-conjugated PEI-PLGA NPs.

![Figure 1](image.png)

**Fig. 1.** Comparison of intracellular uptake and quantitative average fluorescence intensities of (a) 6h, (b) 24h in SiHa cells treated with or without free HA (scale bar: 10µm, ****$P < 0.001$)

---

**421 - Poster Session**

**Survival after minimally invasive surgery in early cervical cancer: Is the uterine manipulator to blame?**

A.I. Nica1; S.R. Kim2; L.T. Gian3; A.L. Covens3; M.Q. Bernardini3; G. Bouchard-Fortier3; R. Kupets4; L. Hogen5; S. Laframboise5; T. May5; D. Vicus5 and S.E. Ferguson5. 1University of Toronto, Toronto, ON, Canada, 2Princess Margaret Cancer Centre, University Health Network, Toronto, ON, Canada, 3Sunnybrook Odette Cancer Centre, Toronto, ON, Canada, 4Sunnybrook Cancer Centre/University of Toronto, Toronto, ON, Canada, 5Princess Margaret Cancer Centre, University of Toronto, Toronto, ON, Canada

**Objective:** Minimally invasive radical hysterectomy (MIS-RH) has been shown to be associated with decreased survival in patients with early cervical cancer. The objective of this study was to determine whether the use of a uterine manipulator at the time of laparoscopic or robotic radical hysterectomy has an impact on patient outcomes.

**Method:** This was a retrospective study of all patients who underwent treatment of cervical cancer by MIS-RH at 2 large-volume centers between 2006 and 2018. Treatment and tumor characteristics were documented from hospital records.

**Results:** A total of 224 patients were identified at the 2 centers. Median age was 44 years, and median follow-up was 49.9 months. The majority of patients (77.6%) had FIGO 2014 IB1 clinical stage prior to surgery. There were no significant differences between the 2 groups in adjuvant treatment, tumor size, and parametrial invasion. The cohort of patients in whom a uterine manipulator was not used was compared with those in whom it was used, and no differences were found in overall survival.
at the time of MIS-RH were more likely to have residual disease in the hysterectomy specimen \( (P < 0.0001) \), positive lymphovascular space invasion (LVSI) \( (P = 0.02) \), positive margins after surgery \( (P = 0.0081) \), and positive lymph node metastasis on final pathology \( (P = 0.0029) \). Unadjusted Kaplan-Meier analysis showed that the use of a uterine manipulator at the time of MIS-RH was associated with significantly better recurrence-free survival (RFS) \( (P = 0.0085, \text{ Figure 1}) \). After controlling for the presence of residual cancer in the hysterectomy specimen, tumor size (microscopic, <7 mm, or macroscopic, ≥7 mm) and high-risk pathologic criteria (positive margins, parametria, or lymph nodes), the use of a uterine manipulator was no longer significantly associated with RFS \( (HR = 0.49, P = 0.12) \). The only factor consistently associated with disease recurrence was tumor size ≥7 mm \( (HR = 9.5, P = 0.03) \).

**Conclusion:** After controlling for adverse clinical and pathological factors, the use of a uterine manipulator in patients with early cervical cancer treated with MIS-RH was not significantly associated with patients' risk of recurrence. We identified that the most significant predictor of cancer recurrence in this population was having a macroscopic tumor. Future studies should examine other possible mechanisms that may explain the results of the laparoscopic approach to cervical cancer (LACC) trial.

**(B) Results of Cox Proportional Hazards analysis, adjusting for tumor size (microscopic <7mm versus macroscopic ≥7mm), residual disease in hysterectomy specimen and high risk pathologic criteria (positive margins, parametria, lymph nodes).**

<table>
<thead>
<tr>
<th>Variable</th>
<th>HR</th>
<th>95% Confidence Limits</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uterine manipulator</td>
<td>0.49</td>
<td>0.2 - 1.2</td>
<td>0.12</td>
</tr>
<tr>
<td>Residual disease on hysterectomy specimen</td>
<td>1.7</td>
<td>0.6 - 12.5</td>
<td>0.2</td>
</tr>
<tr>
<td>Macromscopic tumor (≥7mm)</td>
<td>5.5</td>
<td>1.2 - 72.7</td>
<td>0.03</td>
</tr>
<tr>
<td>Meets high risk pathologic criteria</td>
<td>1.21</td>
<td>0.5 - 3</td>
<td>0.69</td>
</tr>
</tbody>
</table>

Fig. 1.
survival (PFS) of adjuvant full pelvic radiation on chemotherapy regimens containing bevacizumab in women with stage IVB cervical cancer.

**Method:** This is an Institutional Review Board-approved retrospective case series of patients with radiology-confirmed stage IVB cervical cancer treated primarily with platinum-based chemotherapy and bevacizumab between April 2009 and April 2016 at 3 sites. The patients were divided in 3 subgroups: those who received therapeutic pelvic radiation, palliative pelvic radiation, or no radiation. The primary outcome was mean PFS. Disease progression was determined by radiographic findings. Descriptive statistics were performed on patient demographics. Kaplan-Meier method and the log rank test for equality were performed to analyze OS and PFS.

**Results:** A total of 29 patients with stage IVB cervical cancer were identified, with a mean overall survival of 1,362 days. There were 11 patients (38%) in the therapeutic radiation group, 9 (31%) in the palliative radiation group, and 9 (31%) in the no radiation group. Survival did not differ between groups ($P = 0.16$). Of these, 7 patients (88%) in the palliative, 7 patients (88%) who received no radiation, and all patients in the pelvic radiation group experienced progression. The mean PFS between the groups was 228 days (CI 127–325). The PFS of each group (see Table 1) was not different ($P = 0.43$).

**Conclusion:** In this retrospective case series, adjuvant radiation therapy did not significantly affect the PFS between groups, although imbalances in clinical factors may account for these results. A larger study accounting for these clinical factors is required to evaluate the significance of these findings. Furthermore, toxicity of the treatments should be further explored.

**Table 1. Progression free survival.**

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean PFS (days±SD)</th>
<th>95% CI</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>359 ± 504</td>
<td>[124-1233]</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>182 ± 34</td>
<td>[52-]</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>225 ± 128</td>
<td>[299-1499]</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>228±14</td>
<td>[127-385]</td>
<td>0.43</td>
</tr>
</tbody>
</table>

423 - Poster Session

Automated classification of cervical neoplasms through colposcopic photography using machine learning

*University of Hallym, Hallym University Sacred Heart Hospital, Anyang-si, South Korea, Kangnam Sacred Heart Hospital, Seoul, South Korea*

**Objective:** Colposcopy is used to identify cervical neoplastic lesions that require biopsy, but expert physicians are needed for high efficiency. This study aimed to develop and validate machine learning models to automatically classify cervical lesions on colposcopic images.

**Method:** A total of 838 colposcopic photographs of 838 patients were collected from 3 university hospitals and classified by 2 systems: the cervical intraepithelial neoplasia (CIN) system and the lower anogenital squamous terminology (LAST) system. Two convolutional neural network models, Resnet-152 and Inception-Resnet-v2, were trained to classify cervical lesions as well as to determine the need to biopsy by detecting a neoplastic lesion.

**Results:** For the test dataset consisting of 83 images, the mean accuracy for 5-class classification in the CIN system reached 45.8 ± 5.5% by Inception-Resnet-v2, and the mean area under the curve (AUC) was 0.801 ± 0.121 for differentiating ≥CIN2 lesions from <CIN1 lesions by Resnet-152. Per-class accuracy of the best performing model was 20%, 66%, 38%, 10%, and 73% for cancer, CIN3, CIN2, CIN1, and non-neoplasm, respectively. For the LAST system, the accuracy for 4-class classification of Inception-Resnet-v2 model was 65.9 ± 5.6%, and the mean AUC distinguishing >HSIL lesions from ≤LSIL lesions was 0.762 ± 0.073. The mean AUC to determine the need to biopsy reached 0.918 ± 0.022.

**Conclusion:** Machine learning might provide an effective tool for differentiating cervical neoplasms automatically on colposcopy. Unnecessary biopsies could be avoided with the assistance of the CNN model.

424 - Poster Session

Stromal imaging in precancerous cervical lesions

A.M. Mohammad, L.I. Azinfar, E. Johannesen, G. Yao and M.I. Hunter. *University of Missouri, Columbia, MO, USA*

**Objective:** Our objective in this study was to examine human ectocervical lesions with a novel imaging modality, optical polarization tractography (OPT), to investigate differential markers between normal and precancerous lesions.
**Method**: OPT is a recently developed imaging method based on polarization-sensitive optical coherence tomography. It provides three depth-resolved imaging contrasts: intensity, birefringence, and optic axis. Intensity reveals the tissue structure, while birefringence is a measure of fiber integrity, and optic axis exhibits the local collagen fiber orientation in tissue. In this study, 1 fresh human cervical sample was acquired by loop electrosurgical excision procedure. The sample was imaged using OPT at different locations of the ectocervix and was fixed after scanning in 10% neutral buffered formalin for histopathology. Five-μm-thick sections were obtained and stained with H&E stain for histologic evaluation.

**Results**: This index case offered a clear demarcation between normal ectocervix and cervical intraepithelial neoplasia, grade 3 (CIN3). Figure 1b reveals the histology at the location marked with the dashed line in the gross specimen represented by Figure 1a. The histology at this point revealed a clear transition from normal epithelium to CIN3. The intensity image (Figure 1c1) clearly separated epithelium from stroma using a narrow band of lower intensity in nonprecancerous location (right side), while this boundary gradually vanished toward the lesion (left side). Although the stroma layer was not discernable in the intensity image, it was easily distinguishable in the fiber orientation image (Figure 1c2) as a homogeneous layer, with fibers oriented at 12 o’clock. The stroma had stronger birefringence (Figure 1c3), which was supported by a better fiber organization shown in Figure 1c4. The alignment index confirmed a higher fiber organization in nonprecancerous region and profoundly decreased within the lesion (Figure 1c4).

**Conclusion**: OPT imaging revealed a disruption in the epithelial boundary and disorganization of stromal collagen fibers in a precancerous lesion, in agreement with histology in a CIN3 ectocervical sample. This technology has the potential to provide in vivo tissue-imaging capabilities.

---

425 - Poster Session
The change of squamous cell carcinoma antigen levels can predict tumor recurrence and survival in patients with cervical cancer with definitive chemoradiotherapy
S. Lee<sup>a</sup> and J. Lee<sup>b</sup>. <sup>a</sup>Seoul St. Mary's Hospital, Seoul, South Korea, <sup>b</sup>St. Vincent's Hospital, Suwon, South Korea

**Objective**: The aim of this study is to investigate whether the pattern of change in squamous-cell carcinoma antigen (SCC-Ag) levels prior to and following chemoradiotherapy (CRT) can predict tumor recurrence and survival in patients with cervical cancer.

**Method**: Patients with stage IB2 to IVA squamous cell carcinoma of the cervix who received CRT between 2008 and 2017 were included. Serum SCC-Ag test was performed before CRT and reevaluated at median 5.5 weeks after completion of CRT. Patterns of SCC-Ag change in patients with CRT were categorized into three groups: (1) low-low, baseline SCC-Ag <2 ng/mL and post-treatment SCC-Ag <2 ng/mL; (2) high-low, baseline SCC-Ag ≥2 ng/mL and post-treatment SCC-Ag <2 ng/mL; and (3) high-high, baseline SCC-Ag level ≥2 ng/mL and post-treatment SCC-Ag level ≥2 ng/mL. The recurrence-free survival (RFS) and overall survival (OS) were assessed using Kaplan-Meier method to estimate the significance of SCC-Ag level.
**Results:** A total of 291 patients were included. The 3-year RFS was significantly higher in the low-low group than in the high-low and high-high groups (92.9% vs 75.3%, and 59.7%, \(P < 0.001\)). Three-year OS rates were 87.8%, 81.7%, and 55.9% (\(P < 0.001\), respectively. The pattern of SCC-Ag change was significantly associated with RFS and OS in multivariate analysis. See **Figure 1**.

**Conclusion:** The pattern of SCC-Ag change can play an important role in the prediction of tumor recurrence and survival in patients with cervical cancer with definitive CRT.

---

**426 - Poster Session**

Genomic profiling of mesonephric and mesonephric-like carcinomas via solid and liquid biopsy reveals driver mutations and opportunities for targeted therapies

D.I. Lin\(^a\), J.Y. Tse\(^b\), S. Ramkissoon\(^b\), J.S. Ross\(^c\) and J.A. Elvin\(^a\). \(^a\)Foundation Medicine, Cambridge, MA, USA, \(^b\)Foundation Medicine, Morrisville, NC, USA, \(^c\)SUNY Upstate Medical University, Syracuse, NY, USA

**Objective:** Mesonephric carcinoma is a rare cancer that most often arises within the cervix and less frequently in the ovary and endometrium. We analyzed the genomics of these tumors to determine driver and targetable mutations.

**Method:** A retrospective search of our reference molecular laboratory database yielded 20 mesonephric or mesonephric-like cervical (\(n = 10\)), endometrial (\(n = 5\)), ovarian (\(n = 4\)), or peri-bladder (\(n = 1\)) carcinomas that had undergone comprehensive genomic profiling via targeted next-generation sequencing. Clinicopathological and molecular features, including HPV, MSI, and TMB status, were centrally rereviewed.

**Results:** Activating \(K\)RAS mutations were present in 90.0%, 18 of 20 cases, including 2 with G12C. Other recurrent alterations were identified in \(ARID1A\) (25%, 5 of 20), \(PIK3CA\) (20%, 4 of 20), \(CTNNB1\) (15%, 3 of 20), \(TP53\) (10%, 2 of 20), \(MLL2\) (10%, 2 of 20), and \(CDKN2A\) (10%, 2 of 20). One \(K\)RAS wildtype case had a \(GATA3\) mutation as the sole alteration, while the second \(K\)RAS wildtype case had an \(EGFR\) alteration. All tumors were negative for HPV DNA, microsatellite instability, or high tumor mutational burden. Circulating DNA liquid biopsy, performed 6 years after original solid tumor resection in 1 patient with suspected lung metastasis, revealed concordance of \(K\)RAS alteration and new \(TP53\) alterations in the liquid biopsy compared to the original sample.

**Conclusion:** \(K\)RAS activation is a major driver of mesonephric and mesonephric-like carcinomas, with less frequent contribution by \(ARID1A\) and \(PIK3CA\) pathways. Liquid biopsy may be useful in detecting recurrence or metastasis in advanced patients, who may potentially benefit from targeted therapies against \(K\)RAS/MEK and \(PI3K/mTOR\).

---

**427 - Poster Session**

Clinico-pathological factors predicting parametrial invasion in IB2, IIA1, IIA2 (FIGO2009) cervical cancer

H.C. Hsu\(^ab\) and W.F. Cheng\(^c\). \(^a\)National Taiwan University Hospital Hsin-Chu Branch, Hsin-Chu, Taiwan, \(^b\)National Taiwan University, College of Medicine, Taipei, Taiwan, \(^c\)National Taiwan University Hospital, Taipei, Taiwan
Objective: The aim of this study was to identify factors predicting parametrial invasion in stage IB2, IIA1, and IIA2 (FIGO 2009) cervical cancer patients undergoing radical hysterectomy.

Method: We reviewed women with invasive cervical cancer who underwent radical hysterectomy with bilateral pelvic lymphadenectomy at a single medical institute from 2000 to 2011. The clinical and pathological characteristics and outcomes were retrospectively recorded, and the risk factors for parametrial invasion were analyzed.

Results: We enrolled 339 patients, including 7 with stage IA1 carcinomas, 10 with stage IA2, 266 with stage IB1, 39 with stage IB2, 14 with stage IIA1, and 3 with stage IIA2. Of the 56 locally advanced patients, the majority (39/56, 69.6%) had squamous cell carcinoma, while 15 (26.8%) had parametrial invasion. The 15 patients with parametrial invasion were older ($P = 0.038$) and had deeper cervical stromal invasion ($17.40 \pm 4.93$ vs $12.55 \pm 5.18$ mm, $P = 0.048$, Mann-Whitney U test), larger tumor size ($2.32 \pm 1.15$ vs $1.74 \pm 1.14$ cm, $P = 0.015$, Mann-Whitney U test), and greater lymph node metastasis (46.7% vs 16.2%, $P < 0.022$, $\chi^2$ test) than patients without parametrial invasion. Moreover, only 2 patients had isolated recurrence at the paraaortic region (3.6%).

Conclusion: Stage IB2, IIA1, IIA2 (FIGO 2009) cervical cancer patients with parametrial invasion are older, have deeper stromal invasion and larger tumor size, and are more likely to have lymph node metastasis than those without parametrial invasion. Isolated recurrence rate at paraaortic region is low.

428 - Poster Session
Apatinib combined with chemotherapy or concurrent chemo-brachytherapy in patients with recurrent or advanced cervical cancer: A phase II, randomized controlled, prospective study
L. Sun, Q. Guo and E. Kong. Shandong Cancer Hospital and Institute, Shandong First Medical University and Shandong Academy of Medical Sciences, Jinan, China

Objectives: Apatinib mesylate is a novel vascular endothelial growth factor receptor 2 (VEGFR-2) inhibitor, which has exhibited good drug safety and clinical efficacy in several types of solid tumors. The present study aimed to assess the clinical efficacy and safety of apatinib combined with chemotherapy and concurrent chemo-brachytherapy (CCBT) in patients with recurrent and advanced cervical cancer.

Methods: A total of 52 patients with first diagnosed recurrent or untreated FIGO stage IVB cervical cancer admitted at Shandong Cancer Hospital and Institute between July 2016 and May 2018 were enrolled in the current randomized controlled trial. The patients were randomly divided into 2 groups: the apatinib-treated group ($n = 28$) and the control group ($n = 24$). Patients with recurrent cervical cancer in the apatinib-treated group were administered apatinib and carboplatin-paclitaxel as first-line chemotherapy. Patients with advanced cervical cancer were administered apatinib in combination with CCBT. In the control group, patients with recurrent cervical cancer were treated with chemotherapy alone while patients with advanced cervical cancer received CCBT.

Results: A total of 52 patients with first diagnosed recurrent or untreated FIGO stage IVB cervical cancer admitted at Shandong Cancer Hospital and Institute between July 2016 and May 2018 were enrolled in the current randomized controlled trial. The patients were randomly divided into two groups: The apatinib-treated group ($n=28$) and the control group ($n=24$). Patients with recurrent cervical cancer in the apatinib-treated group were administered apatinib and carboplatin-paclitaxel as first-line chemotherapy. Patients with advanced cervical cancer were administered apatinib in combination with CCBT. In the control group, patients with recurrent cervical cancer were treated with chemotherapy alone while patients with advanced cervical cancer received CCBT.

Conclusion: Apatinib exhibited promising clinical efficacy in cervical cancer patients, resulting in an improved response rate and prolonged progression-free survival compared with the control group, and had manageable side effects. The current study revealed that apatinib combination therapy for adenocarcinoma and bone metastasis were independent prognostic risk factors for disease progression and the risk of mortality.

Endometrial

429 - Poster Session
A systematic review of fertility outcomes after uterine preserving management for endometrial cancer and hyperplasia
J.C. Pontre. Mater Misericordiae University Hospital, Dublin, Ireland; King Edward Memorial Hospital, Perth, WA, Australia

Objective: The purpose of this study was to present a comprehensive review of the current literature on the fertility outcomes of conservative fertility-sparing methods of treatment for early endometrioid adenocarcinoma of the endometrium (EAC) and atypical hyperplasia (AH) of the endometrium.
**Method:** We performed a systematic review of the available evidence on fertility outcomes after fertility-sparing treatment for EAC and AH. A literature search up to August 23, 2019, was conducted using Ovid Medline, EMBASE, CENTRAL, and Web of Science electronic databases. Various combinations of MeSH terms and keywords were used to generate a list of citations, including endometrial neoplasm, hyperplasia and cancer; adjuvant and conservative treatment; and fertility preservation and sparing. Identified articles were then screened and included as per protocol.

**Results:** A total of 301 articles were identified. After screening for titles and abstracts, 139 were kept for full text review. Among these, after considering the inclusion and exclusion criteria, a further 92 were excluded, leaving 47 eligible articles reporting fertility outcomes following conservative treatment for EAC and AH for review. In total, 1,852 patients underwent fertility-sparing treatment in the form of oral medroxyprogesterone acetate (MPA) or megestrol acetate (MA), via the levonorgestrel intrauterine system (LNG-IUS), intramuscular GnRH agonist, and aromatase inhibitors (AI). In one study, hysteroscopic resection was performed as treatment. A total of 518 clinical pregnancies and 277 live births occurred.

**Conclusion:** Our review of the available evidence suggests that the pregnancy outcomes of fertility-sparing treatment for EAC and AH are favorable.

---

**430 - Poster Session**

*Weight change in endometrial cancer patients and association with survival outcomes*

K. Tondo-Steele, S. Rafferty, J.O. Elliott, S.R. Pierce, K. Rath and A. Clements. \(^{a}\)Riverside Methodist Hospital, Columbus, OH, USA, \(^{b}\)Ohio University Heritage College of Osteopathic Medicine, Athens, OH, USA

**Objective:** The primary objective of this study was to determine how weight of endometrial cancer patients changes over time. The secondary objective was to determine whether weight change over time was associated with survival outcomes.

**Method:** After Institutional Review Board approval, a retrospective chart review of endometrial cancer patients seen as new patients between May 1, 2015, and June 1, 2017 was performed. Demographic, histopathologic, treatment, and outcome data were collected on these patients. Weight at diagnosis was compared to weight at last follow-up appointment. Descriptive statistics were performed, and Kaplan-Meier survival curves were created to describe progression-free and overall survival.

**Results:** A total of 260 patients were identified. The median follow-up was 26 months (range 1–68 months). The average BMI was 36.5 (13.7–69.1). Over this time period, the average weight change was a loss of 1.19 pounds (−52.7 to +21.8 pounds). At follow-up, 59% of patients (n = 154) had stable weight (loss or gain of <5%). Thirteen percent of patients (n = 34) lost 5%–10% of their weight, while 12% of patients (n = 32) gained 5%–10%. Ten percent of patients (n = 25) lost >10% of their weight, and 6% (n = 15) gained >10% of their weight. Among these groups, age at diagnosis, histology (endometrioid versus serous), stage, grade, race, and rates of treatment with chemotherapy were not significantly different. Rates of radiation treatment did differ, with patients who lost more than 10% of their weight receiving the highest rate of radiation (60%). Progression-free and overall survival were significantly different. Patients who lost greater than 10% of their body weight had the highest recurrence rate (P = 0.002) and the worst survival (P = 0.006). At 2 years, 33% of patients who lost >10% of their weight had recurred compared to 9% of all other patients. Median survival was 79 months in the patients who lost >10% of their weight compared to 84 months in all other patients. When patients who lost >10% of their weight were eliminated and patients who lost 5%–10% of their weight were compared to the rest of the population, there was also a trend toward increased recurrence (P = 0.05), but there was no difference in survival.

**Conclusion:** In this group of endometrial cancer patients, most patients had stable weight 2 years after their diagnosis. Patients who lost more than 10% of their weight had an increased risk of cancer recurrence and worse survival outcomes.

---

**431 - Poster Session**

*A quantification model of lymphocytic tumor infiltration in endometrial cancer*

M. Avila, B. Fellman, S. Crumley, C. Hudgens, M.T. Tetzlaff and R.R. Broaddus. \(^{a}\)The University of Texas MD Anderson Cancer Center, Houston, TX, USA, \(^{b}\)Houston Methodist Hospital, Houston, TX, USA, \(^{c}\)University of North Carolina at Chapel Hill, Chapel Hill, NC, USA

**Objective:** Immunotherapy with checkpoint inhibitors has revolutionized treatment of advanced cancers. Characterizing biomarkers that predict response to this therapeutic approach is important, as these therapies can have significant toxicities. In some tumor types, such as melanoma, higher numbers of tumor-infiltrating lymphocytes are associated with improved response. For endometrial cancer, mismatch repair deficiency is associated with higher numbers of tumor-associated lymphocytes and better response to checkpoint inhibition. For endometrial cancer, a systematic approach to lymphocyte quantification and evaluation in the tumor has not yet been established.
**Method:** A total of 180 primary endometrioid-type endometrial carcinomas were evaluated with immunohistochemistry for CD3 and CD8 followed by Aperio image-based quantification of positively staining lymphocytes. Lymphocytes were quantified in the tumor periphery (tumor-myometrial interface), tumor center (surrounded on all sides by tumor), and tumor hotspot (region with most lymphocytes). Bland-Altman plots were used to assess whether the measurements in the different tumor regions were in agreement (interchangeable) or whether each measurement was providing unique data.

**Results:** In nearly all the Bland-Altman plots generated, the variance of lymphocyte counts greatly increased as the mean lymphocyte count increased. This was especially evident in the mismatch repair-deficient tumors ($n = 48, 27\%$), but it was also observed in mismatch repair-intact endometrial cancers with higher numbers of tumor-infiltrating lymphocytes. This variance contributed to the fact that Bland-Altman plots did not suggest agreement between the CD3+ or CD8+ lymphocyte counts in the different tumor regions measured (representative Bland-Altman plot, Figure 1).

**Conclusion:** In endometrioid-type endometrial cancer, CD3+ and CD8+ measurements in primary tumor regions were found to not be interchangeable. Thus, it is recommended that a variety of different tumor regions be assessed for lymphocyte counts. Future studies will help to determine whether lymphocyte counts in any of these regions are predictive of response to checkpoint inhibition.

---

**Mismatch repair deficiency predicts worse survival despite adjuvant treatment in stage I endometrial cancer: Opportunities for novel adjuvant therapy**

M. Avila$^a$, B. Fellman$^a$ and R.R. Broaddus$^{ab}$.

$^a$The University of Texas MD Anderson Cancer Center, Houston, TX, USA, $^b$University of North Carolina at Chapel Hill, Chapel Hill, NC, USA

**Objective:** In contrast to other common cancers, the annual mortality from endometrial cancer is increasing. There are few reliable biomarkers to identify early-stage patients at risk for recurrence who might benefit from adjuvant therapy. This is a clinically important gap in knowledge, as many endometrial cancer recurrences outside the vaginal cuff are incurable. Mismatch repair deficiency (dMMR) secondary to $MLH1$ methylation and subsequent loss of $MLH1$ protein is one of the most common molecular events in endometrioid endometrial carcinoma, occurring in 15%–20% of cases. Others and we have shown that $MLH1$ loss is associated with worse survival. The survival impact of $MLH1$ loss on patients triaged to adjuvant therapy by conventional clinicopathological factors in stage I endometrial cancer is unknown.

**Method:** This cohort included 515 endometrioid endometrial carcinoma patients who were previously tested by immunohistochemistry for dMMR. dMMR was defined as loss of $MLH1$ expression due to $MLH1$ gene methylation. Intact mismatch repair (iMMR) was defined as positive expression of mismatch repair proteins. For stage I patients, review of the electronic medical records was performed to determine who received adjuvant radiation therapy. Recurrence-free survival (RFS) and overall survival (OS) were estimated using Kaplan-Meier and Cox regression. Median follow-up was 48 months.
Results: Of the 373 stage I patients, 62 (17%) were dMMR and 311 (83%) were iMMR. Of stage I patients, 32% received some type of adjuvant radiation therapy. Multivariate analysis demonstrated that dMMR was associated with significantly worse RFS and OS. Multivariate analysis did not reveal a survival benefit of adjuvant radiation treatment. The dMMR patients who did not receive adjuvant therapy had the worst RFS (Figure 1).

Conclusion: In this cohort of stage 1 patients, tumors with MLH1 hypermethylation had increased risk of recurrence and decreased overall survival regardless of whether they received adjuvant radiation therapy. These data suggest MLH1 hypermethylation can serve as a potential prognostic marker by which to explore alternative adjuvant therapies in stage I patients. One possibility is prospective trials of checkpoint inhibitors, which are FDA-approved for endometrial cancer patients with advanced disease who have dMMR.

Figure 1a. Recurrence-free Survival by Mismatch Repair and Adjuvant Therapy Status

Figure 1b. Overall Survival by Mismatch Repair and Adjuvant Therapy Status

433 - Poster Session
The effect of combined progesterone and GnRH agonist on the growth of endometrial cancer cells
S. Lim¹, K.B. Lee² and I.S. Hong³. ¹Gachon University Gil Medical Center, Incheon, South Korea, ²Gachon University Gil Medical School, Incheon, South Korea

Objective: The purpose of this study was to evaluate the effect of combined progesterone and GnRH agonist on the growth of endometrial cancer cells.

Method: Endometrial cancer cells were obtained from the Korean cell line bank (Seoul, South Korea) and were cultured in DMEM (Invitrogen, Grand Island, NY) supplemented with 10% fetal bovine serum (FBS), 100 U/ml penicillin, and 100 U/ml streptomycin (Lonza, Basel, Switzerland) at 37°C and 5% CO₂. GnRH was purchased from American Peptide Company, Inc. (Sunnyvale, CA). Water-
soluble progesterone was purchased from Sigma (St. Louis, MO). The MTT assay was used to determine the antiproliferative capacity of GnRH or progesterone, according to the manufacturer's protocol. Cells (1 × 10^4 cells/well) were seeded in 96-well plates. After 24 hours of incubation, the cells were treated with GnRH or progesterone for 72 hours. The viable cells were measured at 570 nM using a VersaMax microplate reader.

**Results:** Growth potential was not changed after treatment with progesterone alone at any concentration. GnRH agonist alone and combined progesterone and GnRH agonist showed concentration-dependent growth inhibition of endometrial cells. Growth potential showed 0.8-, 0.7-, and 0.6-fold change compared to control at concentrations of GnRH agonist of 100 nM, 500 nM, and 1 μM, respectively ($P < 0.05$). Growth potential showed 0.8-, 0.7-, and 0.5-fold change compared to control at concentrations of combined progesterone and GnRH agonist of 100 nM, 500 nM, and 1 μM, respectively ($P < 0.05$). However, there was no difference of growth potential between GnRH agonist and combined progesterone and GnRH agonist.

**Conclusion:** GnRH agonist and combined progesterone and GnRH agonist showed significant inhibited endometrial cancer cell growth in concentration-dependent fashion. Progesterone alone did not show cancer cell growth inhibition. This finding may be helpful in evaluating the appropriate treatment in young patients with endometrial cancer who need hormonal treatment because of a desire for fertility preservation.

---

**434 - Poster Session**  
**Case volume and clinico-pathologic characteristics associated with successful bilateral sentinel lymph node dissection in endometrial cancer in a newly adopted program**  
abBeth Israel Deaconess Medical Center, Boston, MA, USA, bBeth Israel Deaconess Medical Center, Milton, MA, USA, cHarvard Medical School, Boston, MA, USA

**Objective:** Sentinel lymph node (SLN) biopsies have high sensitivity in detecting metastatic disease in endometrial cancer, reduce potential complications compared to traditional lymphadenectomy, and have emerged as standard of care. The aim of this study was to examine successful bilateral SLN dissection by surgeon case volume, surgical approach, and disease and patient characteristics.

**Method:** We conducted a prospective study of all patients with endometrial cancer who underwent minimally invasive surgical staging performed by 5 gynecologic oncologists new to SLN technique at a single institution from July 2017 to August 2019. All patients had robotic (Firefly©) or laparoscopic (Opal©) SLN procedure using indocyanine green (ICG) dye. The primary outcome was successful bilateral SLN dissection as defined by the presence of pathology-confirmed bilateral lymph node tissue among total cases. We also assessed surgeon-reported bilateral lymph mapping and the presence of pathology-confirmed lymph node tissue among those cases. Data are presented as percentage and compared with the $X^2$ test.

**Results:** A total of 128 patients underwent SLN mapping. Surgeons reported successful bilateral mapping in 86% of patients, and pathology confirmed bilateral lymph node tissue in 74% of those patients. The proportion of total patients in which pathology-confirmed bilateral lymph node tissue was identified increased with surgeon experience as quantified by number of cases performed (Figure 1); there was no difference by surgical robotic versus laparoscopic approach ($P = 0.14$). Successful bilateral SLN dissection was more likely among patients with a BMI <30 ($P < 0.02$). Age, race, uterine weight, and prior intra-abdominal or cervical surgery were not associated with successful bilateral SLN dissection. While tumor grade ($P < 0.02$) and myometrial invasion ($P < 0.04$) were associated with successful bilateral SLN dissection, tumor size and lymphovascular invasion were not (both, $P ≥ 0.45$).

**Conclusion:** In a newly adopted program, successful bilateral SLN dissection increased with case volume. While surgical approach did not have an impact on successful bilateral SLN dissection, certain patient and disease characteristics such as BMI, tumor grade, and depth of invasion were associated with successful rates of bilateral SLN dissection.
Regression modeling improves or scheduling for robotic surgery on endometrial cancer

E.J. Levy, K. Zumpf and E.J. Tanner III. Northwestern University Feinberg School of Medicine, Chicago, IL, USA

Objective: Our objective was to develop a tool that can accurately predict operating room time for robotic surgery for endometrial cancer using quantifiable and qualitative preoperative variables.

Method: All robot-assisted hysterectomies performed at an academic medical center for endometrial cancer during a 12-month period were identified. The scheduled operating room time was determined from the medical record. This time was primarily based upon the average operating room time for the last 10 cases posted with the same CPT code. Scheduled operating room times were compared to actual operating room times using Bland-Altman plots. We then built a predictive model for log-transformed operating room time by using repeated k-fold cross-validation with 5 folds that were repeated 10 times. Variables included patient age, ASA, preoperative diagnosis, uterine volume, number of previous surgeries, number of pregnancies, and extent of surgery type. ASA and preoperation diagnosis were treated as ordinal variables. Predictability of linear regression, ridge regression, lasso regression, elastic net regression, and random forest models were compared using root mean squared error (RMSE) and $R^2$. The best model was selected by minimizing RMSE and maximizing $R^2$.

Result: A total of 89 robot-assisted hysterectomies meeting inclusion criteria were identified during the study period. Ridge regression with a lambda of 0.1 was found to be the most predictive for log-transformed operating room time with an average RMSE of 0.2511 and an average $R^2$ of 0.2015. The model coefficients are displayed in Table 1. On average, scheduled operating room times underestimated the actual operating room time by approximately 35 minutes. The limits of agreement (2 standard deviations around the mean difference) range from about −170 to +100 minutes.

Conclusion: Regression modeling shows improved accuracy at predicting operating times for robotic surgery in patients with endometrial cancer. This model will be evaluated prospectively to improve case scheduling.

The survival advantage of adjuvant chemoradiotherapy in surgically managed patients with FIGO stages I-III uterine carcinosarcoma treated in Commission on Cancer®-accredited facilities

A. Cousins, A. Casablanca, Y. Casablanca, B. Tian, M.T. Richardson, J.K. Chan, M.A. Powell, C.A. Hamilton, C.M. Annunziata, N.P. Chappell, G.L. Maxwell, M.D. Richardson, J.K. Chan, A. Casablanca, and K.M. Darby. John P. Murtha Cancer Center, Uniformed Services University of the Health Sciences, Walter Reed National Military Medical Center, Bethesda, MD, USA; Gynecologic Cancer Center of Excellence, Walter Reed National Military Medical Center, Uniformed Services University of the Health Sciences, Bethesda, MD, USA; Henry M Jackson Foundation of the Advancement of Military Medicine, Bethesda, MD, USA; Stanford University School of Medicine, Stanford, CA, USA; California Pacific and Palo Alto Medical Foundation/Sutter Health Research Institute, San Francisco, CA, USA; Washington University School of Medicine in St. Louis, St. Louis, MO, USA; Inova Schar Cancer Institute, Inova Center for Personalized Health, Falls Church, VA, USA; Department of Obstetrics and Gynecology, Inova Fairfax Hospital, Falls Church, VA, USA; National Cancer Institute, Bethesda, MD, USA; Inova Fairfax Hospital, Falls Church, VA, USA.

435 - Poster Session

Regression modeling improves or scheduling for robotic surgery on endometrial cancer

E.J. Levy, K. Zumpf and E.J. Tanner III. Northwestern University Feinberg School of Medicine, Chicago, IL, USA

Objective: Our objective was to develop a tool that can accurately predict operating room time for robotic surgery for endometrial cancer using quantifiable and qualitative preoperative variables.

Method: All robot-assisted hysterectomies performed at an academic medical center for endometrial cancer during a 12-month period were identified. The scheduled operating room time was determined from the medical record. This time was primarily based upon the average operating room time for the last 10 cases posted with the same CPT code. Scheduled operating room times were compared to actual operating room times using Bland-Altman plots. We then built a predictive model for log-transformed operating room time by using repeated k-fold cross-validation with 5 folds that were repeated 10 times. Variables included patient age, ASA, preoperative diagnosis, uterine volume, number of previous surgeries, number of pregnancies, and extent of surgery type. ASA and preoperation diagnosis were treated as ordinal variables. Predictability of linear regression, ridge regression, lasso regression, elastic net regression, and random forest models were compared using root mean squared error (RMSE) and $R^2$. The best model was selected by minimizing RMSE and maximizing $R^2$.

Result: A total of 89 robot-assisted hysterectomies meeting inclusion criteria were identified during the study period. Ridge regression with a lambda of 0.1 was found to be the most predictive for log-transformed operating room time with an average RMSE of 0.2511 and an average $R^2$ of 0.2015. The model coefficients are displayed in Table 1. On average, scheduled operating room times underestimated the actual operating room time by approximately 35 minutes. The limits of agreement (2 standard deviations around the mean difference) range from about −170 to +100 minutes.

Conclusion: Regression modeling shows improved accuracy at predicting operating times for robotic surgery in patients with endometrial cancer. This model will be evaluated prospectively to improve case scheduling.

436 - Poster Session

The survival advantage of adjuvant chemoradiotherapy in surgically managed patients with FIGO stages I-III uterine carcinosarcoma treated in Commission on Cancer®-accredited facilities

A. Cousins, A. Casablanca, Y. Casablanca, B. Tian, M.T. Richardson, J.K. Chan, M.A. Powell, C.A. Hamilton, C.M. Annunziata, N.P. Chappell, G.L. Maxwell, M.D. Richardson, J.K. Chan, A. Casablanca, and K.M. Darby. John P. Murtha Cancer Center, Uniformed Services University of the Health Sciences, Walter Reed National Military Medical Center, Bethesda, MD, USA; Gynecologic Cancer Center of Excellence, Walter Reed National Military Medical Center, Uniformed Services University of the Health Sciences, Bethesda, MD, USA; Henry M Jackson Foundation of the Advancement of Military Medicine, Bethesda, MD, USA; Stanford University School of Medicine, Stanford, CA, USA; California Pacific and Palo Alto Medical Foundation/Sutter Health Research Institute, San Francisco, CA, USA; Washington University School of Medicine in St. Louis, St. Louis, MO, USA; Inova Schar Cancer Institute, Inova Center for Personalized Health, Falls Church, VA, USA; Department of Obstetrics and Gynecology, Inova Fairfax Hospital, Falls Church, VA, USA; National Cancer Institute, Bethesda, MD, USA; Inova Fairfax Hospital, Falls Church, VA, USA.
Objective: The purpose of this study was to determine whether adjuvant chemoradiotherapy improves overall survival compared with radiotherapy or chemotherapy alone in patients with stages I–III uterine carcinosarcoma (UCS) treated in Commission on Cancer®-accredited facilities as a follow-up to the randomized GOG-261 phase III trial.

Method: Surgically managed patients diagnosed with stage I–III UCS who received adjuvant therapy between 2004 and 2014 in the National Cancer Data Base were eligible. Patients with multiple malignancies, stage IV disease, no adjuvant therapy, or missing data were excluded. A propensity score approach was applied to balance the clinical characteristics that varied between treatments. Overall survival was compared between treatments using log rank test and Cox regression analysis.

Results: There were 4,546 eligible patients with stages I–III UCS. This included 971 patients treated with radiotherapy, 1,682 with chemotherapy, and 1,893 with chemoradiotherapy. Treatment use varied by age, race, geographic region, year of diagnosis, neighborhood income, insurance, stage, tumor size, regional lymphadenectomy (LND), and lymphovascular space invasion ($P < 0.0001$). The propensity score approach balanced each of these factors. Figure 1A illustrates the survival advantage of chemoradiotherapy versus either radiotherapy or chemotherapy ($P < 0.0001$). Overall survival was similar following radiotherapy versus chemotherapy alone ($P = 0.759$). Adjusted 5-year survival was 48.6% for radiotherapy, 48.5% for chemotherapy, and 57.4% for chemoradiotherapy. Adjusted risk of death was 29% lower for chemoradiotherapy versus radiotherapy ($P < 0.0001$) and 28% lower for chemoradiotherapy versus chemotherapy alone ($P < 0.0001$). The survival benefit associated with chemoradiotherapy versus chemotherapy or radiotherapy extended to all subgroups except for patients with either tumor size $>10$ cm or without regional LND, where chemoradiotherapy was associated with a trend toward better survival rather than superior survival compared with chemotherapy or radiotherapy (Figure 1B). There were 1,152 chemoradiotherapy patients treated with external beam radiation and 741 who received vaginal brachytherapy. Overall survival did not vary in chemoradiotherapy patients by radiation type ($P = 0.603$).

Conclusion: Adjuvant chemoradiotherapy improved overall survival compared to radiotherapy or chemotherapy alone in surgically managed patients with stages I–III UCS. A prospective randomized trial will be required to validate the survival advantage of chemoradiotherapy and to evaluate local control, progression-free survival, quality of life, and companion diagnostics in this patient population.
Fig. 1. Adjusted overall survival was compared between treatment arms using log rank test and Cox regression analysis. (A) Overall survival for surgically managed stages I-III UCS treated with adjuvant RT, CT, or CRT. (B) Forest plot displaying adjusted hazard ratios and 95% confidence intervals between 2 treatment arms: CT vs. RT, CRT vs. RT, CRT vs. CT, and within all or subgroups of patients treated with CRT vs. RT or CT.

437 - Poster Session
Characterization of venous thromboembolism risk in patients with endometrioid endometrial adenocarcinoma
D. Samuel, J. Ratcliffe, M. Fazzari, N.S. Nevadunsky and G.M. Gressel. Montefiore Medical Center, New York, NY, USA, Albert Einstein College of Medicine, Bronx, NY, USA, Albert Einstein College of Medicine/Montefiore Medical Center, New York, NY, USA

Objective: The aim of this study was to determine the incidence of venous thromboembolism (VTE) in women with endometrioid endometrial adenocarcinoma (EAC), identify major risk factors for VTE, and evaluate the Khorana score as a VTE risk stratification instrument in this population.

Method: We performed a retrospective cohort study of all patients treated for EAC at our institution from 1998 to 2015. Demographic and clinical data were abstracted from the medical record. VTE was diagnosed radiographically. Khorana score was calculated retrospectively for patients who received chemotherapy, and high-risk score was defined as greater than or equal to 3. Univariate and multivariate models were estimated to examine the association between clinicopathologic variables and incident VTE via Cox proportional hazards modeling and using time-dependent covariates.

Results: Of the 1,157 included women with EAC, 64 (5.5%) developed VTE during the follow-up period. Obesity (HR = 1.1, 95% CI 0.7–2.0), smoking status (HR = 0.6, 95% CI 0.2–2.0), and radical surgery (HR = 1.3, 95% CI 0.7–2.3) were not associated with the hazard of
incident VTE. History of prior VTE (HR = 6.4, 95% CI 3.4–12.1) and stage II–IV disease (HR = 2.7, 95% CI 1.5–4.9) were associated with increased hazard of VTE. After controlling for other covariates, current or prior chemotherapy administration was strongly associated with increased hazard of venous thromboembolism (HR = 12.3, 95% CI 6.1–24.6). This association persisted regardless of low-risk (HR = 12.0, 95% CI 4.6–31.2) or high-risk (HR = 26.3, 95% CI 9.1–76.3) Khorana score. See Table 1.

**Conclusion:** Women with EAC in our cohort had a higher incidence of VTE than has been reported in the literature. Those who had a history of VTE or who had current or prior treatment with chemotherapy were at high risk of VTE. The Khorana score did not further delineate those who were at highest risk for developing VTE during chemotherapy. Further prospective studies are needed to determine whether women may benefit from extended prophylaxis during adjuvant treatment for EAC.

Table 1. Logistic regression model examining association of clinical and pathologic covariates with VTE risk in women with EAC.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Hazard ratio (95% confidence interval)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking</td>
<td>0.6 (0.2 – 2.0)</td>
<td>0.44</td>
</tr>
<tr>
<td>Obesity</td>
<td>1.1 (0.7 – 2.0)</td>
<td>0.67</td>
</tr>
<tr>
<td>Radical surgery</td>
<td>1.3 (0.7 – 2.3)</td>
<td>0.39</td>
</tr>
<tr>
<td>Discharge with postoperative thromboprophylaxis</td>
<td>2.1 (0.8 – 5.3)</td>
<td>0.12</td>
</tr>
<tr>
<td>Stage II–IV disease</td>
<td>2.7 (1.5 – 4.9)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>History of venous thromboembolism</td>
<td>6.4 (3.4 – 12.1)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Current or prior chemotherapy</td>
<td>13.5 (6.9 – 26.4)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Low risk Khorana score (&lt;3)</td>
<td>12.0 (4.6 – 31.2)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>High risk Khorana score (&gt;=3)</td>
<td>26.3 (9.1 – 76.3)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

---

**438 - Poster Session**

**Somatic mutation detection by cervicovaginal swab as a potential screening test for endometrial cancer: A pilot study**

M.P. Schlumbrecht, Z. Gao, Y. Ban, A. Pinto, M. Huang, J.M. Pearson, B. Slomovitz and S. George. University of Miami, Sylvester Comprehensive Cancer Center, Miami, FL, USA

**Objective:** There is no screening test for endometrial cancer, the most common gynecologic malignancy in the United States. Vaginal swabs accurately detect HPV and are useful for cervical cancer screening in underserved groups. Our objective was to evaluate somatic mutations within a cohort of endometrial cancer patients, and to assess concordant detection of these mutations by patient and physician-collected vaginal swabs as an exploratory platform for early detection and patient triage.

**Method:** Women undergoing hysterectomy for benign disease and newly diagnosed endometrial cancer were consented over an 8-month period. Patients were segregated by benign disease, low-grade histology (grades 1 and 2 endometrioid), and high-grade histology. A patient-collected swab was obtained prior to surgery. In the operating room, a physician-collected swab and tumor were obtained. DNA was extracted from all specimens and whole exome sequencing (WES) analysis performed. WES somatic deleterious variants were called by Polyphen and SIFT scores. Descriptive statistics and Pearson correlation coefficients were used for analyses, with $P < 0.05$ considered significant.

**Results:** A total of 61 women participated: 12 benign, 30 low grade, and 19 high grade. Missense mutations were most common in both low-grade and high-grade endometrial cancer. Among low grade alone, the most common mutations were TTN, RLIM, and PTEN. In high grade, HRNR, TTN, MUC 16&17, FLG, TAS2R30, KCNH1, and RLIM were the most common mutations. There was insufficient DNA on patient-collected swabs to perform concordance analyses. Correlation of gene mutation between physician-collected swab and tumor was not significant for both low grade and high grade when all mutations were evaluated $(P > 0.05)$. However, of those genes with expected somatic mutations reported by The Cancer Genome Atlas (TCGA), high correlation between tumor and swab detection for both high grade ($R^2 = 0.70, P = 0.001$) and low grade ($R^2 = 0.89, P < 0.001$) endometrial cancer was seen (Figure 1).

**Conclusion:** A number of previously unstudied gene mutations were identified in this cohort. Swabs of cervicovaginal fluid may be a potential means of endometrial cancer screening.
Unproductive T cell receptor-β and T cell receptor-δ recombination recoveries in tissue and blood samples are associated with improved survival outcomes for uterine and ovarian cancers


Objective: In certain cancer settings, a T cell response represents a more favorable outcome. However, T lymphocytes that have an apparent unproductive T cell receptor (TcR) V(D)J recombination event have not been well investigated, with regard to cancer biology or their informative value in prognoses. Thus, in this report we investigated patient outcomes associated with unproductive TcR recombinations in endometrial and ovarian cancers.

Method: To investigate the relationship between the infiltration of lymphocytes with unproductive TcR recombination events into the tumor microenvironment and patient survival, we used a genomics approach to recover unproductive V(D)J recombination sequences from primary tumor and blood, whole exome sequence files for uterine corpus endometrial carcinoma (UCEC, n = 548) and ovarian serous cystadenocarcinoma (OVCA, n = 606). Relevant clinical variables and RNAseq data were acquired from bioinformatic databases.

Results: Results indicated that the recovery of unproductive TcR-β recombination (sequencing) reads were associated with improved overall survival outcomes when compared to patients with no such recoveries from primary tissue (P = 0.0371) and blood samples (P = 0.0162), for patients with UCEC. Furthermore, RNA sequencing, gene expression analyses demonstrated that among UCEC patients with unproductive TcR-β recoveries in tissue samples, there was consistently decreased expression of T cell exhaustion markers (PD1, PDL-1, CTLA-4, LAG-3, TIM-3, 2B4/CD244/SLAMF4, CD160, and TIGIT). In the case of OVCA, patients with unproductive TcR-δ recombination read recoveries in OVCA blood samples demonstrated improved overall (P = 0.0025) and disease-free (P = 0.0262) survival outcomes.

Conclusion: Detection of unproductive TcR-β and TcR-δ recombinations was strongly associated with, and may contribute to, a collection of biomarkers for an improved clinical outcome in UCEC and OVCA, particularly given the consistencies between primary tumor and blood results. The possible sources of the unproductive recombination reads, including possible sequencing errors, along with possible mechanistic connections to tumor biology and the tumor immune response, require further investigation.

Burden of lymphedema after sentinel lymph node dissection in early endometrial cancer patients


Objective: Estimates of the burden of lower extremity lymphedema in patients with endometrial cancer who have undergone sentinel lymph node (SLN) dissection are limited. We sought to obtain health-related quality of life (HRQOL) and patient-reported outcomes (PROs) relevant to lower extremity limb dysfunction caused by lymphedema.

Method: Study subjects were fluent in English and seen January 1, 2015, to December 31, 2017, at a single academic institution for outpatient surveillance visits following hysterectomy and SLN dissection for endometrial cancer during the same study period. No patient had complete lymphadenectomy. The subjects completed 2 validated HRQOL and PRO surveys (GOG Protocol #244 for EC and
Results: Seventy subjects of median age 61 years (range 34–83 years) completed both surveys. Adjuvant treatment was given to 20% ($n = 14$) for high-risk findings (pelvic radiation ± IVRT, 7%, $n = 5$; IVRT alone, 13%, $n = 9$; and chemotherapy, 7%, $n = 5$). Zero subjects reported lymphedema prior to surgery. At the time of survey completion, 24% ($n = 17$) reported they had experienced lower extremity swelling within the previous 4 weeks, 7% ($n = 5$) of whom reported the lower extremity swelling with pitting. Seventeen percent ($n = 12$) reported heaviness of the lower extremities. Zero subjects reported receiving treatment for lymphedema. Ten percent ($n = 7$) of subjects reported extreme or quite a bit of difficulty walking 2 blocks or 10 stairs and 11% ($n = 8$) walking 1 mile. When asked whether they are satisfied with their quality of life, 96% ($n = 67$) reported somewhat to very much.

Conclusion: Following SLN mapping, patients report a good quality of life. Lower extremity swelling following lymph node assessment is more commonly reported than lymphedema treatment prescribed. This calls into question whether utilization of a PRO routine clinical practice may lead to more effective identification of patients with lymphedema than current provider-directed screening approaches.

441 - Poster Session
Thirty-day and 90-day hospital readmission rates in women with endometrial cancer
R. Shibata$, A. Nizam$, J.S. Whyte$, B. Bustamante$, W. Shan$, L. dos Santos$, M. Frimer$, A.W. Menzina$, A. Sakaris$, K.K. Shih$ and G.L. Goldberg$. $Zucker School of Medicine at Hofstra/Northwell, New Hyde Park, NY, USA, $Hofstra - North Shore Long Island Jewish School of Medicine, Manhasset, NY, USA

Objective: The aim of this study was to evaluate our long-term outcomes related to early (within 30 days) and late postoperative hospital readmissions (31 to 90 days) after initial surgery in women with endometrial cancer. The Centers for Medicare and Medicaid Services (CMS) monitors all hospital admissions during the global period for surgical procedures, which must be reported and have an impact on hospital reimbursement and loss of revenue.

Method: This was an Institutional Review Board-approved review of all early postoperative surgical admissions of women with endometrial cancer to an academic gynecologic oncology service from January 2011 to December 2017. Demographics and outcome measures were abstracted from the medical record. We included all women readmitted within 90 days of their initial surgery. The indication for readmission, length of stay, surgical intervention, or intensive care unit admission were evaluated with respect to progression-free survival (PFS) and overall survival (OS). Survival analysis was performed using Kaplan-Meier product limit estimator, and significance ($P < 0.05$) was calculated by log rank tests.

Results: During the study period 754 women received initial surgical staging for endometrial cancer. Fifty-four patients were readmitted (7.8%) a total of 69 times; 4.9% of first readmissions occurred within 30 days postoperatively and 2.9% between 31 and 90 days. The mean readmission stay was 9 days (range 1–50 days). Open surgery, increasing stage, tumor grade, and type 2 histology were associated with early and late readmission ($P < 0.05$). There was no association with type of lymph node dissection, the presence of lymphovascular space invasion (LVSI), or cervical involvement ($P > 0.05$). Ten percent of readmissions required ICU care, but this was not associated with worse OS ($P > 0.05$). Early readmission was associated with a significantly lower PFS and OS ($P < 0.05$, Figure 1). Late readmission was not associated with decreased PFS or OS ($P > 0.05$).

Conclusion: Our 30-day postoperative readmission rate for women with endometrial cancer was 4.9%. Higher readmission rates were associated with open surgery, advanced surgical stage, grade, and type 2 histology. Women readmitted within 30 days had a worse PFS and OS. This was not seen in those readmitted between 30 and 90 days. ICU care during any readmission was not associated with lower PFS or OS. These data provide a preliminary insight into the factors that influence the lower PFS and OS in the surgical management of endometrial cancer patients readmitted within 30 days of initial surgery.
Is platinum-free interval relevant in recurrent uterine serous carcinoma?
R.N. Beavers, B. Fellman, M. Eyada, A.H. Klopp, N.D. Fleming, K.H. Lu, P.T. Soliman and S.N. Westin. The University of Texas MD Anderson Cancer Center, Houston, TX, USA

Objective: Uterine serous carcinoma (USC) behaves aggressively and carries a poor prognosis. The study objective was to delineate platinum-free interval and other variables that may pose a prognostic impact on patients with recurrent USC.

Method: A retrospective review of patients diagnosed with USC at our institution from 1993 to 2012 was performed. We examined overall survival (OS), recurrence-free survival after primary treatment (RFS1), and RFS after first recurrence (RFS2) using Kaplan-Meier methods. RFS2 was calculated from date of first recurrence to date of second recurrence, death, or last visit. Platinum-sensitive interval was defined as months from adjuvant chemotherapy stop date to recurrence for the purposes of our study. Cox proportional hazards regression was used to model association of prognostic factors with survival outcomes.

Results: The study included 365 patients with median age of 64 years (range 30–89 years); 252 (69%) patients were late stage (III or IV) and 113 (31%) were early stage (I or II) at diagnosis. The majority of patients (79%) were treated with chemotherapy ± radiation. Median RFS1 and OS for the cohort were 19.5 months (95% CI 16.2–26.2) and 44.2 months (95% CI 39.1–52.7), respectively. Over a median follow-up time of 40.56 months, 216 (65%) patients recurred. Median RFS2 was 7.3 months (95% CI 6.2–8.1). Early-stage (P < 0.001), mixed serous histology (P = 0.024), and platinum sensitivity/platinum-free interval (P < 0.001) were associated with improved RFS1 and OS. Platinum sensitivity/platinum-free interval (P < 0.001), use of chemotherapy (P = 0.010), and response to therapy (P < 0.001) were associated with improved RFS2.

Conclusion: Platinum sensitivity and platinum-free interval are strong predictors of survival in patients with recurrent USC. This information can be used for counseling and treatment decisions for these patients.

Outcomes after chemotherapy, radiation or combination therapy for high-intermediate and high-risk early-stage endometrial cancer
V.L. Nieto, J.D. Wright, L. Chen, J.Y. Hou, A.I. Tergas, F. Khoury Collado, C.M. St. Clair and A. Melamed. New York-Presbyterian/Columbia University Medical Center, New York, NY, USA

Objective: The adjuvant therapy for high-intermediate and high-risk endometrial cancer remains controversial. A recent randomized trial (PORTEC-3) reported that survival was improved with combination chemotherapy and radiotherapy, although the survival benefit was most pronounced in women with stage III tumors. We analyzed the association between multimodal therapy and survival for women with stage I–II high- and high-intermediate risk endometrial cancer.

Method: The National Cancer Data Base was used to identify women with stage I–II endometrial cancer with pathologic characteristics similar to those included in PORTEC-3 (stage I endometrioid with lymphovascular space invasion or >50% myoinvasion, stage II endometrioid, or stage I–II serous or clear cell) from 2004 to 2015. The association between adjuvant therapy (chemotherapy, external beam radiation [EBRT], or combination [all with or without brachytherapy]) and survival was examined using multivariate models. We fit separate models for each histology/stage grouping.

Results: Of the 21,830 patients identified, 3,028 (13.9%) received chemotherapy alone; 5,726 (26.2%) were treated with EBRT alone; and 1,460 (6.7%) received chemotherapy in combination with EBRT. Use of combination therapy was 6.0% in 2010 and rose to 9.4% in 2015 and was much more common in women with serous and clear cell tumors. There was no association between use of combination therapy and survival for women with stage IA/grade 3/LVSI endometrioid tumors, stage IB/grade 3 endometrioid tumors, or stage II endometrioid tumors (all, P > 0.05). Similarly, among women with stage I–II clear cell carcinomas, combination chemotherapy and EBRT was not associated with improved survival (HR = 0.90, 95% CI 0.54–1.52). In contrast, a combination of chemotherapy and EBRT was associated with improved survival for women with stage I–II serous carcinomas (HR = 0.54, 95% CI 0.43–0.69). These findings were robust in a variety of sensitivity analyses.

Conclusion: Among all women with high-intermediate and high-risk early-stage endometrial cancer, combination therapy shows no survival benefit for women with stage I–II endometrioid and clear cell carcinomas. However, combination chemotherapy and radiation was associated with improved survival for stage I–II uterine serous carcinomas.
**Objective:** The aim of this study was to investigate the relationship between preoperative serum albumin levels and 30-day postoperative morbidity and mortality for women with endometrial cancer undergoing surgical treatment.

**Method:** Data analysis was conducted as a retrospective cohort study, and data were pulled from the National Surgical Quality Improvement Program (NSQIP) from 2012 to 2016. ICD codes were used to identify endometrial cancer patients undergoing hysterectomy. Multivariate regression model was used to analyze preoperative albumin levels with 30-day postoperative outcomes.

**Results:** A total of 93,655 women were identified with endometrial cancer and preoperative albumin levels; 7,603 (8.1%) and 35,353 (37.7%) were classified as low and normal, respectively. The proportion of patients with low albumin levels preoperatively was significantly different between groups based on race (\(P < 0.0001\)), age (\(P < 0.0001\)), BMI (\(P < 0.0001\)), smoking status (\(P < 0.0004\)), diabetes status (\(P < 0.0001\)), and functional status (\(P < 0.0001\)). Patients with low albumin levels had a longer mean operation time (154.6 ± 81.08 vs 141.9 ± 72.87, \(P < 0.0001\)), mean length of stay (4.5 days ± 5.97 vs 2.1 days ± 4.11, \(P < 0.0001\)), higher percentages of blood transfusions (22.2% vs 6.4%, \(P < 0.0001\)), readmissions (8.6% vs 4.7%, \(P < 0.0001\)), reoperations (3.2% vs 1.8%, \(P < 0.0001\)), surgical site infections (3.4% vs 1.8%, \(P < 0.0001\)), and death (1.3% vs 0.2%, \(P < 0.0001\)).

**Conclusion:** Low preoperative albumin levels are associated with several 30-day poor postoperative outcomes, affecting morbidity and mortality in endometrial cancer patients. Albumin levels can be used as an indicator for identifying at-risk patients and better predicting postoperative expectations. Nutritional optimization to improve albumin levels can be used to improve postoperative healing and reduce complications in such a high-risk surgical population.

**Objective:** Endometrial cancers are categorized by histologic criteria, with higher grade tumors portending a worse prognosis. Herein, we examine a putative biological basis for the worse prognosis seen in higher grade tumors. We posit that somatic copy-number alterations (SCNA) burden and TP53 drive radiation resistance.

**Method:** Genomic data from established endometrial cancer cell lines from the Cancer Cell Line Encyclopedia (CCLE) were analyzed. Cell lines were profiled for radiation response in triplicate by using a validated high-content platform. Area under the curve (AUC) after irradiation was calculated for each cell line. A novel exon/intron junctional CRISPR/Cas9 methodology was used to knock out TP53 in targeted cell lines while maintaining the ability to complement with wildtype (exonic) TP53. Knockout was confirmed via Western blots of monoclonal isolates prior to radiation profiling. ANOVA was performed to compare AUC of knockout and complement cell lines.

**Results:** In total, 23 established cell lines were profiled for radiation response. Increasing SCNA were positively correlated with AUC for radiation response (\(R^2 = 0.26, P = 0.01\)). TP53 mRNA expression was not statistically different between cell lines (\(R^2 = 0.02, P = 0.4\)). In SCNA low cell lines with wildtype TP53, knockout of TP53 AUC was between 43% and 53% (\(P = 0.002\)). Conversely, in SCNA high cell lines containing TP53 missense mutations, knockout did not appear to alter AUC (\(P > 0.5\)). Complementation of wildtype restored the radiosensitive phenotype of SCNA low cell lines, but only partially conferred sensitivity in SCNA high cell lines.

**Conclusion:** High SCNA levels and TP53 status affect radiation response. Assessing the impact of the cancer genome on radiotherapy outcomes may create an information capability to guide individualized radiotherapy dose prescriptions.
Objective: Endometrial cancers with high levels of somatic copy-number alterations (SCNA) represent a poor prognostic group, frequently comprising high-grade carcinomas. To date, no studies have demonstrated a correlation between SCNA burden and response to genotoxic therapies. Herein, we examine whether high SCNA status is associated with significantly worse outcomes after radiotherapy compared to an unirradiated population, potentially indicating that SCNA is predictive of radiotherapeutic efficacy.

Method: De-identified clinical data from The Cancer Genome Atlas (TCGA) endometrial cancer cohort were analyzed. Only patients with information including stage, histology, somatic copy-number burden, and exposure to radiotherapy or chemoradiotherapy (CRT) were included. Patients who received CRT were analyzed separately from those receiving radiotherapy. SCNA values were abstracted from the fraction of genome altered estimates. ANOVA was performed to test for differences in SCNA burden between groups. Kaplan-Meier analyses were performed to determine overall survival (OS) and progression-free survival (PFS) for each cohort, stratified by median SCNA values.

Results: In total, 66 patients had genomic and treatment data available for analysis. The mean SCNA for the no therapy, radiotherapy, and CRT groups was 0.24, 0.3, and 0.31, respectively ($P = 0.62$), indicating no significant difference in SCNA burden between each cohort. In patients who received radiotherapy, high SCNA was associated with a worse PFS (HR = 0.14, $P = 0.006$) and OS (HR = 0.07, $P < 0.001$). Similarly, patients with high SCNA receiving CRT had a worse PFS (HR = 0.12, $P = 0.04$). A difference in OS did not reach statistical significance in the CRT cohort (HR = 0.15, $P = 0.11$). Importantly, in the no treatment cohort, OS and PFS were not significantly different when comparing SCNA groups. See Figure 1.

Conclusion: These data indicated that SCNA burden is predictive of poor outcomes after radiotherapy, in turn explaining the poor prognosis observed in these groups. This summary genomic marker could inform the treatment of patients with endometrial cancer. Additional work to determine a biological basis for these findings is pending.
**Objective:** Endometrial cancer is the most common gynecologic malignancy in the Western world. The overall risk of recurrence is associated with traditional risk factors. Their relative significance is under debate, and new molecular signatures are being looked at. We aim to evaluate whether machine learning algorithms can predict recurrence of endometrial cancer.

**Method:** Machine learning was used to predict recurrence among women who were diagnosed and treated for endometrial cancer between 2006 and 2014 at 1 university-affiliated medical center. Median follow-up was 5 years. The following data were retrieved from the medical records: age, chronic metabolic diseases, family and personal cancer history, hormone replacement therapy use, endometrial thickness, uterine polyp presence, laboratory results at diagnosis, CA-125 level, surgical staging, histology, depth of myometrial invasion, lymphovascular space invasion (LVSI), grade, cytology, lymph nodes metastasis and location, and adjuvant treatment. We used XGBoost algorithm, which fits the training data using decision trees and can also rate the factors according to their influence on the prediction. We assigned a weight to each class (positive/negative) to overcome potential biases due to the unbalanced nature of data. For the machine training phase, 66% of the cohort was randomly selected. We then used the rest of the samples as a test set to evaluate our model’s accuracy. The test set samples’ parameters were fed into the trained model, and the predicted outcome was compared to the actual outcome.

**Results:** A total of 321 women were found, and 60 of them had a recurrent disease at 5 years of follow-up. The incidence outcome of recurrent disease was 18.6% for the whole cohort. On the randomly picked samples used to evaluate our model, the specificity was 75%, and the sensitivity was 89%. The most predictive parameters were white blood count, age, hemoglobin, and CA-125.

**Conclusion:** A state-of-the-art machine learning algorithm presented promising ability to predict recurrence of endometrial cancer. The algorithm provides an opportunity to identify at-risk patients who may benefit from adjuvant therapy, tighter surveillance, and intervention. We now plan to expand the cohort and evaluate the model in larger numbers.

---

**448 - Poster Session**

**What is the clinical significance of grade 2 histology in patients with stage IA endometrial cancer?**

D. Nelson, A. Nizam, K.K. Shih, W. Shan, B. Bustamante, L. dos Santos, M. Frimer, A.W. Menzino, A. Sakaris, J.S. Whyte, and G.L. Goldberg. Zucker School of Medicine at Hofstra/Northwell, New Hyde Park, NY, USA, Hofstra - North Shore Long Island Jewish School of Medicine, Manhasset, NY, USA

**Objective:** In women with FIGO stage 1A endometrioid adenocarcinoma, grade 2 histology represents an equivocal prognostic indicator. There is debate about the need for adjuvant therapy. Despite the increasing prevalence of early-stage endometrial cancer, there is ongoing uncertainty regarding the difference in outcomes of a 3-tiered histologic grading system.

**Method:** An Institutional Review Board-approved study identified all patients with FIGO stage 1A endometrioid adenocarcinoma treated between January 2011 and February 2019. Uterine serous and clear cell carcinomas were excluded. Demographics and outcome measures were abstracted from the medical records and tumor registry. Cox proportional hazard models, log rank tests, and comparisons of means were used to calculate significance ($P < 0.05$).

**Results:** Four hundred eighty-four women were identified and were eligible for evaluation; 354 (73.3%) were grade 1, 91 (18.8%) grade 2, and 38 (7.87%) grade 3. Women with grade 2 were significantly older than those with grade 1 (66 years vs 62 years, $P < 0.05$). There was no difference in age between the grade 2 and the grade 3 patients (66 years vs 66 years, $P > 0.05$). Sixteen (17.6%) patients with grade 2 pathology met standard criteria for adjuvant therapy. Sixty-nine (75.8%) patients with grade 2 pathology underwent minimally invasive surgical staging compared to 307 with grade 1 (86.8%) and 28 with grade 3 (73.7%) ($P < 0.05$). Seven (7.7%) women with grade 2 recurred within 5 years of surgical staging with 4 vaginal recurrences. Grade 2 patients have a significantly worse progression-free survival (PFS) and overall survival (OS) than grade 1 patients ($P < 0.05$) and a significantly improved PFS and OS when compared to grade 3 patients (**Figure 1**).

**Conclusion:** Our cohort demonstrates that patients with stage IA grade 2 endometrial cancer have a significantly different outcome profile than grade 1 and grade 3 patients. Given the differences between grade 1 and grade 3, further studies are needed to determine the relation between grade 2 and high-intermediate risk endometrial endometrioid cancer.
What is the clinical significance of stage II endometrial cancer?

D. Nelson, A. Nizam, K.K. Shih, W. Shan, B. Bustamante, L. dos Santos, M. Frimer, A.W. Menz, A. Sakaris, J.S. Whyte and G.L. Goldberg. Zucker School of Medicine at Hofstra/Northwell, New Hyde Park, NY, USA, Hofstra - North Shore Long Island Jewish School of Medicine, Manhasset, NY, USA

Objective: Stage II endometrial cancer represents a dilemma for the choice of optimal management and adjuvant therapy. The prevalence of stage II endometrial cancer is much lower than both early- and more advanced-stage disease. There is a need for clear guidelines for the management of women with stage II endometrial cancer.

Method: An Institutional Review Board-approved study identified all patients with surgically staged FIGO stage II endometrial cancer treated between January 2011 and February 2019. All histologic subtypes were included. Demographics and outcome measures were abstracted from medical records and the tumor registry. Cox proportional hazard models, log rank tests, and comparisons of means were used to calculate significance ($P < 0.05$).

Results: Forty-seven (47) women were identified and were eligible for evaluation. All patients were treated with total hysterectomy, bilateral salpingo-oophorectomy, and lymph node sampling. Two patients (4.26%) declined adjuvant therapy; 5 patients (10.6%) received chemotherapy alone; 32 (68.1%) patients received radiation therapy; and 8 (17.0%) patients received both chemotherapy and radiation. Fourteen (29.8%) women recurred within the study period with the most common recurrence site being an abdominal mass or bone metastases with 3 recurrences at each of these sites. Radiation therapy and chemotherapy with radiation improved progression-free survival (PFS) and overall survival (OS) when compared to no adjuvant treatment and to chemotherapy alone ($P < 0.05$, Figure 1). Increasing age at time of diagnosis was an independent risk factor for PFS ($P < 0.05$). Age, grade, and race had no significant effect on OS ($P > 0.05$).

Conclusion: Our cohort demonstrates that patients with stage II endometrial cancer treated with radiation therapy or chemotherapy with radiation therapy after definitive surgical staging have a significantly improved PFS and OS. Those women who had no adjuvant therapy and those who received chemotherapy alone had a worse PFS and OS. These data did not change based on histologic subtype. Given the differences between these adjuvant treatment groups, further information is needed to determine the optimal adjuvant therapy for women with stage II endometrial cancer.

Fig. 1. Median progression free survival.
endometrial cancer

Objective: The aim of this study was to identify predictors of quality of life (QOL) among patients who undergo surgical staging with sentinel lymph node (SLN) biopsy or lymphadenectomy (LND) for endometrial cancer.

Method: Attempted SLN mapping was introduced at Mayo Clinic in October 2013. Women who underwent minimally invasive surgery (MIS) and surgical staging for primary endometrial cancer at Mayo Clinic during January 2009–June 2016 were mailed a 30-item Quality of Life in Cancer questionnaire (QLQ-C30) and a previously validated 13-item screening questionnaire for the assessment of lower extremity lymphedema (LEL) starting in December 2016. Patients were excluded if they had a preoperative history of LEL or if they answered an insufficient number of survey items for scoring. Multivariate linear regression models were fit to evaluate predictors of QOL. Differences of 10 points or more on the QOL scales were considered clinically important.

Results: Of 835 patients who underwent MIS with surgical staging, 68 were deceased at the time of the mailing, 342 did not return a survey, 54 returned a survey but met exclusion criteria, and 371 returned a survey and were included in the analysis. Patients were stratified into three groups: those who underwent (1) LND before October 2013 (n = 147), (2) bilateral LND after October 2013 with/without SLN (n = 102), or (3) SLN removal with/without unilateral LND (n = 122). The prevalence of LEL (defined as self-reported lymphedema diagnosis or positive on screening survey) was 57.1%, 38.2%, and 26.2%, in the three groups, respectively. Based on multivariate analysis (performed separately for each QOL scale), many comorbid conditions such as BMI, LEL, congestive heart failure, and kidney disease had significant (P < 0.05) and clinically meaningful negative impacts on QOL. The impact of LEL and comorbid obesity was particularly marked; for example, the average adjusted global QOL score was 23.2 points lower (poorer) in morbidly obese (BMI > 40 kg/m²) patients with LEL compared to nonobese patients without LEL (Table 1). In contrast, the adjusted average global QOL score was only 1.6 and 2.9 points different than the SLN group and either LND group, respectively.

Conclusion: No clinically meaningful differences in QOL scores were observed between patients who underwent MIS for endometrial cancer with SLN biopsy versus LND after accounting for the impact of comorbid conditions.

Table 1. Parameter coefficients from multivariable analysis of predictors of QOL, evaluated separately for each of the functioning and symptom scales.

<table>
<thead>
<tr>
<th>Variables included in each multivariable model</th>
<th>Functioning Scales‡</th>
<th>Symptom scales‡</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Global QOL</td>
<td>Physical</td>
</tr>
<tr>
<td>Intercept</td>
<td>81.75</td>
<td>131.68</td>
</tr>
<tr>
<td>Age at survey (years, reference is age 0)</td>
<td>0.02</td>
<td>-0.57*</td>
</tr>
<tr>
<td>LEL and BMI category</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No LEL &amp; BMI &lt;30 (reference)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>No LEL &amp; BMI 30-39.9</td>
<td>-5.99*</td>
<td>-5.79*</td>
</tr>
<tr>
<td>No LEL &amp; BMI 40+</td>
<td>-8.89*</td>
<td>-11.17*</td>
</tr>
<tr>
<td>LEL &amp; BMI 30-39.9</td>
<td>-15.05*</td>
<td>-15.55*</td>
</tr>
<tr>
<td>LEL &amp; BMI at 40+</td>
<td>-23.24*</td>
<td>-30.94*</td>
</tr>
<tr>
<td>History of diabetes at time of survey</td>
<td>-2.21</td>
<td>-4.54*</td>
</tr>
<tr>
<td>History of heart failure or congestive heart failure at time of survey</td>
<td>-10.88*</td>
<td>-6.62*</td>
</tr>
<tr>
<td>History of kidney disease or failure at time of survey</td>
<td>-8.75*</td>
<td>-4.17*</td>
</tr>
<tr>
<td>Ever received external beam radiation after surgery</td>
<td>0.19</td>
<td>1.76</td>
</tr>
<tr>
<td>FIGO stage III or IV disease (vs. I or II)</td>
<td>-4.34</td>
<td>-4.48</td>
</tr>
</tbody>
</table>

Abbreviations: BMI, body mass index (kg/m²) at time of survey; LEL, lower extremity lymphedema, QOL, quality of life. QOL scores range from 0-100. ‡Higher functional scores indicate better functional well-being.
‡Higher symptom scores indicate worse symptom.
* Statistically significant, p <0.05.
Bold indicates clinically meaningful difference (≥10 points).

451 - Poster Session
The survival impact of radiation therapy in addition to chemotherapy in patients with pathologically confirmed node-positive endometrial cancer

Objective: The purpose of this study was to examine the survival impact of external beam radiation therapy (EBRT) in addition to chemotherapy based on histologic type in patients with pathologically confirmed node-positive endometrial cancer.

Method: The National Cancer Data Base was used to identify women with pathologically confirmed pelvic or aortic lymph node metastasis (stage IIIC1 or IIIC2) endometrial cancer who underwent hysterectomy and staging followed by chemotherapy alone or combination of chemotherapy and EBRT between 2010 and 2016. Adjusted survival analysis was performed by way of multivariate Cox proportional hazards regression.

Results: In total, 6,646 patients were included in the final analysis. Fifty-nine percent (3,949) received chemotherapy and EBRT, and 41% (2,697) chemotherapy only. In multivariate analysis, chemotherapy and EBRT was associated with an 18% reduction in mortality compared to chemotherapy alone (aHR = 0.82, 95% CI 0.71–0.94, P = 0.0045). Among patients with nonendometrioid carcinoma, chemotherapy and EBRT was associated with a 19% reduction in mortality (aHR = 0.81, 95% CI 0.67–0.97, P = 0.0225), but no difference in survival was detected in those with endometrioid carcinoma (aHR = 0.87, 95% CI 0.70–1.08, P = 0.2123). In a subgroup analysis of those with nonendometrioid histology that included carcinosarcomas, serous carcinoma and clear cell, only patients with carcinosarcomas had a survival benefit from addition of EBRT to chemotherapy (aHR = 0.55, 95% CI 0.35–0.88, P = 0.0129). See Figure 1.

Conclusion: The addition of EBRT to chemotherapy provided a survival benefit for patients with nonendometrioid node-positive stage IIIC endometrial cancer, in particular those with carcinosarcoma.

Fig. 1. Overall survival in patients with stage IIC uterine carcinosarcoma.

452 - Poster Session
Mismatch repair protein status and effect on outcomes in high-intermediate risk endometrial cancer
A.M. Barrie, M.T. McHale, C.C. Saenz, S.C. Plaxe and R.N. Eskander. UCSD Rebecca and John Moores Cancer Center, La Jolla, CA, USA

Objective: The aim of this study was to evaluate differences in outcomes between patients with mismatch repair-proficient (pMMR) and MMR-deficient (dMMR) high-intermediate risk endometrial cancer.

Method: Adult women with high-intermediate risk endometrial cancer who received treatment at an academic center between January 1, 2016, and December 31, 2018, were identified. High-intermediate risk criteria were defined as having the presence of 3 risk factors if
age <50 years, 2 risk factors if age ≥50 and <70 years, and 1 risk factor if age ≥70 years. Risk factors were grade 2–3, presence of lymphovascular space invasion (LVSI), and ≥50% myometrial invasion as per GOG 249. Categorical variables were compared using χ² tests. Continuous variables were compared using independent t tests. The Kaplan-Meier method was used to evaluate progression free-survival and overall survival. Cox proportional hazard models were used to evaluate factors predictive of survival.

Results: Fifty-one patients with high-intermediate risk endometrial cancer were identified during the study period. Of these, 33 patients (65%) were pMMR (by immunohistochemical staining), and 18 patients (35%) were dMMR. There was no difference in mean age, BMI, stage, grade, presence of LVSI, or type of adjuvant treatment received in the pMMR versus dMMR cohorts. Within the entire cohort, 6 patients (12%) experienced cancer recurrence and 1 patient died. The median follow-up period was 563 days. There was no difference in rates of recurrence between the pMMR and dMMR groups (6% vs 22%, P = 0.09). Mean time to recurrence in the pMMR cohort was 967 days (n = 2, 95% CI 890–1,044) versus 789 days in the dMMR population (n = 4, 95% CI 689–887), which was not significantly different (P = 0.49). In those in the pMMR cohort who recurred, 1 received vaginal brachytherapy (VBT), and 1 received whole pelvic radiation therapy (WPRT). The patient who received VBT died from cancer recurrence. In those in the dMMR group who recurred, 1 received no adjuvant treatment, 1 received WPRT, and 2 received VBT. Adjuvant treatment had no effect on recurrence-free survival (P = 0.827). See Table 1.

Conclusion: In our cohort, there was no difference in rates of recurrence or time to recurrence between patients with pMMR or dMMR high-intermediate risk endometrial cancer. In addition, we did not find any significant differences in clinicopathologic characteristics or adjuvant treatment between the study cohorts.

Table 1: Characteristics of pMMR vs dMMR groups.

<table>
<thead>
<tr>
<th></th>
<th>pMMR (n = 33)</th>
<th>dMMR (n = 18)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age</td>
<td>64 years old</td>
<td>67 years old</td>
<td>0.32</td>
</tr>
<tr>
<td>Mean BMI</td>
<td>30.16 kg/m²</td>
<td>32.72 kg/m²</td>
<td>0.26</td>
</tr>
<tr>
<td>Stage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- IA</td>
<td>n = 5 (15%)</td>
<td>n = 7 (39%)</td>
<td>0.09</td>
</tr>
<tr>
<td>- IB</td>
<td>n = 28 (85%)</td>
<td>n = 11 (61%)</td>
<td></td>
</tr>
<tr>
<td>Grade</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 1</td>
<td>n = 1 (3%)</td>
<td>n = 1 (6%)</td>
<td>0.50</td>
</tr>
<tr>
<td>- 2</td>
<td>n = 22 (67%)</td>
<td>n = 9 (50%)</td>
<td></td>
</tr>
<tr>
<td>- 3</td>
<td>n = 10 (30%)</td>
<td>n = 8 (44%)</td>
<td></td>
</tr>
<tr>
<td>LVSI</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Present</td>
<td>n = 21 (63%)</td>
<td>n = 16 (89%)</td>
<td>0.10</td>
</tr>
<tr>
<td>- Absent</td>
<td>n = 12 (37%)</td>
<td>n = 2 (11%)</td>
<td></td>
</tr>
<tr>
<td>Treatment Received</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- None</td>
<td>n = 7 (21%)</td>
<td>n = 3 (17%)</td>
<td>0.39</td>
</tr>
<tr>
<td>- VBT</td>
<td>n = 9 (27%)</td>
<td>n = 6 (33%)</td>
<td></td>
</tr>
<tr>
<td>- WPRT</td>
<td>n = 16 (49%)</td>
<td>n = 9 (50%)</td>
<td></td>
</tr>
<tr>
<td>- ChemoRT</td>
<td>n = 1 (3%)</td>
<td>n = 0 (0%)</td>
<td></td>
</tr>
<tr>
<td>Recurrence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Yes</td>
<td>n = 2 (6%)</td>
<td>n = 4 (22%)</td>
<td>0.09</td>
</tr>
<tr>
<td>- No</td>
<td>n = 31 (94%)</td>
<td>n = 14 (79%)</td>
<td></td>
</tr>
<tr>
<td>Time to Recurrence</td>
<td>n = 2,967 days</td>
<td>n = 4,789 days</td>
<td>0.49</td>
</tr>
</tbody>
</table>

453 - Poster Session
Enhanced recovery after surgery (ERAS) protocol on the gynecologic oncology surgery service dramatically decreases narcotic use and decreases inpatient costs
R. Altera, M.J. Sperlingb, R. Blumenthalb, G.C. Rodriguezb, T.J. Vogelb, J.A. Hurteaub, C.V. Kirschnerb and E.D. Mooreb. aThe University of Chicago Medicine, Chicago, IL, USA, bNorthShore University Health System, Evanston, IL, USA

Objective: Implementation of enhanced recovery after surgery (ERAS) protocols has been shown to decrease hospital charges, but data on the effects of ERAS on hospital costs are lacking. This study aimed to assess the impact of ERAS on hospital costs.

Method: An ERAS protocol for patients undergoing abdominal hysterectomy on the gynecologic oncology service was implemented in July 2018. The ERAS protocol included preoperative patient education, carbohydrate loading, and nonopioid analgesics; intraoperative euvoema, normothermia, liposomal bupivacaine TAP blocks, and prophylactic anti-emetics; and postoperative multimodal analgesics, early nutrition, and early ambulation. Patient information was collected from August 2018 to July 2019 and compared to a pre-ERAS cohort of consecutive patients from June 2017 to July 2018. Data collected included length of stay, narcotic use, and hospital costs.
**Results:** A total of 106 patients were enrolled in the ERAS group and compared with 99 consecutive comparable patients preceding the implementation of ERAS. Median length of stay decreased from 3 to 2 days with ERAS. The use of patient-controlled anesthesia was eliminated (78% to 0%); average morphine milligram equivalents (MME) per patient decreased from 187.26 to 22.04; and the number of patients using no opioids increased from 1% to 19.4%. In addition, 30% of ERAS patients used no class II or III narcotics and only required tramadol for pain control compared to 2% in the pre-ERAS cohort. Overall direct costs decreased by 18% per case ($1,644/case), and hospital charges decreased by 6.6% with implementation of ERAS. Cost savings were seen in surgery/anesthesia ($731/case), nursing ($797/case), laboratory ($159/case), and physical therapy/occupational therapy ($46/case). Despite the dramatic decrease in narcotic use, there was a 68% increase in pharmacy costs ($362/case) because of the use of more expensive non-narcotic medications. Even with this increase in pharmacy cost, overall cost savings were achieved. Of note, despite the introduction of routine TAP blocks prior to the start of surgery, the median time from room entry to incision increased by only 7 minutes.

**Conclusion:** The implementation of an ERAS protocol on the gynecologic oncology service decreased hospital stay, narcotic use, and hospital charges, as well as led to significant hospital cost savings despite the increase in medication costs.

---

**454 - Poster Session**

Recurrence patterns and recurrence free survival following primary surgical staging among women with early-stage uterine serous carcinoma who receive adjuvant vaginal brachytherapy in addition to chemotherapy versus chemotherapy alone

A. Freeman, A.M. Barrie, L.Y. Tucker and R.D. Littell. *Kaiser Permanente San Francisco Medical Center, San Francisco, CA, USA, University of California, San Francisco, San Francisco, CA, USA, UCSD Rebecca and John Moores Cancer Center, La Jolla, CA, USA, Kaiser Permanente Northern California, Oakland, CA, USA, Kaiser Permanente Northern California Gynecologic Oncology Program, San Francisco, CA, USA*

**Objective:** The purpose of this study was to evaluate the effect of adding vaginal brachytherapy (VBT) to adjuvant chemotherapy on patterns of recurrence and recurrence-free survival (RFS) among women with stage I–II uterine serous carcinoma (USC).

**Method:** We conducted a retrospective cohort analysis of all women undergoing primary surgical staging from January 2001 to June 2017 with follow-up until December 2017 in a community-based hospital system in Northern California. Patients with stage I–II disease who received adjuvant chemotherapy with or without VBT were included. Patients without lymphadenectomy or who had external beam radiation therapy were excluded. Kaplan-Meier was used to estimate RFS, and Cox proportional hazards models were used.

**Results:** A total of 395 women underwent surgery for early-stage USC during the study period. Nearly half (n = 194, 49%) received adjuvant chemotherapy with or without VBT, of which 155 (79.9%), 30 (15.5%), and 9 (4.6%) had stage IA, IB, and II disease, respectively. There were 116 (59.8%) in the VBT group and 78 (40.2%) in the non-VBT group. Clinical characteristics including age, race, stage, lymph node count, confined to polyp, myometrial invasion, lymphovascular invasion, and pelvic washings between groups were not statistically significant. Median number of chemotherapy cycles was 6 (IQR 3–6) for both groups. The total recurrence rate was 15.0% (29/194). There was no difference in overall recurrence rate, with 18/116 (15.5%) vs 11/78 (14.1%) recurrences in the VBT versus the non-VBT group, respectively (P = 0.79). There was a similar proportion of distant recurrences (44.4% vs 45.5%); relative to chemotherapy alone, VBT was associated with more abdominal recurrences (38.9% vs 9.1%) but fewer pelvic recurrences (11.1% vs 27.3%, P = 0.009). There was 1 vaginal-only recurrence in the VBT group and 2 vaginal-only recurrences in the non-VBT group (P = 0.54). There was no difference in RFS between groups (P = 0.76). Five-year RFS was 75.4% and 81.3%, respectively (Figure 1). In multivariate analysis, addition of VBT was not associated with increased RFS (HR = 1.09, 95% CI 0.50–2.40).

**Conclusion:** Among women with early-stage USC, the addition of VBT to chemotherapy was associated with a shift in recurrence pattern with fewer pelvic and more abdominal recurrences, without a significant change in overall risk of recurrence.
The role of endometrial sampling for surveillance of recurrence in patients with medically inoperable endometrial cancer


Washington University School of Medicine in St. Louis, St. Louis, MO, USA

Objective: There are no specific guidelines regarding the role of endometrial sampling during post-treatment surveillance in medically inoperable endometrial cancer patients who achieve a complete response with initial treatment. We aimed to characterize the role of surveillance endometrial sampling in stage I medically inoperable endometrioid endometrial cancer patients managed with progestin therapy (PT) or definitive radiation therapy (RT).

Method: This was a cohort study of women with clinical stage I medically inoperable endometrioid endometrial cancer treated with either PT or RT at a single large academic institution between 2009 and 2018. Demographic variables, number of endometrial biopsies, as well as recurrence and survival rates were obtained from the electronic medical record.

Results: Sixty women were included; 29 (48.3%) received PT and 31 (51.7%) RT. Medically managed patients were commonly treated with Megestrol acetate (70%), a levonorgestrel intrauterine device (72.4%), or both. Radiated patients were mostly treated with high dose rate (HDR) brachytherapy only (78%). Most patients had grade 1 disease (93.3%) and imaging prior to treatment (80%), and were considered ineligible for surgery due to obesity (72.4%) or a cardiopulmonary diagnosis (67.2%). Patients treated with PT had significantly higher median BMI (kg/m²) ($57.1$ vs $45.4$, $P<0.01$), but otherwise were similar to patients treated with RT. Recurrence occurred in 2 (6.9%) of women who received PT and 1 (4.2%) woman who received RT ($P=0.23$). All recurrences in the PT group occurred locally and were diagnosed by routine endometrial sampling surveillance; the 1 recurrence in the RT group occurred distally in the lung 25.3 months after completing brachytherapy (Table 1). Only 23% of patients in the PT group followed up with regular endometrial sampling.

Conclusion: Radiation therapy provides such excellent local control in patients with presumed stage I, medically inoperable endometrial cancer that post-treatment endometrial sampling may be safely excluded after definitive RT. Conversely, there is a role for endometrial sampling in medically managed patients in order to diagnose local recurrence. Given overall poor compliance with routine endometrial sampling, adherence to follow-up should be considered when determining initial treatment for patients with medically inoperable endometrial cancer.

Table 1. Summary of medically inoperable patients who recurred.
<table>
<thead>
<tr>
<th>Surgery contraindication</th>
<th>58</th>
<th>57</th>
<th>71</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age*</td>
<td>57</td>
<td>71</td>
<td>58</td>
</tr>
<tr>
<td>Clinical Stage</td>
<td>IA</td>
<td>IA</td>
<td>IB</td>
</tr>
<tr>
<td>Treatment</td>
<td>LNG-IUD</td>
<td>LNG-IUD</td>
<td>36 Gy HDR brachy only*</td>
</tr>
<tr>
<td>Endometrial sampling q3 months?</td>
<td>Yes</td>
<td>No</td>
<td>N/A</td>
</tr>
<tr>
<td>How recurrence was detected</td>
<td>Biopsy</td>
<td>Biopsy</td>
<td>Other</td>
</tr>
<tr>
<td>Time to recurrence after negative biopsy (months)</td>
<td>9</td>
<td>6.2</td>
<td>25.3 (from date of brachy completion)</td>
</tr>
<tr>
<td>Site of recurrence</td>
<td>Uterus</td>
<td>Uterus</td>
<td>Right lung†</td>
</tr>
<tr>
<td>Treatment of recurrence</td>
<td>Hormonal therapy</td>
<td>Radiation</td>
<td>Hormonal therapy</td>
</tr>
<tr>
<td>Follow-up from diagnosis (y)</td>
<td>1.8</td>
<td>4.9</td>
<td>4.2</td>
</tr>
<tr>
<td>Status</td>
<td>Alive with disease</td>
<td>Alive with disease</td>
<td>Dead of disease</td>
</tr>
</tbody>
</table>

*Age at diagnosis
LNG-IUD = Levonorgesterel intrauterine device; HDR = high dose rate; brachy=brachytherapy
† This was suspected based interval increase in size of pulmonary nodules visualized on CT scan of the chest taken 8.2 months apart. Not amenable to CT-guided biopsy and patient too unhealthy to undergo a video-assisted thoracoscopy surgery.

---

456 - Poster Session
Oncologic and pregnancy outcomes with fertility-sparing management for early-stage endometrial cancer in young women
Y.S. Chung and J.Y. Lee. Yonsei University College of Medicine, Seoul, South Korea

Objective: The aim of this study is to evaluate the long-term oncologic and pregnancy outcomes of progestin treatment in young women with early-stage endometrial cancer who wish to preserve their fertility.

Method: We retrospectively reviewed medical records of 82 patients (age <45 years) with clinical stage IA–IB, grade 1–2 endometrial cancer who had received fertility-sparing management from February 2006 to December 2018 at our institution. Time interval to complete response (CR) and time interval from CR to recurrence or pregnancy trial were evaluated. A Cox regression analysis was used to identify factors associated with recurrence to progestin treatment.

Results: Sixty-one (74.4%) showed CR after progestin treatment, and 19 (31.1%) of them experienced recurrence after a median follow-up time of 40.6 months. The 5-year recurrence-free survival was 52.3% (95% CI 42.3%–60.8%). Multivariate analysis showed that presence of myometrial invasion (HR = 14.00, 95% CI 2.45–80.14, \(P = 0.003\)) was significantly associated with a higher risk of recurrence, whereas maintenance treatment (HR = 0.26, 95% CI 0.08–0.85, \(P = 0.026\)) and assisted reproductive technology (ART) utilization (HR = 0.20, 95% CI 0.06–0.66, \(P = 0.008\)) were significantly associated with a lower risk of recurrence. Of the 24 patients who tried to conceive after CR, 20 (83.3%) underwent ART, 13 (54.2%) experienced pregnancy, and 10 (41.7%) had live newborn infants.

Conclusion: Fertility-sparing management for early-stage, low-grade endometrial cancer is feasible with progestin treatment, and pregnancy outcomes are promising. Patients with maintenance treatment, ART utilization, and no evidence of myometrial invasion were associated with a higher probability of long-term success.

---

457 - Poster Session
Rates of obesity management counseling in obese patients with stage I endometrioid endometrial cancer
N. Desravines, M. Ertel, A. Staley and L.H. Clark. University of North Carolina at Chapel Hill, Chapel Hill, NC, USA

Objective: Data suggest women diagnosed with stage 1, grade 1 endometrioid endometrial cancer are more likely to die from cardiovascular comorbid conditions. We sought to determine the rate of counseling for weight loss management in obese endometrioid endometrial cancer patients and associated patient characteristics.

Method: Newly diagnosed endometrioid endometrial cancer patients from April 2014 through December 2018 who underwent primary treatment at a single tertiary care academic center were reviewed. Obese women (defined as BMI ≥ 30 kg/m²) and stage 1 grade 1 cancer with endometrioid histology were included. Demographic and clinicopathologic data were recorded. Obesity management counseling was defined as having at least 1 of the following documented in the 6 months following endometrioid endometrial cancer...
diagnosis: (1) lifestyle counseling, (2) initiation of medical management, (3) referral to a nutritionist, or (4) referral to bariatric surgery. Prevalence was calculated using descriptive statistics. Differences between the 2 groups were measured using Student t test and X² test. Bivariate analysis was performed using logistic regression modeling.

**Results:** During the study period, 1,190 endometrioid endometrial cancer patients were treated with 233 meeting all inclusion criteria and constituting the study cohort. Obesity management counseling was documented in 31% (n = 55) of patients. There was no difference in mean age (58 years vs 58 years, \( P = 1.0 \)) or race (60% vs 67% Caucasian, \( P = 0.41 \)) between patients receiving and not receiving obesity management counseling. There was no difference in rates of hypertension (78% vs 72%, \( P = 0.39 \)) or diabetes (47% vs 38%, \( P = 0.24 \)) between the 2 groups. Patients who received obesity management counseling had a higher baseline BMI (45.7 vs. 40, \( P < 0.05 \)) and higher incidence of pulmonary disease (40% vs 23%, \( P < 0.01 \)). In logistic regression controlling for comorbid conditions, more obese patients were more likely to receive counseling with a 1.05 increased odds of counseling (95% CI 1.02–1.10).

**Conclusion:** One-third of endometrial cancer patients with low-grade stage I disease had documentation of obesity management counseling. Increasing BMI was associated with increased documentation of obesity management counseling. Given the high prevalence of mortality from noncancer-related illnesses, provider incentives or medical record prompts may improve counseling rates in this critical population in an effort to improve overall survival.

---

**458 - Poster Session**

**Dose dense carboplatin-paclitaxel improves survival in patients with endometrial cancer: Long term follow-up**

E. Matanes\(^a\), C. Mitrica\(^b\), Z. Amajoud\(^a\), J. Abitbol\(^a\), N. Eisenberg\(^b\), A. Nazer\(^a\), V. López-Ozuna\(^a\), A. Yasmeen\(^a\), S. Salvador\(^a\), S. Lau\(^a\), W.H. Gotlieb\(^a\) and L. Kogan\(^a\). \(^a\)Jewish General Hospital, McGill University, Montreal, QC, Canada, \(^b\)Center Hospitalier de l’Universite de Montreal, Montreal, QC, Canada

**Objective:** The aim of this study was to assess survival outcomes of weekly paclitaxel plus carboplatin every 3 weeks (dose dense regimen) compared to the standard 3-week protocol in the adjuvant setting for endometrial cancer.

**Method:** This was a prospective study of all patients diagnosed with high-risk endometrial carcinoma treated in a single tertiary care center, comparing a dose dense protocol (\( n = 60 \)) to a nonoverlapping similar historical cohort treated every 3 weeks (\( n = 60 \)).

**Results:** After a median follow-up of 5.6 years (0.6–10.6 years), 36 deaths were recorded. Twenty-five deaths were observed in women treated in the standard protocol (41.7%), compared to 11 deaths (18.3%) in patients in the dose dense schedule (\( P = 0.009 \)). Patients who were treated with the dose dense protocol were less likely to have distant recurrences compared to the standard cohort with a hazard ratio of 0.4 on multivariate analysis (CI 95% 0.2–1.0, \( P = 0.04 \)), had significantly less progression (\( P = 0.01 \)), and had improved overall and progression-free survival on Kaplan-Meier survival analyses (\( P = 0.01 \) and \( P = 0.01 \)). See **Figure 1**.

**Conclusion:** Dose dense chemotherapy might be a superior option for adjuvant treatment of endometrial cancer, compared to standard chemotherapy.
459 - Poster Session
Dose dense chemotherapy might be the only modifiable factor associated with distant recurrence in high-risk patients with endometrial cancer
E. Matanes, C. Mitrica, Z. Amajoud, J. Abitbol, N. Eisenberg, A. Nazer, V. López-Ozuna, A. Yasmeen, S. Salvador, S. Lau, W.H. Gotlieb and L. Kogan. “Jewish General Hospital, McGill University, Montreal, QC, Canada, bCenter Hospitalier de l’Université de Montreal, Montreal, QC, Canada

Objective: The aim of this study was to assess risk factors for distant recurrences in patients with high-risk endometrial carcinoma.

Method: This was a retrospective analysis of 120 consecutive patients diagnosed with high-risk endometrial carcinoma who underwent full staging in a single tertiary cancer center. Sixty patients received weekly paclitaxel coupled with 3 weekly carboplatin (dose dense protocol), and 60 were treated with the standard 3-weekly protocol (standard). Evaluated variables were age, BMI, stage, grade, histology, and preoperative ASA score. Odds ratios (OR) and hazard ratios (HR) and their respective 95% confidence intervals (95% CI) were calculated using multivariate logistic regression and Cox proportional hazard models.

Results: During a follow-up of 5.6 years, 30 distant recurrences were recorded (25%), and 80% of these patients died. Twenty distant recurrences were observed in women treated in the standard protocol (33.3%), compared to 10 distant recurrences observed in patients in the dose dense schedule (16.6%, \( P = 0.05 \)). In a multivariate analysis, dose dense chemotherapy protocol was associated with reduced risk for distant recurrence (HR = 0.4, CI 95% 0.2–1.0, \( P = 0.04 \)), and advanced stage was associated with increased risk for distant recurrences (HR = 4.9, CI 95% 2.1–11.3, \( P < 0.001 \)). See Figure 1.

Conclusion: Dose dense chemotherapy is associated with decreased risk of distant metastasis in patients with high-risk endometrial cancer.

Fig. 1. Kaplan-Meier overall survival.

460 - Poster Session
Predicting histologic upgrading in endometrial cancer
E. Matanes, C. Mitrica, M. Wissing, Z. Amajoud, J. Abitbol, N. Eisenberg, V. López-Ozuna, O. Raban, A. Yasmeen, S. Salvador, S. Lau, W.H. Gotlieb and L. Kogan. “Jewish General Hospital, McGill University, Montreal, QC, Canada, bCenter Hospitalier de l’Université de Montreal, Montreal, QC, Canada

Objective: The aim of this study was to identify clinical determinants associated with upgrading between preoperative endometrial biopsy and postoperative histology in patients with endometrial cancer.

Method: All consecutive endometrial cancers in a tertiary cancer center between 2008 and 2015 were included. Associations between upgrading and clinical variables were calculated using univariate linear and multivariate regression models; covariates included age, BMI, year of biopsy, preoperative CA-125, ECOG score, tumor histology, and time between diagnosis and surgery.

Fig. 1. Kaplan-Meier progression free survival analyses for distant recurrence.
**Results:** A total of 472 patients were included in the study. The median follow-up was 5.9 years (range 4.3–7.5 years). Final pathology upgraded 113 (23.9%) patients compared to the preoperative biopsy. Using multivariate logistic regression models, older age (OR = 1.26, 95% CI 1.09–1.47) and elevated CA-25 above 50 U/ml (OR = 11.01, 95% CI 3.19–38.02) were significantly associated with upgrading. Upgrading was not associated with time between diagnosis and surgery (per week increment), BMI (per 5 kg/m² increment), and preoperative ECOG. All patients older than 65 years with elevated CA-125 (above 50 U/ml) were upgraded (Figure 1).

**Conclusion:** Preoperative grade is unreliable in one quarter of patients. Full surgical staging should be considered in patients older than 65 years with elevated CA-125 (regardless of grade).

![Fig. 1. Risk stratification based on two preoperative factors which found to be associated with increased risk of upgrading: age and CA125 level.](image)

---

**461 - Poster Session**

**Prolonged waiting times for surgery in patients with endometrial cancer is associated with lymph-vascular space invasion but has limited effect on clinical outcome**

C. Mitric, M. Wissing, E. Matanes, Z. Amajoud, J. Abitbol, N. Eisenberg, V. López-Ozuna, A. Yasmeen, S. Salvador, S. Lau, W.H. Gotlieb and L. Kogan. Jewish General Hospital, McGill University, Montreal, QC, Canada, Center Hospitalier de l’Université de Montreal, Montreal, QC, Canada

**Objective:** The aim of this study was to determine whether increased surgical waiting time affects final pathology results, survival, and treatment in patients with endometrial cancer.

**Method:** All consecutive patients diagnosed with endometrial carcinoma treated in a single tertiary care center were included. Associations between surgery waiting times and other variables were calculated using multivariate linear regression models. Cox proportional hazard models were used to calculate hazard ratios (HR) for survival.

**Results:** A total of 358 patients were followed for 5.9 years (median) and categorized into 4 groups based on their waiting time: 89, 87, 91, 91 women with a median waiting time of 37 days (range 8–49), 62 days (range 50–70), 84 days (range 71–103), and 126 days (range 104–869), respectively. Increased surgical waiting time was associated with increased lymphovascular space invasion (LVSI) (adjusted OR = 1.30, 95% CI 1.02–1.67) and distant metastases (adjusted OR = 5.61, 95% CI 1.21–26.09). A longer waiting time was not significantly associated with disease-specific survival (adjusted HR = 1.24, 95% CI 0.92–1.69) or adjuvant treatment (adjusted OR = 0.95, 95% CI 0.75–1.21). However, various subgroups, such as patients with grade 2 (HR = 2.59, 95% CI 1.03–6.50), patients with BMI >30 (HR = 1.43, 95% CI 1.00–2.03), and patients with endometrioid histology (HR = 1.55, 95% CI 1.09–2.21) seemed to benefit from early surgery. See Figure 1.

**Conclusion:** Longer waiting time in patients with endometrial cancer has minimal impact on clinical outcomes compared to other predictors for outcome. Future studies need to evaluate whether molecular-based subgroups may benefit from earlier surgery.
**Objective:** The aim of this study was to assess the value of sentinel lymph nodes sampling (SLN) compared to lymphadenectomy (standard) for staging in patients with high-risk endometrial cancer.

**Method:** This was a prospective study including consecutive patients (n = 134) with high-risk endometrial cancer undergoing lymphadenectomy (n = 55) compared to a nonoverlapping historical cohort with similar characteristics who underwent SLN (n = 79).

**Results:** After a median follow-up of 5.5 years, 34 disease-specific deaths were recorded (26.6%). Sixteen deaths were observed in women treated with the standard protocol (disease-specific survival 69.8%), compared to 18 deaths with the SLN protocol (disease-specific survival 76%) (P = 0.5). Multivariate Cox regression analysis for disease-specific survival, adjusted by age, stage, grade, and lymphovascular space invasion, did not find lymphadenectomy superior to SLN (P = 0.4). See Figure 1.
**Conclusion:** Preliminary data suggest that performing SLN for staging on high-risk endometrial cancer patients is not associated with adverse long-term survival outcomes compared to standard lymphadenectomy.

![Kaplan-Meier disease free survival analysis.](image)

**Fig. 1.** Kaplan-Meier disease free survival analysis.

---

**Objective:** The aim of this study was to examine the utilization and outcomes of sentinel lymph node biopsy (SLN) in patients with low-grade endometrioid endometrial carcinoma.

**Method:** Patients who underwent minimally invasive hysterectomy for clinical FIGO stage I, grade 1 or 2 endometrioid endometrial carcinoma diagnosed from 2012 to 2015 were identified using the National Cancer Data Base. The rates of SLN were evaluated compared to standard lymph node dissection (LND), defined as ≥4 resected lymph nodes per patient. Factors associated with the receipt of SLN were assessed. Kaplan-Meier survival curves were generated and compared using log rank tests to examine overall survival (OS).

**Results:** A total of 28,148 patients met the inclusion criteria; 8.4% (2,367) received SLN. The utilization of SLN increased from 3.2% in 2012 to 14.5% in 2015. Compared to LND, patients who underwent SLN were more likely to have private insurance (57.7% vs 54.9%, \( P < 0.001 \)) and be treated at an academic center (58.1% vs 40.2%, \( P < 0.001 \)). Patients with SLN were more likely to have stage IA disease (82.5% vs 74.9%, \( P < 0.001 \)) and smaller (median 3.0 vs 3.4 cm, \( P < 0.001 \)), grade 1 tumors (65.1% vs 58.9%, \( P < 0.001 \)), although similar rates of lymphovascular invasion \( (P = 0.8) \) were observed. Patients with SLN were less likely to be converted to open surgery (1.6% vs 2.5%, \( P = 0.007 \)) and had shorter hospitalizations (mean 1.05 vs 1.42 days, \( P < 0.001 \)). Ninety-day mortality and 30-day readmissions were similar between groups \( (P = 0.850) \). The rate of positive lymph node detection was significantly higher in patients who underwent SLN. The respective detection of positive pelvic and paraaortic lymph nodes was similar among both groups. For patients with positive lymph nodes, there was a statistically significant difference in the application of adjuvant therapy. SLN patients received less chemotherapy (13.9% vs 27.2% LND) and more chemoradiation (58.3% SLN vs 44.7% LND, \( P = 0.008 \)). Although adjuvant therapy differed, the overall survival of node-positive patients remained comparable between groups \( (3\text{-year OS} = 86.5\% \text{ SLN vs 84.5}\% \text{ LND, } P = 0.661) \).

**Conclusion:** SLN is increasingly utilized in the management of low-risk endometrial cancer. The performance of SLN demonstrates superior perioperative outcomes and similar short-term survival when compared to standard LND.
Sentinel lymph node sampling is associated with better survival outcome in intermediate-high risk patients with endometrial cancer

E. Matanes, C. Mitrice, Z. Amajoud, J. Abitbol, N. Eisenberg, V. López-Ozuna, A. Yasmeen, J. How, S. Salvador, S. Lau, W.H. Gottlieb and L. Kogan, Jewish General Hospital, McGill University, Montreal, QC, Canada, Center Hospitalier de l’Université de Montreal, Montreal, QC, Canada, Banner MD Anderson Cancer Center, Gilbert, AZ, USA

Objective: The aim of this study was to assess the value of sentinel lymph node (SLN) sampling compared to lymphadenectomy (LND) for staging in patients with intermediate-high risk endometrial cancer, based on GOG99 characteristics.

Method: This was a prospective study including consecutive patients \( n = 112 \) with intermediate-high risk endometrial cancer undergoing LND \( n = 55 \) compared to a nonoverlapping historical cohort with similar characteristics who underwent SLN \( n = 57 \).

Results: After a median follow-up of 6 years, 10 disease-specific deaths were recorded (8.9%) with only 1 (1.9%) disease-related death (OS = 94.7%) in the SLN cohort versus 9 endometrial cancer-related deaths (16.3%) in the LND cohort (OS = 72.7%, \( P = 0.006 \) and \( P = 0.002 \), respectively). The LND cohort had more patients with stage IB–II and higher rate of lymphovascular space invasion (54.4% vs 35.1%) than the group of patients who underwent SLN (\( P = 0.009 \) and \( P = 0.04 \), respectively). Both cohorts were similarly given adjuvant chemo- and radiotherapy (\( P = 0.8 \) and \( P = 0.9 \), respectively). See Figure 1.

Conclusion: SLN might be associated with better stratification of endometrial cancer patients into risk groups, by better identifying positive-node patients, potentially tailoring the right adjuvant treatment and improving oncological outcome.

Table 1: Intermediate-high criteria

<table>
<thead>
<tr>
<th>FIGO stage</th>
<th>IA, IB, II</th>
</tr>
</thead>
</table>
| 3 risk factors | 1. LVS| presence.  
|              | 2. Grade 2–3.  
|              | 3. Deep myometrial invasion  
| Intermediate high | a. Age <70 years with one risk factor.  
|                   | b. Age 50 to 69 years with two risk factors.  
|                   | c. Age <18 years with all three risk factors.  
|                   | d. Deep myometrial invasion (>50% myometrium) with grade 3, regardless of age.

Fig. 1: Kaplan-meier disease free survival analysis

![Figure 1](image)

P value = 0.03

465 - Poster Session
The role of CCNE1 amplification in refractory ovarian and endometrial cancer

J.A. Park, B. Bethanya, M. Frimer, K. Cheng and V.S. John, Monter Cancer Center, New Hyde Park, NY, USA, Northwell Health, New Hyde Park, NY, USA, Hofstra - North Shore Long Island Jewish School of Medicine, Manhasset, NY, USA

Objective: CCNE1 gene amplification has been associated with decreased disease-free survival rates in different types of cancers. Cyclin E1 (CCNE1) gene amplification has been reported in 15%–20% of high-grade serous ovarian tumors and 89.5% of uterine serous carcinomas. This study investigated the role of CCNE1 amplification in ovarian and endometrial cancer in determining prognosis and survival.
**Method:** We collected retrospective data on 20 patients with CCNE1 amplification confirmed by FoundationsOne testing at a single tertiary care center. Data points collected included age, FIGO stage, histology, whether the patient received neoadjuvant chemotherapy, and treatment outcomes including partial response, complete response, relapse-free interval (RFI), and overall survival.

**Results:** A total of 14 patients (70%) had advanced-stage disease at diagnosis (stages III–IV). Time to first relapse ranged from 3 months to 16 months. Only 2 patients had prolonged RFI of over 2 years from initial treatment. Eight (40%) had refractory disease, and 11 (55%) had partial or complete response. Ultimately, 5 (25%) are deceased, 14 (70%) with recurrent or refractory disease, and 1 had complete response.

**Conclusion:** In our study, patients with CCNE1 amplification ovarian and endometrial cancer presented mostly at an advanced stage at diagnosis (70%), had shorter disease-free intervals, and subsequent higher prevalence of refractory disease compared to historical data. This was consistent with our hypothesis that CCNE1-amplified ovarian and endometrial carcinomas have aggressive disease courses and poor outcomes. Next-generation sequencing of the few patients with long RFI may be helpful in discovering other prognostic markers. In summary, these findings provide important insight into the role of CCNE1 and call for a larger study to further investigate its value as a prognostic indicator and its therapeutic implications.

---

**466 - Poster Session**

**Assessment of the clinical significance of the variable microsatellite instability phenotype observed in MMR-defective endometrial carcinoma**

C. Johnson, W.H. Bradley and C. Mackinnon. *Medical College of Wisconsin, Milwaukee, WI, USA*

**Objective:** The purpose of this study was to assess the clinical significance of the phenotypic variability of microsatellite instability (MSI) routinely observed in endometrial cancer.

**Method:** A total of 108 consecutive patients who underwent hysterectomy for endometrial cancer and whose tumor demonstrated loss of expression of 1 or more mismatch repair (MMR) proteins (MLH1, PMS2, MSH2, and MSH6) by immunohistochemistry (IHC) were included. The MSI phenotype was determined by PCR analysis of 5 mononucleotide microsatellite loci (NR27, BAT25, BAT26, NR24, and NR21). “Marker sum” was used to quantify the MSI phenotype for each case and was calculated by first subtracting the size (i.e., number of nucleotides) of each microsatellite in tumor tissue from the corresponding microsatellite in paired normal tissue; next, the absolute differences in size for all 5 microsatellites were summed to generate the marker sum. Tumor-infiltrating lymphocytes (TILs) in representative cases were identified by IHC for CD3, CD4, and CD8 and quantified with digital image analysis. Fisher exact test, odds ratio, and relative risk were used for cohort analysis.

**Results:** The marker sum ranged from 1 to 32. Two cohorts were defined based upon MSI phenotype: cohort A verified marker sum <12 and included 46 patients, and cohort B demonstrated marker sum ≥12 and included 62 patients. A significant difference in tumor grade between cohorts—14.5% of cohort A and 43.5% of cohort B had FIGO grade 3 tumors (RR = 2.995, 95% CI 1.51–5.96, \( P = 0.001 \))—was observed. Otherwise, all clinicopathological features (age, BMI, race, smoking status, immunosuppression status, diabetes status, TNM stage, PFS, and OS) were similar between cohorts. The number and type of TILs identified in cohort A (12 patients, average market sum = 4.6) was indistinguishable from the TIL profile observed in cohort B (8 patients, average marker sum = 22.8).

**Conclusion:** We utilized marker sums to quantify and evaluate the clinical significance of variation in MSI phenotypes observed in MMR-defective endometrial cancer. A wide range of microsatellite lengths was noted. Excepting tumor grade, the clinicopathological features and the number and types of TILs in endometrial cancer were similar in both cohorts. Our findings suggest that the immunogenicity of MMR-defective endometrial cancer does not correlate with severity of the MSI phenotype.

---

**467 - Poster Session**

**Is universal sentinel lymph node sampling indicated in endometrial intraepithelial neoplasia (EIN)?**

D. Glassman, J. Emerson, M.R. Quddus, C. Raker and C.A. Mathews. *Women & Infants Hospital, Brown University, Providence, RI, USA*

**Objective:** The aim of this study was to identify the frequency for which a preoperative diagnosis of endometrial intraepithelial neoplasia (EIN) is upstaged to cancer at hysterectomy and sentinel lymph node (SLN) sampling would be indicated.

**Method:** This was a retrospective cohort study of patients undergoing hysterectomy with a preoperative diagnosis of EIN or complex atypical hyperplasia (CAH) from 2007 to 2018. Patients were included when pathology was reviewed at our institution, the interval between sampling and surgery was ≤6 months, and the preoperative diagnosis was either EIN or CAH. Final pathologic specimens were assessed by traditional Mayo criteria: endometrioid histology with tumor grade 1 or 2, depth of invasion <50%, no lymphovascular space invasion (LVSIs), tumor size <2 cm, and no macroscopic extraterine disease.
Results: The cohort included 196 subjects with a mean age of 55 years (SD 10.0). Pathology at hysterectomy was benign in 30% (n = 59), EIN or CAH in 41% (n = 80), and endometrioid adenocarcinoma (EC) in 29% (n = 57) of patients. Among 57 cases of EC, 26 (45.6%) had microscopic tumor, 15 (26.3%) had tumors between 0 and 2 cm, and 17 (30.3%) had tumors >2 cm. No myometrial invasion was identified in 76.4% of ECs; the maximum depth of invasion seen was 37%. No EC cases had definitive LVSI. The majority of EC cases were FIGO grade 1 (91%, n = 52/57); the remainder were FIGO grade 2 (9%, n = 5/57). Ultimately 8.6% (n = 17/196) of the total EIN cohort met Mayo criteria; all of these were due to tumor size alone. Lymph node sampling was performed in 2.5% (n = 5); there were no cases of positive lymph nodes identified.

Conclusion: The accepted risk of lymph node positivity is 3%–5% for EC cases deemed high risk by Mayo criteria. The 9% of EIN patients in our cohort meeting Mayo criteria were very low risk for nodal metastasis based on uterine risk factors. Assuming a 5% nodal positivity rate among these 17 patients, approximately 200 women with EIN would need to undergo sentinel nodes to identify 1 patient with nodal metastasis.

468 - Poster Session
Risk of occult atypical hyperplasia or cancer in women with non-atypical endometrial hyperplasia
N. Leea, K.B. Leeb, K. Kimc, J.H. Hongd, G.W. Yima, S.J. Seonge,f, B. Leeg, J.M. Leeh, S. Limb, Y.T. Ouhd and Y.B. Kimc. aSeoul National University Hospital, Seoul, South Korea, bGachon University Gil Medical Center, Incheon, South Korea, cSeoul National University Bundang Hospital, Seongnam-Si, South Korea, dKorea University Guro Hospital, Seoul, South Korea, eCHA Gangnam Medical Center, CHA University, Seoul, South Korea, fCHA Gangnam Medical Center, Seoul, South Korea, gHallym University Kangdong Sacred Heart Hospital, Seoul, South Korea, hKyung Hee University Hospital, Seoul, South Korea

Objective: The aims of this study were to investigate the risk of occult atypical endometrial hyperplasia (AEH) or endometrial cancer (EC) in women who were diagnosed as non-atypical endometrial hyperplasia (NAEH) by endometrial biopsy and to identify subsets with higher risk.

Method: We retrospectively reviewed the medical records of 327 women who underwent hysterectomy within 6 months after being diagnosed as NAEH on endometrial biopsy. Data on age, BMI, menopausal status, hormone replacement therapy, tamoxifen use, history of NAEH, previous progestin treatment, endometrial biopsy details (who, where, curettage vs pipelle sampling), interval between endometrial biopsy and hysterectomy, and presence of occult AEH or EC on hysterectomy specimens were collected. Association of variables with occult AEH or EC was analyzed.

Results: Among 327 women, 33 (10.1%) and 5 (1.5%) had occult AEH and EC in uterus, respectively. Women with occult AEH or EC were older (51.0 ± 6.8 vs 47.6 ± 0.4 years, \( P < 0.001 \)) and more menopausal (55% vs 21%, \( P < 0.001 \)) than those without occult AEH nor EC. BMI, hormone replacement therapy, tamoxifen use, history of NAEH, previous progestin treatment, endometrial biopsy details (who, where, curettage vs pipelle sampling), interval between endometrial biopsy and hysterectomy, and presence of occult AEH or EC on hysterectomy specimens were not associated with occult AEH or EC. In 81 postmenopausal women, 16 (19.8%) and 5 (6.2%) had occult AEH and EC, respectively. In 246 premenopausal women, 17 (6.9%) had occult AEH and none had occult EC.

Conclusion: The overall risk of occult AEH or EC in women with NAEH is low. However, the risk in postmenopausal women is high. In postmenopausal women with NAEH, the risk of occult AEH or EC should be informed and hysterectomy can be recommended.

469 - Poster Session
Survival analysis of robotic staging surgery using three robotic arms versus open surgery for endometrial carcinoma
Y.T. Kim, H. Lee, K.J. Eoh and J.W. Kim. Yonsei University College of Medicine, Seoul, South Korea

Objective: The purpose of our study was to compare overall survival (OS) and disease-free survival (DFS) between open and robotic staging surgery (RSS) using three robotic arms for patients with endometrial cancer.

Method: A cohort study included 423 patients with endometrial carcinoma, of whom 218 underwent open and 205 underwent RSS using 3 robotic arms between May 2006 and May 2018. Robotic procedures were performed using the da Vinci robotic system. Patient demographic data and clinical outcomes were prospectively collected in a computerized database and extracted for this study. Cox and propensity score regression analysis and univariate and multivariate regression analysis were performed for OS and DFS.

Results: The robotic approach consisted of 3 robotic arms including the camera arm and 1 conventional assistant port. There were no conversions to open laparotomy. The 5-year OS was 85% and 93% and DFS was 78% and 89% for the open and robotic cohorts, respectively. The recurrence pattern was similar in both groups. Using propensity score analysis and matched cohorts of 146 women in each surgical group, no significant differences were seen in survival: 5-year OS of 91% versus 92% and DFS of 86% versus 89% in the open and robotic cohort, respectively (HR = 1.02, 95% CI 0.82–1.67). In univariate analysis with OS as the endpoint, surgical method,
age, stage, type II histology, grade, and lymph node metastasis were independently associated with survival. However, stage, grade, and type II histology were found as independent significant risk factors in multivariate analysis with OS.

**Conclusion:** These findings were consistent with the concept that robotic staging surgery using 3 robotic arms might not compromise long-term survival outcomes when compared to laparotomy for endometrial carcinoma.

---

**470 - Poster Session**

**A modern assessment of the surgical pathologic spread of endometrial cancer**

A.M. Praissa, Y. Huangb, F. Khoury Colladoc, A.I. Tergasc, A. Melamedc, J.Y. Houb, C.M. St. Clairc and J.D. Wrighta.

**Columbia University, New York, NY, USA, bColumbia University College of Physicians and Surgeons, New York, NY, USA, cNew York-Presbyterian/Columbia University Medical Center, New York, NY, USA**

**Objective:** Since the publication of GOG 33 describing the surgical pathologic spread of endometrial cancer, staging criteria for endometrial cancer have evolved and there is a need for updated risk assessment of lymph node metastases in women with apparent early-stage tumors. The objective of this study was to examine the risk of nodal metastases in a contemporary group of women from across the United States based on pathologic risk factors including histology, depth of invasion, tumor grade, and lymphovascular space invasion (LVSI).

**Method:** The National Cancer Data Base was utilized for analysis. From 2004 to 2016 we identified women with histologically confirmed uterine cancer who underwent hysterectomy with lymph node assessment. Lymph node metastases were assessed in relation to tumor T stage and grade, and further stratified by LVSI status for endometrioid, uterine papillary serous (UPSC), and clear cell cancers.

**Results:** A total of 161,960 patients including 148,035 (91.4%) with endometrioid cancers, 11,261 (6.9%) with UPSC, and 2664 (1.6%) with clear cell cancers were identified. The rate of lymph node metastases T1A endometrioid tumors was 1.1% for grade 1, 2.9% for grade 2, and 4.8% for grade 3 tumors. The rates of nodal disease among T1B endometrioid cancers were 8.6%, 13.7% and 16.9% for the respective tumor grades. Among UPSC patients, nodal metastases were noted in 7.9% of T1A, 31.1% of T1B, and 38.9% of T1B neoplasms. For clear cell tumors the rates of nodal disease were 8.6% for T1A, 29.4% for T1B, and 29.8% for T2 carcinomas. For all tumor grades and histologies, LVSI increased the risk of nodal disease. See Table 1.

**Conclusion:** There is a sequential increase in the risk of lymph node metastases based on depth of uterine invasion, tumor grade, and the presence of LVSI. The rates of nodal metastases are higher for women with UPSC and clear cell histology. There is an overall lower rate of nodal involvement within these surgical categories compared to the original GOG 33 trial.

**Table 1.** Rate of positive lymph node involvement amongst endometrioid cancers, in relation to pathologic T stage, grade, and lymphovascular space involvement (LVSI).

<table>
<thead>
<tr>
<th>T stage</th>
<th>Grade</th>
<th>Overall Patients (n=148,035)</th>
<th>LVSI positive patients (n=15,175)</th>
<th>LVSI negative patients (n=73,575)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Total number</td>
<td>Positive nodes n (%)</td>
<td>Total number</td>
</tr>
<tr>
<td>T1A</td>
<td>Well</td>
<td>47,057</td>
<td>529 (1.1)</td>
<td>1,353</td>
</tr>
<tr>
<td></td>
<td>Moderate</td>
<td>30,557</td>
<td>880 (2.9)</td>
<td>1,723</td>
</tr>
<tr>
<td></td>
<td>Poorly</td>
<td>9,488</td>
<td>458 (4.8)</td>
<td>1,027</td>
</tr>
<tr>
<td></td>
<td>Unknown p-value</td>
<td>&lt;.0001</td>
<td></td>
<td>1,027</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T1B</td>
<td>Well</td>
<td>10,756</td>
<td>923 (8.6)</td>
<td>1,530</td>
</tr>
<tr>
<td></td>
<td>Moderate</td>
<td>12,632</td>
<td>1,733 (13.7)</td>
<td>2,662</td>
</tr>
<tr>
<td></td>
<td>Poorly</td>
<td>6,285</td>
<td>1,060 (16.9)</td>
<td>1,899</td>
</tr>
<tr>
<td></td>
<td>Unknown p-value</td>
<td>&lt;.0001</td>
<td></td>
<td>1,415</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>T2</td>
<td>Well</td>
<td>3,185</td>
<td>379 (11.9)</td>
<td>402</td>
</tr>
<tr>
<td></td>
<td>Moderate</td>
<td>5,020</td>
<td>980 (19.5)</td>
<td>930</td>
</tr>
<tr>
<td></td>
<td>Poorly</td>
<td>2,563</td>
<td>731 (28.5)</td>
<td>715</td>
</tr>
<tr>
<td></td>
<td>Unknown p-value</td>
<td>&lt;.0001</td>
<td></td>
<td>492</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
471 - Poster Session

Does race impact time to presentation in patients with endometrial cancer?

M. Saleh, J.P. Curtin and L.R. Boyd. New York University School of Medicine, New York, NY, USA

Objective: Prior studies have investigated how long women cope with the symptoms of endometrial cancer prior to presentation to a physician. Most studies utilized patient surveys following cancer diagnosis, which are subject to recall bias. Black women are known to present with more advanced stages of endometrial cancer and more aggressive subtypes. We sought to investigate whether race has an impact on time to presentation to a physician with symptoms of endometrial cancer and whether this may account for later stage at diagnosis.

Method: This was a retrospective chart review of endometrial cancer patients at an urban academic center from October 22, 2010, to October 22, 2018. Demographic and cancer-related data were abstracted. Time to presentation was determined by review of clinical documentation. Student t and χ² tests were utilized to compare groups. Statistics were performed with Stata v15.

Results: A total of 885 patients were identified for inclusion. There were 625 white women and 108 black women. Most patients presented with postmenopausal bleeding (65% of white women vs 61% of black women). White women experienced symptoms for 97 days prior to presentation to care, whereas black women experienced symptoms for 242 days (P = 0.0015). There was no significant difference in proportion of black women or white women who had public insurance. Black women were on average younger than white women (61.9 years vs 63.9 years, P = 0.04) and had higher BMI at diagnosis (34.7 kg/m² vs 30.7 kg/m², P < 0.00001). White women had lower parity than black women (P < 0.001) and were more likely to be nulliparous than black women (P = 0.000389). The average time between the first visit with gynecologic oncology and date of first treatment was 34 days, which was equivalent among both groups. Black women were more likely to present at stage II or later than white women (P = 0.000003).

Conclusion: Black women experienced symptoms of endometrial cancer for significantly longer than white women and were more likely to present at stage II or greater. This occurred despite no differences in insurance status. Although white women presented earlier, both groups exhibited a waiting period of more than 3 months prior to presentation. Increased efforts at education and outreach are warranted by these results.

472 - Poster Session

Evaluation of the optimal sequence of chemotherapy and radiation therapy in the treatment of advanced endometrial cancer

J. McEachrona, N. Zhoua, C. Spencerb, L. Shanahanb, C. Chattertonb, S. Naegelea, J. Katz,a, P.K. Singhala and Y.C. Leea. aSUNY Downstate, University Hospital of Brooklyn, Brooklyn, NY, USA, bGood Samaritan Hospital Medical Center, West Islip, NY, USA

Objective: Evidence supports the use of multimodality therapy in the treatment of advanced endometrial carcinoma (EC). However, the optimal sequence of chemotherapy (CT) and radiation (RT) remains unclear. In the present study, we evaluated the outcomes of patients treated with multimodality therapy in sandwich fashion, defined as CT followed by RT then further CT (CRC), versus those treated in sequence with CT followed by RT (CR) or RT followed by CT (CR), to determine whether there is a survival advantage associated with a particular treatment sequence.

Method: A multicenter retrospective analysis of patients with stage III and IV EC from 2000 to 2016 was conducted. Inclusion criteria were patients with a diagnosis of EC who had undergone comprehensive surgical staging, followed by both adjuvant CT and RT. Differences in the frequencies of histology, stage, cytoreduction status, treatment delays, and sites of disease recurrence were identified using Pearson χ² test. PFS and OS rates were calculated using Kaplan-Meier estimates.

Results: Final analysis included 152 patients receiving dual modality postoperative adjuvant therapies: 36.8% (n = 56) CRC, 28.9% (n = 44) CR, and 34.2% (n = 51) RC. The median age was 65 years (range 47–87 years); histology included 44.0% endometrioid, 47.5% serous, and 8.5% clear cell tumors. Ninety-five percent of patients underwent optimal cytoreduction. The median duration of follow-up was 34.6 months. There was no difference in proportion of black women or white women who had public insurance. Black women were on average younger than white women (61.9 years vs 63.9 years, P = 0.04) and had higher BMI at diagnosis (34.7 kg/m² vs 30.7 kg/m², P < 0.00001). White women had lower parity than black women (P < 0.001) and were more likely to be nulliparous than black women (P = 0.000389). The average time between the first visit with gynecologic oncology and date of first treatment was 34 days, which was equivalent among both groups. Black women were more likely to present at stage II or later than white women (P = 0.000003).

Conclusion: Adjuvant therapy delivered in CRC sequence was associated with improvements in both PFS and OS in patients with advanced EC compared to alternant therapy sequencing.
Fig. 1. Kaplan-Meier survival analysis by treatment group. A: Progression free survival analysis. B: Overall survival analysis.

**CRC**: Chemotherapy, followed by radiation, then further chemotherapy.

**CR**: Chemotherapy followed by radiation.

**RC**: Radiation followed by chemotherapy.

**PFS**: Progression free survival.

**OS**: Overall survival.

---

**473 - Poster Session**

**Adiposity and influence on response to immunotherapy**


aThe University of Oklahoma Health Sciences Center, Oklahoma City, OK, USA,  
bThe University of Oklahoma, Oklahoma City, OK, USA,  
cThe University of Oklahoma Stephenson Cancer Center, Oklahoma City, OK, USA

**Objective:** The aim of this study is to establish a relationship between patient markers of adiposity including BMI, subcutaneous fat area (SFA), visceral fat area (VFA), subcutaneous fat density (SFD), and visceral fat density (VFD) and response to immunotherapy in patients with endometrial cancer.

**Method:** This is a retrospective, Institutional Review Board-approved study of women with endometrial cancer treated with immunotherapy. Demographics, physical examination parameters, surgical data, and tumor characteristics were collected. To assess a patient’s adiposity, SFA and VFA were calculated from pretreatment CT scans. These were then compared with survival data, including overall survival (OS) and progression free survival (PFS). SAS 9.3 was used for statistical analyses.

**Results:** A total of 18 patients were analyzed in this retrospective study. The majority of patients were Caucasian and had either stage IIIC2 or IVB disease. Forty-four percent of patients had endometrioid histology, with carcinosarcoma and serous being the next most common (16.7% each). The median BMI was 31.7 kg/m². Median VFA, VFD, SFA, and SFD were 130.5 mm², −80.5 HU, 269.5 mm², and −103 HU. Median total psoas area was 1,510.5 mm². OS did not differ between patients with BMI, SFA, SFD, VFA, VFD, or psoas area greater than the median when compared to those <50th percentile (P = 0.96, 0.73, 0.67, 0.61, 0.16, and 0.88 respectively). PFS also did not differ either between cohorts (P = 0.38, 0.51, 0.75, 0.62, 0.56, and 0.45, respectively).

**Conclusion:** Obesity has been well established as a risk factor for the development of endometrial cancer. One mechanism through which obesity promotes endometrial cancer is by creation of an inflammatory state with increased levels of Interleukin-6 and tumor necrosis factor. Data evaluating immunity in both mouse models and patients with melanoma have demonstrated that obesity hastens T cell aging and increases PD-1 expression. Together these led to T cell dysfunction and increased tumor progression. Continuing to identify biomarkers that may identify patients who will benefit most from therapy warrants further research.
**474 - Poster Session**

**Relationship between body mass index, characteristics of sentinel lymph nodes, and disease features in women with endometrial cancer**

*aUniversity of Rochester Medical Center, Rochester, NY, USA, bWomen & Infants Hospital, Brown University, Providence, RI, USA, cWomen & Infants Hospital, Brown University, Providence, RI, USA*

**Objective:** Sentinel lymph node (SLN) biopsy has emerged as a viable alternative to complete lymph node dissection in women with endometrial cancer. This technique’s high negative predictive value (NPV) and accuracy have been demonstrated. However, research has also suggested SLN mapping is less successful in obese women. Because obesity is a direct risk factor for endometrial cancer, it is imperative this technique be thoughtfully evaluated in obese women. We sought to define the rate of successful SLN mapping in women with a BMI <30 versus ≥30 among a large cohort.

**Method:** We performed a retrospective chart review of all patients who underwent laparoscopic SLN mapping and biopsy during endometrial cancer staging surgery between 2013 and 2018 at two academic institutions in the United States. Institutional Review Board approval was obtained at both institutions. Statistical analyses were performed using χ², Kruskal-Wallis, and Fisher exact tests.

**Results:** A total of 573 patient charts were reviewed. The mean BMI of the cohort was 34.8. Overall successful SLN mapping, defined as identifying either unilateral or bilateral SLN, was achieved 92% of the time, with 23% of cases being unilateral and 69% bilateral. BMI was negatively associated with rate of successful SLN mapping. As shown in Table 1, women with a BMI <30 had a failure rate of 5.2%, compared with 8.3% in the obese group (P = 0.023). However, among patients in whom SLN mapping was successful, BMI was not correlated with the number of SLNs identified. Among patients with successful SLN mapping, 8% had lymphatic malignant invasion, and there was no association between BMI and rate of lymph node metastasis. Obese women were more likely to have low-grade and early-stage disease.

**Conclusion:** Women with endometrial cancer and BMI >30 were more likely to have SLN mapping failure compared to women with BMI <30. In women for whom the SLN mapping technique was successful, BMI did not have an impact on the number of SLNs identified or nodal positivity.

**Table 1.** Association between BMI categories and SLN mapping results (n = 573)

<table>
<thead>
<tr>
<th>BMI</th>
<th>Successful SLN mapping</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bilateral n=398 (%)</td>
</tr>
<tr>
<td>Normal weight (BMI&lt;25)</td>
<td>45 (11)</td>
</tr>
<tr>
<td>Overweight (25 ≤ BMI &lt; 30)</td>
<td>90 (22)</td>
</tr>
<tr>
<td>Obese Class I/II (30 ≤ BMI &lt; 40)</td>
<td>165 (41)</td>
</tr>
<tr>
<td>Obese Class III (BMI ≥ 40)</td>
<td>98 (25)</td>
</tr>
</tbody>
</table>

---

**475 - Poster Session**

**The oncologic outcome after fertility-sparing hormonal management more than 9 months treatment for early stage endometrioid endometrial cancer**

*aKonkuk University School of Medicine, Seoul, South Korea, bHosan Women’s Hospital, Seoul, South Korea*

**Objective:** In early-stage endometrioid endometrial cancer (EC) patients who are fertile, fertility-sparing therapy is enforced than primary surgical staging. However, there is no consensus for the optimal duration of this treatment. The aim of this study is to determine the duration of fertility-sparing hormone therapy in patients with early-stage endometrioid EC.

**Method:** We retrospectively analyzed patients with presumed stage IA, grade 1 endometrioid EC who underwent fertility-sparing treatment and compared the oncologic outcome between patients who had been treated for less than 9 months and patients who had been treated for more than 9 months. The optimal treatment time for fertility-sparing hormone was analyzed.

**Results:** A total of 120 patients with presumed stage IA, grade 1 endometrioid EC were treated with oral progestin/LNG-IUD. The complete remission (CR) rate was 84.2% (101/120), and the recurrence rate was 31.7% (38/120). The median time of treatment duration in total, less than 9 months, and more than 9 months group was 10.8 (3–102) months, 6.6 (range 3–8) months, and 14.8 (range 9–102) months, respectively. The CR rates were not statistically significant different in the less-than-9-months and more-than-9-months
groups, 86.7% (39/45) and 82.7% (72/75), respectively ($P = 0.62$). The recurrence rate was not statistically significant different in the 2 groups, 35.6% (16/45) and 29.3% (22/75), respectively ($P = 0.55$). The cumulative CR rate was increasing more than 10% up to 15 months, and after 15 months the increasing rate was lower than 10% ($P < 0.05$).

**Conclusion:** The treatment could be continued for more than 9 months and extended to 15 months. At least 12 months after the start of treatment, staging workup is required. Further prospective study is needed to prove the optimal duration of fertility-sparing treatment.

---

**476 - Poster Session**

**Genomic analysis of serous tubal intraepithelial carcinoma-like lesions and concurrent endometrial serous carcinoma: Related entities?**

K. Dessources, A.D.C. Paula, S.S. Lee, P. Selenica, R.A. Soslow, B. Weigelt and R. Murali. *Memorial Sloan Kettering Cancer Center, New York, NY, USA*

**Objective:** In women with endometrial serous carcinoma (ESC) confined to the uterine corpus, concurrent isolated serous tubal intraepithelial carcinomas (STIC)-like lesions in the fallopian tube(s) may be found. We sought to determine whether these ESCs and STICs are synchronous unrelated lesions or whether they are genetically related (potentially implying that one is a metastasis from the other).

**Method:** Five ESCs with co-occurring STICs were identified and their histologic features centrally reviewed. The ESCs and STICs were microdissected under a dissecting microscope and laser-capture microdissected, respectively. Microdissected ESC, STIC, and normal DNA samples were subjected to a massively parallel sequencing assay targeting 468 cancer-related genes. Sequencing data were analyzed using a validated bioinformatics approach.

**Results:** High-quality sequencing results were obtained from 2 synchronous ESC-STIC pairs. The ESC of case 1 harbored clonal TP53 (p.C238F) and FBXW7 mutations and a NF1 frameshift mutation. The STIC lesion of case 1 harbored a distinct clonal TP53 (p.M237I) hotspot mutation and lacked the FBXW7 and NF1 mutations and displayed a distinct copy number profile. These data provide evidence suggesting that the ESC and STIC lesions in case 1 were unrelated. In contrast, the ESC and the STIC of case 5 harbored the same clonal TP53 (p.V272M) hotspot mutation and a PPP2R1A (p.P179R) hotspot mutation, and shared specific copy number gains and losses. In addition, the PPP2R1A mutation was found to be subclonal in the STIC lesion and became clonal in the ESC, indicating that the ESC and STIC were clonally related and that the ESC may have stemmed from a subclone from the STIC. The ESC harbored 14 additional private mutations, including a clonal PIK3R1 (p.F456_Q457del) in-frame deletion and a RNF43 (p.X148_splice) splice-site mutation.

**Conclusion:** Our data suggest that co-occurring STICs and ESCs may be genetically related and that, in a subset of ESCs, STICs may be the substrate from which the endometrial lesions develop. Additional work needs to be done to better understand the risk of ESC with the presence of an STIC.

---

**477 - Poster Session**

**Evaluation of preoperative positron emission tomography (PET)/computed tomography (CT) in women with endometrial cancer**

K. Nicholson, Z. LaPier, B. Zaghi, A. Urh, G.L. Goldberg and B.M. Schwartz. *Hofstra - North Shore Long Island Jewish School of Medicine, Manhasset, NY, USA*

**Objective:** The incidence of endometrial cancer, the most common gynecologic malignancy in the United States, is rising with the obesity epidemic. Clinical evaluation in these women is often limited due to body habitus. Universal preoperative imaging is not routinely performed because of a lack of evidence demonstrating a clinical benefit and justifying its cost. Imaging, including CT, MRI, and PET/CT, have similar rates of sensitivity in the metastatic evaluation of these patients. PET/CT has been shown to be more specific in detecting both lymph node (90% to 100%) and distant metastases (94%). The aims of this study are to investigate the value of preoperative PET/CT in women with endometrial cancer and to determine whether this testing alters patient care.

**Method:** A retrospective chart review was performed for all patients who had a preoperative PET/CT for newly diagnosed endometrial cancer from January 2014 to June 2018 at a single tertiary care center. Patient demographics and clinicopathologic information were documented. Demographic data were analyzed using descriptive statistics. Outcomes were compared for statistical differences between cohorts. Multivariate logistic regression was used to determine statistically significant ($P < 0.05$) predictors of outcome.

**Results:** A total of 165 patients (mean age 65.7 years) were studied. Histologic subtypes consisted of endometrioid (72.7%, 120), uterine serous (15.8%, 26), and clear cell (6.1%, 10) carcinomas and other (5.4%, 4). The sensitivity and specificity of nodal metastases by PET/CT was 60% and 95.3%, respectively, and 56.3% and 98% for extra-uterine metastases, respectively. PET/CT scan upstaged 13.3% (22, 16 true positives). Incidental primary cancers were detected in 12 patients (7.3%). PET/CT altered the initial management in 17
Objective: The prognosis for women diagnosed with advanced or recurrent endometrial cancer (EC) is poor, with an estimated 5-year overall survival (OS) of ~17%. The standard first-line treatment for these patients is paclitaxel-carboplatin chemotherapy (CT); however, there is an imperative need for more tolerable and effective therapies. Combination therapy with the PD-1 inhibitor pembrolizumab (pembro) and the tyrosine kinase inhibitor lenvatinib resulted in an objective response rate (ORR) of 39% in women with EC in the phase 1b–2 trial KEYNOTE-146. ENGOT-en9/LEAP-001 (NCT03884101) is a phase 3, randomized, active-controlled, open-label study that is evaluating this combination therapy in women with newly diagnosed stage III–IV or recurrent EC.

Method: Eligible patients must have newly diagnosed advanced or recurrent EC not previously treated with antiangiogenic agents, systemic CT (unless as part of a chemoradiation regimen), PD-1 or PD-L1 inhibitors, or other T cell receptor–targeted agents. Patients will be stratified prerandomization by proficient versus deficient mismatch repair status (pMMR vs dMMR), and the pMMR population will be stratified prerandomization by proficient versus deficient mismatch repair status (pMMR vs dMMR), and the pMMR population will be further stratified by prior chemoradiation (yes vs no), measurable disease (yes vs no), and ECOG performance status (0 vs 1).

Patients will then be randomly assigned 1:1 to receive pembro 200 mg every 3 weeks plus lenvatinib 20 mg daily or paclitaxel plus carboplatin (paclitaxel 175 mg/m², carboplatin AUC 6) every 3 weeks. Treatment will continue for up to 35 cycles for pembro or 7 cycles for paclitaxel-carboplatin CT, or until disease progression, initiation of new anticancer treatment, unacceptable toxicity, or voluntary withdrawal. Patients who complete 35 cycles of pembro will continue receiving lenvatinib until disease progression or unacceptable adverse events. Primary endpoints are progression-free survival per Response Evaluation Criteria in Solid Tumors (RECIST) v1.1 by blinded independent central review and OS. Secondary endpoints are ORR, health-related quality of life, safety and tolerability, and lenvatinib pharmacokinetics. Primary and secondary endpoints will be assessed in both the total and pMMR populations. Exploratory endpoints include clinical benefit rate, disease control rate, and duration of response. Patient accrual is ongoing.

Results: The trial is in progress.

Conclusion: The trial is in progress.
mice 12 weeks after injection. The microbiota profiles were characterized by bacterial 16S rRNA high-throughput sequencing, and the data were analyzed using Quime2.

**Results:** HFD increased body weight and EC tumor weight threefold ($P < 0.05$) in postmenopausal LKB1fl/flp53fl/fl mice but had no effect on normal uterine weight. The overall bacterial composition in the normal and malignant uterus differed from that of matched stool in both lean and obese mice ($P < 0.001$). In mice with normal uteri, the microbiota profiles of stool differed in lean versus obese mice ($P < 0.012$); however, there was little difference in the uterine microbiota according to obesity status. In mice with EC, differences in genus level bacterial species were found in both stool (*Turicibacter*, *Latococcus*) and tumor (*Mucispirillum*, *Streptococcus*, *Helicobacter*, *Ruminococcus*) when obese were compared with lean mice ($P < 0.05$). The presence of *Ruminococcus* also differed in the ECs versus normal uteri in obese mice ($P < 0.05$).

**Conclusion:** Bacterial presence is distinct in the ECs and gut of obese versus lean LKB1fl/flp53fl/fl mice, suggesting that the microbiome may play a role in obesity-driven EC.

---

**480 - Poster Session**

**The survival effect of the preservation of ovary in the early FIGO stage endometrial cancer patients: Single institution’s retrospective analysis**

W.K. Shin, S.Y. Park, S. Kang and S.S. Seo. *National Cancer Center Korea, Goyang-si, South Korea*

**Objective:** We investigated the effect of the preservation of ovary during surgery in early-stage endometrial cancer patients.

**Method:** Medical records were retrospectively reviewed for 539 patients diagnosed with early-stage endometrial cancer between January 2006 and December 2017. Patients were categorized as the ovary preservation group and the removal group. Each group’s demographics and survival curve were compared, and the risk factor was evaluated in endometrial cancer.

**Results:** The median follow-up period was 85 months (range 6–142 months), and the median age was 52.7 years. The mean age was higher in the ovary removal group than in the ovary preservation group (54.4 vs 40.94 years, $P < 0.001$). The ovarian preservation group showed a relatively early FIGO stage than the ovarian removal group ($P = 0.0264$). The adjuvant chemotherapy has been treated a little more in the removal group. There were no differences in other baseline characteristics. When the 5-year survival rates were compared, there was no statistical difference between the 2 groups (98.6 vs 93.0, $P = 0.0892$). See Figure 1.

**Conclusion:** When performing surgery of endometrial cancer patients in early FIGO stage, ovarian preservation is worth considering, as it does not affect patient survival, and it helps the patient’s quality of life after surgery.
**Fig. 1.**

**481 - Poster Session**

**Whole-exome sequencing and clonal evolution of brain metastases in low-grade early-stage endometrioid endometrial adenocarcinoma**


**Objective:** Brain metastases in the setting of low-grade early-stage endometrioid endometrial cancer (EEC) are extremely rare. We sought to characterize the genetic alterations and clonal evolution of primary EECs and their matched brain metastases.

**Method:** Stage I, low-grade primary EECs, pelvic recurrences, and brain metastases from 2 patients were subjected to microdissection, DNA extraction, and whole-exome sequencing. Somatic mutations, copy number alterations, mutational signatures, and clonal decomposition were determined by using validated bioinformatics methods.

**Results:** Histologically, the low-grade endometrioid features of the primary tumors were retained in the respective brain metastases. In the metastatic process, we observed clonal selection from the primary tumors to the brain metastases in both cases and an accumulation of somatic mutations, however, due to distinct biological mechanisms. The primary EEC of patient 1 harbored 66 somatic nonsynonymous mutations, including a clonal ARID1A loss-of-function and KRAS and PTEN hotspot mutations; the matched brain metastasis harbored 88 nonsynonymous mutations and acquired 2 CTNNB1 gain-of-function hotspot mutations. While the primary EEC of patient 1 displayed a dominant aging mutational signature 1, the brain metastasis had dominant hypermutation-associated APOBEC signatures 2 and 13. In the progression of patient 2, we observed a stepwise increase in the number of nonsynonymous somatic mutations from the primary EEC (n = 234), the 2 recurrences (n = 866 R1, n = 837 R2) to the brain metastasis (n = 1,133) and in the MSI-sensor scores (15 primary, 38/40 recurrences, 41 brain metastasis). Furthermore, the primary EEC had a dominant aging mutational signature 1, and the pelvic recurrences and brain metastases a dominant DNA mismatch repair (MMR) signature 6. In this case we observed the selection of subclonal MSH2 and MSH6 mutations in the primary EEC, which became clonal in the brain metastasis.

**Conclusion:** The acquisition of genetic instability through defective DNA repair mechanisms, including APOBEC and DNA MMR, and the associated accumulation of somatic mutations may play a role in the progression of EECs to brain metastatic disease.

**482 - Poster Session**

**Identification of endometrial cancer mutations in pelvic washings using massively parallel sequencing: A pilot study**


**Objective:** The prognostic significance of positive pelvic washings in endometrial cancer (EC) is unknown. We sought to assess the feasibility of identifying EC cells/mutations in pelvic washings using massively parallel sequencing compared to conventional cytology.

**Method:** We prospectively collected pelvic washings for 60 presumed uterine-confined ECs. One aliquot was sent for routine cytology and 1 for DNA extraction. In this pilot study, DNA samples from the pelvic washing, primary tumor, and matched normal from 5 cases were subjected to targeted high-depth sequencing of 468 cancer-related genes. Sequencing data were analyzed using validated bioinformatics methods, and the results compared to those obtained by cytological analysis.

**Results:** The 5 ECs included in this study were of endometrioid histology with no extraterine, intraperitoneal metastases (stage I or stage IIIC). Based on conventional cytology analyses, 1 case had negative washings (W2); 3 had positive washings (W9, W22, W23); and 1 had suspicious washings (W31). Sequencing analysis of the primary ECs revealed that 2 were microsatellite unstable (W2, W22) and that the remaining 3 were of copy-number low (endometrioid) subtype (W9, W23, W31). In the 3 ECs with positive washings, more than 50% of the somatic mutations present in the primary tumor were also identified in the pelvic washings. The median variant allele fraction of mutations identified in the washings was 9% (1%–20%) compared to 28% (9%–47%) in the primary tumors. For case W31 (suspicious washings by cytology), 7/7 mutations from the primary tumor were identified de novo by sequencing in the washings, providing evidence to suggest that the suspicious cells were consistent with the primary carcinoma. For case W2 (negative washings by cytology), none of the 32 somatic mutations present in the primary tumor were identified by sequencing in the washings, consistent with the notion that no carcinoma cells were present.

**Conclusion:** Massively parallel sequencing analyses may be employed for the identification of endometrial carcinoma cells/mutations in pelvic washings. This method may also be utilized to clarify the etiology of suspicious appearing cells. Larger studies are warranted to assess the sensitivity and specificity of this methodology and whether it can aid in understanding the prognosis of positive washings in EC.
The effect of accumulated minimally invasive surgical experience on endometrial cancer outcomes


Objective: The aim of this study was to compare minimally invasive surgery (MIS) rates and perioperative and oncologic outcomes in endometrial cancer between an early period of robotic integration and a later period of accumulated experience.

Method: We retrospectively identified consecutive patients with newly diagnosed endometrial cancer who underwent primary surgery via any approach at our institution from 2009 to 2012 (early period) and 2014 to 2018 (late period). χ² and Mann-Whitney U tests were used to compare categorical and continuous variables, respectively. Kaplan-Meier curves were used to estimate survival, compared using log rank test.

Results: We identified 2,402 patients, 1,306 (43%) in the early period and 1,366 (57%) in the later period. Median BMI, stage, endometrioid versus nonendometrioid histology, grade, complication grade, and use of adjuvant treatment were clinically and statistically the same between both time periods. Median age for the early period was 61.5 years (range 28–90 years) and 63 years (range 23–96 years) for the late period (P = 0.04). In the early and late time periods, 799 (77%) of 1,036 patients and 1,205 (88%) of 1,366 patients, respectively, had a planned MIS (P < 0.001). Rates of conversion were 2.7% (22/799) and 1.4% (17/1,205), respectively (P = 0.1). Thirty-day postoperative complication rates were 17% (177/1,036) and 13% (176/1,366), respectively (P = 0.004). Median operating room times were 192 minutes (range 69–936 minutes) and 158 minutes (range 53–619 minutes), respectively (P < 0.001). Median length of hospital stay was 1 day (range 0–49 days) for the early-period group and also 1 day (range 0–32 days) for the late-period group (P < 0.001). Same-day discharge rates were 6% (66/1,036) and 21% (285/1,366), respectively (P < 0.001). Median follow-up was 60.6 months (range 0–127 months) and 28.1 months (range 0–66 months), respectively (P < 0.001). Two-year progression-free survival rates were 85% (SE ± 1.2) and 83% (SE ± 1.1), respectively (P = 0.2). Two-year overall survival rates were 91% (SE ± 0.9) and 92% (SE ± 0.8), respectively (P = 0.7). See Table 1.

Conclusion: In a cohort of patients with newly diagnosed endometrial carcinoma, continued improvement in MIS rates led to shorter operating room times, decreased length of stay, and a lower rate of complications, without an impact on oncologic outcomes.

Table 1.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>2402</td>
<td>1036 (43.1%)</td>
<td>1366 (56.9%)</td>
<td></td>
</tr>
<tr>
<td>Median Age (years)</td>
<td></td>
<td>62</td>
<td>61.5</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>Range</td>
<td>23-96</td>
<td>28-90</td>
<td>23-96</td>
</tr>
<tr>
<td>Median BMI (kg/m²)</td>
<td></td>
<td>29.4</td>
<td>30.5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Range</td>
<td>16-69</td>
<td>14-69</td>
<td>14-67</td>
</tr>
<tr>
<td>Median Length of Stay (days)</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Range</td>
<td>0-49</td>
<td>0-49</td>
<td>0-32</td>
</tr>
<tr>
<td>LOS= 0 days</td>
<td>351 (14.6%)</td>
<td>66 (6.4%)</td>
<td>285 (20.9%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Median OR Time (minutes)</td>
<td>171 min</td>
<td>192 min</td>
<td>158 min</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Range</td>
<td>53-936</td>
<td>69-936</td>
<td>53-619</td>
</tr>
<tr>
<td>Procedure</td>
<td></td>
<td></td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Robotic</td>
<td>1604 (66.7%)</td>
<td>578 (55.8%)</td>
<td>1026 (75.1%)</td>
<td></td>
</tr>
<tr>
<td>Laparoscopic</td>
<td>361 (15%)</td>
<td>199 (19.2%)</td>
<td>162 (11.9%)</td>
<td></td>
</tr>
<tr>
<td>Open</td>
<td>437 (18.2%)</td>
<td>259 (25.0%)</td>
<td>178 (13.0%)</td>
<td></td>
</tr>
<tr>
<td>MIS</td>
<td>1965 (81.8%)</td>
<td>777 (75.0%)</td>
<td>1188 (87.0%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Open</td>
<td>437 (18.2%)</td>
<td>229 (25.0%)</td>
<td>178 (13.0%)</td>
<td></td>
</tr>
<tr>
<td>Total Cases</td>
<td>2402</td>
<td>1036</td>
<td>1366</td>
<td></td>
</tr>
<tr>
<td>-------------</td>
<td>------</td>
<td>------</td>
<td>------</td>
<td></td>
</tr>
<tr>
<td><strong>Planned MIS</strong></td>
<td>2004 (83.4%)</td>
<td>799 (77.1%)</td>
<td>1205 (88.2%)</td>
<td></td>
</tr>
<tr>
<td><strong>Completed MIS</strong></td>
<td>1966 (98.1%)</td>
<td>777 (75%)</td>
<td>1189 (87%)</td>
<td></td>
</tr>
<tr>
<td><strong>Converted</strong></td>
<td>39 (1.94%)</td>
<td>22 (2.1%)</td>
<td>17 (1.2%)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Complication</th>
<th>0.004</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>2049 (85.3%)</td>
</tr>
<tr>
<td>Yes</td>
<td>353 (14.7%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>2402</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Complication Grade</th>
<th>0.299</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>177 (7.4%)</td>
</tr>
<tr>
<td>2</td>
<td>123 (5.1%)</td>
</tr>
<tr>
<td>3</td>
<td>51 (2.1%)</td>
</tr>
<tr>
<td>4</td>
<td>1 (0%)</td>
</tr>
<tr>
<td>5</td>
<td>1 (0%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>353</td>
</tr>
</tbody>
</table>

| Median Follow Up (months) | 33.55 (0-127) | 60.75 (0-127) | 28.1 (0-66) |

<table>
<thead>
<tr>
<th>Histology</th>
<th>0.172</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endometrioid</td>
<td>1710 (71.2%)</td>
</tr>
<tr>
<td>Non-Endometrioid</td>
<td>693 (28.8%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grade</th>
<th>0.186</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1166 (48.6%)</td>
</tr>
<tr>
<td>2</td>
<td>390 (16.3%)</td>
</tr>
<tr>
<td>3</td>
<td>416 (28.7%)</td>
</tr>
<tr>
<td>Missing</td>
<td>430 (17.9%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stage</th>
<th>0.57</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1859 (77.4%)</td>
</tr>
<tr>
<td>II</td>
<td>65 (2.7%)</td>
</tr>
<tr>
<td>III</td>
<td>314 (13.1%)</td>
</tr>
<tr>
<td>IV</td>
<td>164 (6.8%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Adjuvant Treatment</th>
<th>0.149</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>1155 (48.1%)</td>
</tr>
<tr>
<td>Yes</td>
<td>1247 (51.9%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Type of Adjuvant Treatment</th>
<th>&lt;0.001</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td>1159 (48.3%)</td>
</tr>
<tr>
<td>chemotherapy alone</td>
<td>257 (10.7%)</td>
</tr>
<tr>
<td>IVRT alone</td>
<td>407 (16.9%)</td>
</tr>
<tr>
<td>WPRT alone</td>
<td>37 (1.5%)</td>
</tr>
<tr>
<td>chemotherapy+IVRT</td>
<td>365 (15.2%)</td>
</tr>
<tr>
<td>chemotherapy+WPRT</td>
<td>149 (6.2%)</td>
</tr>
<tr>
<td>IVRT+WPRT</td>
<td>4 (0.2%)</td>
</tr>
<tr>
<td>hormone alone</td>
<td>10 (0.4%)</td>
</tr>
<tr>
<td>RT+hormone</td>
<td>2 (0.1%)</td>
</tr>
<tr>
<td>chemotherapy+IVRT+EBRT</td>
<td>12 (0.5%)</td>
</tr>
</tbody>
</table>

| Recurrences | 436 (18.2%) | 202 (19.5%) | 234 (17.1%) |
| Deaths | 356 (14.8%) | 212 (20.5%) | 144 (10.5%) |
| Deaths from Disease | 258 (10.7%) | 142 (13.7%) | 116 (8.5%) |
**484 - Poster Session**

**Highly potent dopamine receptor D2 antagonist ONC206 demonstrates anti-tumorigenic activity in endometrial cancer**


*University of North Carolina at Chapel Hill, Chapel Hill, NC, USA, Oncoceutics, Inc., Philadelphia, PA, USA, University of North Carolina Lineberger Comprehensive Cancer Center, Chapel Hill, NC, USA*

**Objective:** The imipridone ONC201 (Oncoceutics), a dopamine receptor-2 antagonist, has antitumorigenic effects in preclinical studies of endometrial cancer (EC) and is already in phase 2 clinical trials for EC. ONC206, a derivative of ONC201 that shares the imipridone core structure, exhibits distinct receptor pharmacology and nanomolar potency. Thus, we evaluated the antitumorigenic effects of ONC206 in human EC cell lines and the LKB1^{flox/flox}p53^{flox/flox} genetically engineered mouse model of endometrioid EC.

**Method:** The ECC1 and Ishikawa EC cell lines were treated with ONC201 and ONC206. Cell proliferation was assessed by MTT assay. Cell cycle progression was assessed by Cellometer. Apoptosis was assessed by Annexin V-FITC assay. Reactive oxygen species (ROS) were measured using DCFH-DA assay. Western blot for apoptotic, cell cycle, cellular stress, and mTOR/S6 pathway proteins was performed. LKB1^{flox/flox}p53^{flox/flox} mice were fed either a low-fat diet (lean, 10% calories from fat) or a high-fat diet (obese, 60% calories from fat) to mimic diet-induced obesity. Following EC onset, the mice were treated with placebo or ONC206 (130 mg/kg, weekly, oral gavage) for 4 weeks.

**Results:** ONC206 and ONC201 inhibited cell proliferation in both EC cell lines, with greater potency exhibited by ONC206 (IC_{50} range of 0.7–3.3 uM ONC206 vs 9.8–65 uM ONC201). ONC206 increased G0/G1 cell cycle arrest and ROS production as well as induced apoptosis (P < 0.05). ONC206 increased expression of cellular stress proteins and decreased expression of antiapoptotic and cell cycle-related proteins. Treatment with ONC206 decreased phosphorylation of S6 and increased phosphorylation of AKT in the EC cells. ONC206 reduced EC tumor weight in obese (73%) and lean (68%) mice after 4 weeks of treatment (P < 0.01).

**Conclusion:** ONC206 exhibited nanomolar potency for inhibiting EC cell growth and was efficacious in reducing EC tumor growth in both obese and lean mice. Thus, ONC206 may be a promising therapeutic agent to be explored in future clinical trials in endometrioid EC.

---

**485 - Poster Session**

**Improving response to olaparib in uterine serous cancer through treatment with AVB500, a receptor tyrosine kinase AXL inhibitor**


**Objective:** Given that the NRG GY012 trial for uterine cancer patients randomized women to olaparib as a treatment arm, we determined whether combination therapy with AVB500, an AXL inhibitor, could improve response in a uterine serous cancer (USC) model.

**Method:** A USC (ARK1) cell line was treated with AVB500 (Aravive Biologics, Houston, TX) in combination with a poly(ADP-ribose) polymerase inhibitor (PARPi), olaparib. MTS viability assays were performed after 72 hours of treatment with AVB500 alone, olaparib alone, or combination treatment (olaparib plus AVB500). Colony-forming assays were assessed after 4 days of treatment in the same conditions as described above, and relative cell viability for both treatments as well as IC_{50} for the MTS assays were calculated using Graph Pad Prism. In vivo studies were performed using NOD-SCID mice injected with 1 × 10^7 ARK1 cells intraperitoneally followed by treatment q3 days for a 14-day treatment period. Treatment groups were vehicle control, AVB500 alone, olaparib alone, and combination treatment olaparib with AVB500.

**Results:** In MTS viability assays, the IC_{50} in ARK1 cells was significantly less with combination treatment than with olaparib alone (3.85 nM vs 6.04 nM), and the relative cell viability was significantly lower for the combination treatment at every concentration (0.024 uM to 12.5 uM, P < 0.05). In clonogenic assays, colonies were stained and absorbance was obtained for each experimental arm. The absorbance for olaparib plus AVB500 was significantly less than the absorbance for the olaparib only group (0.417 nM vs 0.756 nM, P = 0.001). Immunofluorescence demonstrated treatment with AVB500 alone and in combination with olaparib resulted in increased yH2AX foci compared to vehicle controls or olaparib alone indicating AXL inhibition increases DNA damage. Last, NOD-SCID mice receiving the olaparib plus AVB500 combination had significantly less tumor weight than those treated with olaparib alone (0.008 g vs 0.138 g, P = 0.002) and AVB500 alone (0.008 g vs 0.145 g, P = 0.0006).
**Objective:** Minimally invasive surgical (MIS) staging is standard-of-care treatment for women with clinical stage I endometrial cancer (EC). Historical rates of medical inoperability in EC do not account for advances in MIS treatment. We aimed to describe a contemporary incidence of medical inoperability in women with newly diagnosed clinical stage I EC at a single, high-volume center.

**Method:** A cross-sectional study of patients diagnosed with EC from April 2014 to December 2018 was performed using EMERSE software to identify patients. Inclusion criteria were clinical stage I EC of any histology at the time of consultation. The primary outcome was medical inoperability, which was defined as (1) deemed inoperable by a gynecologic oncologist at consultation, (2) deemed inoperable during preoperative clearance, or (3) having a hysterectomy aborted at the time of surgical effort. Patients were excluded if they opted for fertility-sparing treatment or declined surgery. Descriptive statistics were performed and comparisons were made by using χ² and t tests as appropriate.

**Results:** Overall, 767 patients met inclusion/exclusion criteria. Of the cohort, 4% (n = 31) were deemed inoperable prior to proceeding to the operating room. Of those deemed potential surgical candidates, hysterectomy was aborted intraoperatively in 0.5% (n = 4). There was no difference in mean age between operable and inoperable patients (64 vs 62 years, P = 0.39). BMI was significantly higher in inoperable versus operable patients (51.8 vs 34.9, P < 0.0001). The inoperable group had higher rates of diabetes (68% vs 27%, P < 0.0001), coronary artery disease (35% vs 3%, P < 0.0001), and hypertension (94% vs 70%, P = 0.0005). Of patients able to undergo hysterectomy, 3.9% (n = 29) did not have nodal assessment because of habitus or tolerance of surgery. Of those not staged, 72.4% (n = 21) met Mayo criteria on final pathology resulting in potential compromise of their care because of lack of staging. Conversion to laparotomy was 1.9% (n = 14).

**Conclusion:** With maximal surgical effort and MIS, hysterectomy is possible in >95% of patients with newly diagnosed endometrial cancer treated at a high-volume tertiary care center. Given the high failure rates of alternative treatment modalities, referral to a high-volume center for MIS hysterectomy could improve outcomes for medically complex and obese patients.

**487 - Poster Session**

**Homologous recombination deficiency score testing in endometrial cancer**

**Objective:** The purpose of this study was to determine the association between homologous recombination deficiency (HRD) score and chemotherapy response in endometrial cancer.

**Method:** An initial cohort of patients with endometrial cancer and independent validation cohort was queried to determine frequency and clinical significance of alterations in the HR pathway; 253 (137 for test and 116 for validation cohorts) endometrioid adenocarcinoma patient samples were tested for HRD score (Myriad HRD assay), microsatellite instability (MSI), and tumor mutation burden (TMB) using a next-generation sequencing assay. HRD scores were also generated on endometrial cancer cell lines, and in vivo response to olaparib was assessed.

**Results:** An HRD score of 10 was chosen as a cutoff because the majority of tumors in our cohort with somatic mutations in TP53 have scores ≥10, and the majority of the oncogene mutated tumors, as well as MSI and TMB positive tumors, have scores <10. Using a cutoff of 10, there was no significant difference in disease-free survival (DFS) between the groups in the initial cohort. Subsequently, ROC curves were employed to determine optimal cutoffs of HRD in relation to survival impact in endometrial cancer, and an additional cutoff of HRD ≥4 was suggested for DFS. Patients with HRD score ≥4 trended toward worse survival than those with HRD score <4. When grouped by molecular subtype, there was a significant difference between groups (TMB positive; MSI positive; HRD positive; all others) using an HRD ≥4 cutoff (P = 0.0024). Moreover, the association between HRD score, MSI, TMB, and survival was validated in an independent cohort. Patients with a HRD score ≥4 had significantly worse survival (P = 0.001). When grouped by molecular subtype, there was a
significant difference between groups (TMB positive; MSI positive; HRD positive; all others) using the HRD ≥4 cutoff (\(P = 0.042\)), supporting that high HRD score (≥4) was associated with worse DFS in endometrial cancer patients than in patients with HRD score <4. In additional experiments, the Hec1a model (HRD score = 19) was highly sensitive to olaparib in in vitro and in vivo models.

**Conclusion:** High HRD score was associated with worse survival in our patient cohort. Our findings may support further validation of use of HRD score to guide the choice of adjuvant therapy for patients with advanced and recurrent endometrial cancer.

---

**488 - Poster Session**

Is an endometrial cancer diagnosis a ‘teachable moment’ leading to weight loss among obese women? A case-control study.

R.F. Harrison, H. Zhao, S. Fu, C.C. Sun, S.N. Westin, K.H. Lu, S.H. Giordano and L. Meyer. The University of Texas MD Anderson Cancer Center, Houston, TX, USA

**Objective:** Obesity is a risk factor for endometrial cancer (EC) and other chronic diseases. It is uncertain whether an EC diagnosis leads to weight loss or health behavior changes to mitigate obesity-related health risks. We compared the post-treatment BMI trajectories of a cohort of EC patients to those of matched controls.

**Method:** Using the MarketScan health insurance claims database, we identified overweight/obese EC patients treated with surgery and matched them to overweight/obese controls without cancer. Matching was done by birth year, baseline BMI (kg/m²), and follow-up duration. Follow-up duration for cases was defined as hysterectomy date to last available post-treatment BMI measurement; controls were required to have similar (±60 days) duration from first to last BMI measurement. More than 6 months of post-treatment follow-up was required. An exploratory analysis of patients undergoing bariatric surgery was performed.

**Results:** A total of 551 case control pairs were identified. Median age was age 54 (IQR 49–58) years. Median pretreatment BMI was 37 (IQR 30.9–44). Median follow-up duration was 588 days (IQR 364–1,089 days). No difference in BMI change was seen between cases and controls. Median BMI change was 0 (cases, IQR −2 to 2; controls, IQR −2 to 1.8). Among EC patients, 44.5% gained weight, 40.5% lost weight, and 15.1% were unchanged. Among controls, 43.4% gained weight, 41.4% lost weight, and 15.3% were unchanged. When patients were evaluated by change in BMI classification, there was also no difference between cases and controls. Only 2% of EC patients had normal BMI at post-treatment follow-up. Compared to controls, more EC patients reported working on improving diet post-treatment (54% vs 41%, \(P < 0.02\)) but were not more likely to report exercising more or attempting weight loss. No difference in the incidence of bariatric surgery was observed with 12 cases (2.2%), and 15 controls (2.7%, \(P = 0.56\)) undergoing bariatric surgery in the follow-up period with a median BMI change of −10.6 and −10.1, respectively. See Table 1.

**Conclusion:** Compared to matched controls, EC survivors do not tend to lose more weight following treatment, despite reporting interest in making health behavior changes. Significant weight loss was seen in EC survivors who underwent bariatric surgery post-treatment. Innovative approaches to improve the health of EC survivors and mitigate their obesity-related health risks are needed.

**Table 1.** Body Mass Index Changes Over Time in Endometrial Cancer Patients & Matched Controls.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Cases (n=551)</th>
<th>Controls (n=551)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial BMI, kg/m²</td>
<td>Median (IQR)</td>
<td></td>
</tr>
<tr>
<td>Initial WHO Obesity Classification</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overweight [BMI 25.0-29.9]</td>
<td>n (%)</td>
<td>112 (20.3%)</td>
</tr>
<tr>
<td>Obese, Class I [BMI 30.0-34.9]</td>
<td>n (%)</td>
<td>110 (20.0%)</td>
</tr>
<tr>
<td>Obese, Class II [BMI 35.0-39.9]</td>
<td>n (%)</td>
<td>115 (20.9%)</td>
</tr>
<tr>
<td>Obese, Class III [BMI ≥40.0]</td>
<td>n (%)</td>
<td>214 (38.8%)</td>
</tr>
<tr>
<td>Final BMI, kg/m²</td>
<td>Median (IQR)</td>
<td>36.0 (31.0 – 43.7)</td>
</tr>
<tr>
<td>Final WHO Obesity Classification</td>
<td></td>
<td>35.8 (30.0 – 43.0)</td>
</tr>
<tr>
<td>Underweight [BMI &lt;18.5]</td>
<td>n (%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Normal weight [BMI 18.51-24.9]</td>
<td>n (%)</td>
<td>11 (2.0%)</td>
</tr>
<tr>
<td>Overweight [BMI 25.0-29.9]</td>
<td>n (%)</td>
<td>95 (17.2%)</td>
</tr>
<tr>
<td>Obese, Class I [BMI 30.0-34.9]</td>
<td>n (%)</td>
<td>128 (23.2%)</td>
</tr>
<tr>
<td>Obese, Class II [BMI 35.0-39.9]</td>
<td>n (%)</td>
<td>119 (21.6%)</td>
</tr>
<tr>
<td>Obese, Class III [BMI ≥40.0]</td>
<td>n (%)</td>
<td>198 (35.9%)</td>
</tr>
<tr>
<td>Overall BMI Change, kg/m²</td>
<td>Median (IQR)</td>
<td>-0 ( -2 - 2)</td>
</tr>
<tr>
<td>Patients with pre-to-post BMI Increase</td>
<td>n (%)</td>
<td>245 (44.5%)</td>
</tr>
<tr>
<td>BMI Increase, kg/m²</td>
<td>Median (IQR)</td>
<td>2 (1 - 4)</td>
</tr>
<tr>
<td>Patients with pre-to-post BMI Decrease</td>
<td>n (%)</td>
<td>223 (40.5%)</td>
</tr>
<tr>
<td>BMI Decrease, kg/m²</td>
<td>Median (IQR)</td>
<td>-2 (-4 - -1)</td>
</tr>
<tr>
<td>Patients with Increase in WHO Obesity Classification</td>
<td>n (%)</td>
<td>96 (17.4%)</td>
</tr>
<tr>
<td>Patients with Decrease in WHO Obesity Classification</td>
<td>n (%)</td>
<td>110 (20.0%)</td>
</tr>
<tr>
<td>----------------------------------------------------</td>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>Patients Undergoing Bariatric Surgery During Follow-up</td>
<td>n (%)</td>
<td>12 (2.2%)</td>
</tr>
<tr>
<td>BMI Change, kg/m^2</td>
<td>Median (IQR)</td>
<td>-10.6 (-12.8 — -4.65)</td>
</tr>
</tbody>
</table>

**489 - Poster Session**

**Outcomes after the regionalization of care for high-risk endometrial cancers: A population-based study**

A.I. Nica\(^a\), R. Sutradhar\(^b\), A.L. Covens\(^c\), R. Kupets\(^d\), D. Vicus\(^e\), Q. Li\(^f\), S.E. Ferguson\(^g\) and L.T. Giens\(^h\).

\(^a\)University of Toronto, Toronto, ON, Canada, \(^b\)Institute for Clinical Evaluative Sciences, Toronto, ON, Canada, \(^c\)Sunnybrook Odette Cancer Centre, Toronto, ON, Canada, \(^d\)Sunnybrook Cancer Centre/University of Toronto, Toronto, ON, Canada, \(^e\)Sunnybrook Regional Cancer Centre, Toronto, ON, Canada, \(^f\)Princess Margaret Hospital, University of Toronto, Toronto, ON, Canada

**Objective:** In June 2013, the agency responsible for advancing cancer care in Ontario, Canada, published practice guidelines recommending that gynaecologic oncologists at tertiary care centers manage the treatment of patients with high-grade endometrial cancers. This study examines the effects of this regionalization of care on patient outcomes.

**Method:** In this retrospective cohort study, patients from 2003 to 2017 diagnosed with nonendometrioid high-risk endometrial cancer (serous, carcinosarcoma, clear cell, and undifferentiated) were identified in population-based administrative provincial data sources. Two regionalization periods were defined, to allow 6 months for knowledge translation. An interrupted time series model was used to test the effect of the guidelines. Multivariate Cox proportional hazards regression was used to evaluate whether regionalization of care had an impact on patient survival.

**Results:** A total of 3,518 patients with high-risk endometrial cancer were identified. The case mix as represented by patient comorbid conditions and the disease stage distribution did not differ significantly between the 2 regionalization periods. There was a significant increase (69% to 85%, \(P < 0.001\)) in the proportion of primary surgeries performed by gynaecologic oncologists after regionalization, which was not explained by secular trends (Figure 1). Patients with older age (OR = 1.01, 1.0–1.02, \(P = 0.02\)) and advanced stage (OR = 2.54, 1.92–3.35, \(P = 0.0003\)) and who had a preoperative biopsy (OR = 1.63, 1.13–2.36, \(P = 0.02\)) were more likely to have surgery with a gynaecologic oncologist. After regionalization, the proportion of surgeries performed through a minimally invasive (MIS) approach increased significantly (24% to 48%, \(P < 0.001\)), as did the proportion of patients who had surgical staging (50% to 63%, \(P < 0.001\)) and the proportion of patients who received adjuvant treatment (65% to 71%, \(P < 0.001\)). After adjusting for age, stage, and comorbid conditions, there was an increase in overall survival (HR = 0.85, 0.73–0.99, \(P = 0.04\)) after regionalization.

**Conclusion:** The publication of a regionalization policy for the treatment of high-risk histology endometrial cancers in Ontario led to an increase in the proportion of surgeries performed by gynaecologic oncologists, surgical staging, and adjuvant treatment. This also translated into a significant improvement in patient survival.
Comparison in outcomes between minimally invasive sentinel nodes versus full laparoscopic lymphadenectomy for endometrial cancer

R.W. Naumann^a, A. Lehman^b, E.K. Crane^b, D.L. Tait^b, R.V. Higgins^b and J. Brown^b. ^aLevine Cancer Institute, Charlotte, NC, USA, ^bLevine Cancer Institute, Carolinas Medical Center, Charlotte, NC, USA

Objective: The aim of this study was to compare the perioperative outcome of minimally invasive sentinel node dissection to full laparoscopic lymph node dissection with respect to intraoperative and immediate postoperative narcotic use, recovery room time, and total hospital stay.

Methods: Hospital billing records were used to identify all patients with endometrial cancer treated from January 1, 2018, through July 31, 2019, with either a sentinel node dissection or a full lymphadenectomy. Total narcotic use was converted to milligrams morphine IV for the surgical dose and the total amount in recovery. Total time in recovery and length of hospital stay were also compared.

Results: There were 97 sentinel node biopsies and 65 full lymphadenectomies for endometrial cancer during the study period. There was no difference with respect to estimated blood loss (EBL) \((P = 0.19)\), use of a preoperative enhanced recovery after surgery (ERAS) program \((P = 0.51)\), or BMI \((34.0 \text{ vs } 33.7, P = 0.87)\). The use of full lymphadenectomy was dependent on the surgeon \((P < 0.001, R^2 = 0.17)\). There was no difference in milligrams of IV morphine equivalent used in surgery \((20.9 \text{ vs } 22.2 \text{ mg}, P = 0.37)\), recovery \((4.6 \text{ vs } 4.9 \text{ mg}, P = 0.73)\), or total dose \((25.4 \text{ vs } 27.0 \text{ mg}, P = 0.33)\). The surgical procedure was longer with lymphadenectomy \((185.2 \text{ vs } 214.2 \text{ minutes}, P < 0.001)\). The recovery room time was longer, but this did not reach significance \((126.8 \text{ vs } 158.2 \text{ minutes}, P = 0.15)\). The hospital stay was longer with lymphadenectomy \((16.3 \text{ vs } 25.5 \text{ hours}, P < 0.001)\) and same-day discharge less frequent \((48.5\% \text{ vs } 13.8\%, P < 0.001)\).

Conclusion: As expected, sentinel node dissection shortens surgical time when compared to lymphadenectomy. There does not appear to be a statistical difference in EBL, recovery room stay, or perioperative narcotic use. The hospital stay is longer for full lymphadenectomy, but this may be surgeon-dependent.

Same day discharge after robotic surgery for endometrial cancer
Objective: The aim of this study was to assess the safety of same-day discharge in patients undergoing robotic surgery for endometrial cancer and to identify risk factors contributing to overnight hospital stay.

Method: Patients undergoing robotic staging for endometrial cancer from April 1, 2017, to April 1, 2019, were identified for analysis. A review of the electronic medical record (EMR) was performed, evaluating for postoperative admission, readmission after discharge, emergency visits following discharge, and demographics. Patients were discharged after the following criteria were met: tolerating oral intake, voiding spontaneously, ambulating, negative orthostatic vitals, postoperative hemoglobin not fallen more than 2 g/dL, pain controlled on oral medications, and motivated to leave. Risk factors for postoperative admission were identified using odds ratios and multivariate analyses.

Results: During the study period, 188 patients received robotic surgery for endometrial cancer; 132 (70.2%) were discharged the same day. The median age and BMI of our study population were 62 years and 36.1 kg/m², respectively. There were 122 (64.9%) patients with hypertension and 64 (34.0%) with diabetes. Of all patients, 132 (70.2%) had a final diagnosis of stage I endometrial cancer. The median length of stay after surgery was 288 minutes (range, 116–4,461 minutes). Of 56 patients requiring postoperative admissions, 39 (69.6%) stayed due to a medical reason. Reasons for admissions were late surgery time (n = 16), urinary retention (n = 13), abnormal vitals (n = 11), inability to tolerate oral intake (n = 7), pain (n = 3), and other (n = 7). Preoperative factors associated with failure to discharge on day of surgery were age ≥70 years (OR = 2.38, 95% CI 1.13–5.07) and start time of 1600 or later (OR = 12.03, 95% CI 4.19–34.55). Although patients with hypertension and diabetes were more likely to be admitted, the difference was not significant, nor was the distance from the patients’ residence to the hospital. There were 2 emergency room visits within 30 days of discharge in the same-day discharge group, with 1 requiring admission for a vaginal cuff repair on postoperative day 23. See Table 1.

Conclusion: Same-day discharge is safe and feasible after robotic surgery for endometrial cancer using our criteria. Age and start time of surgery are associated with overnight stay following robotic endometrial cancer staging.

<table>
<thead>
<tr>
<th>Factor evaluated</th>
<th>Same day discharge</th>
<th>Postoperative admission</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypertension n (%)</td>
<td>81 (61.4)</td>
<td>41 (73.2)</td>
<td>0.1216</td>
</tr>
<tr>
<td>Diabetes n (%)</td>
<td>47 (35.6)</td>
<td>17 (30.4)</td>
<td>0.4878</td>
</tr>
<tr>
<td>Hyperlipidemia n (%)</td>
<td>37 (28.0)</td>
<td>15 (26.8)</td>
<td>0.8615</td>
</tr>
<tr>
<td>Obesity n (%)</td>
<td>92 (69.7)</td>
<td>37 (66.1)</td>
<td>0.6244</td>
</tr>
<tr>
<td>COPD n (%)</td>
<td>3 (2.3)</td>
<td>5 (8.9)</td>
<td>0.0547</td>
</tr>
<tr>
<td>CHF n (%)</td>
<td>2 (1.5)</td>
<td>3 (5.4)</td>
<td>0.1601</td>
</tr>
<tr>
<td>Start time &gt; 1600 n (%)</td>
<td>5 (3.8)</td>
<td>18 (32.1)</td>
<td>&lt; 0.0001</td>
</tr>
<tr>
<td>Age &gt; 70 years n (%)</td>
<td>19 (14.4)</td>
<td>16 (28.6)</td>
<td>0.0247</td>
</tr>
<tr>
<td>Age &gt; 65 years n (%)</td>
<td>41 (31.1)</td>
<td>22 (39.3)</td>
<td>0.2756</td>
</tr>
<tr>
<td>ASA class ≥ 4 n (%)</td>
<td>1 (0.8)</td>
<td>5 (8.9)</td>
<td>0.0212</td>
</tr>
<tr>
<td>Smoking = yes n (%)</td>
<td>8 (6.1)</td>
<td>5 (8.9)</td>
<td>0.4810</td>
</tr>
<tr>
<td>Prior pelvic/abdominal surgery n (%)</td>
<td>102 (77.3)</td>
<td>42 (75.0)</td>
<td>0.7365</td>
</tr>
<tr>
<td>Age, y, median (range)</td>
<td>62 (33-83)</td>
<td>63.5 (29-84)</td>
<td>0.0177</td>
</tr>
<tr>
<td>BMI, kg/m², median (range)</td>
<td>36.1 (17.8-71.4)</td>
<td>36.1 (20.3-65.4)</td>
<td>0.8271</td>
</tr>
<tr>
<td>Distance from hospital, mi, median (range)</td>
<td>49.3 (19-155)</td>
<td>29.15 (0.5-135)</td>
<td>0.2506</td>
</tr>
<tr>
<td>EBL, mL, median (range)</td>
<td>35 (10-200)</td>
<td>45 (10-200)</td>
<td>0.2010</td>
</tr>
</tbody>
</table>
Results: We identified 102 women who met inclusion criteria; 84 received chemotherapy first (CTx6-RT) and 18 received sandwich radiation (CTx3-RT-CTx3). Median age was 65.1 years. Pelvic and paraaortic nodes were removed in 99.0% and 88.2%, respectively. With chemotherapy before radiation, 94.9% completed at least 4 cycles of chemotherapy compared to only 75% with radiation before chemotherapy in GOG 258 and PORTEC 3. Median follow-up among those alive at last follow-up was 5.9 years. For the chemotherapy-first approach, 44.0% had nonendometrioid histology; 46.4% had stage IIIC2 disease; and at 3 years LRR = 6.8% (95% CI 0.8–12.5%), DRR = 24.4% (95% CI 14.5–33.2%), and OS = 81.7% (95% CI 73.8–90.5%). For the sandwich approach, 66.7% had nonendometrioid histology; 55.6% had stage IIIC2 disease; and at 3 years LRR = 11.8% (95% CI 0–25.8%), DRR = 42.9% (95% CI 12.4–62.8%), and OS = 70.3% (95% CI 51.5–96.1%). Among all 102, pelvic recurrence was seen in 1 patient, paraaortic in 1 patient, and vaginal in 5 patients. While most failures were distant, women with endometrioid endometrial cancer had a favorable 3-year DRR of 13.2% (95% CI 2.8–22.5%) with chemotherapy first. Hematological toxicity information was complete for 46 women; 37.0%, 8.7%, and 10.9% had grade 3+ neutropenia, thrombocytopenia, and anemia, respectively. See Table 1.

Conclusion: For patients with stage IIIC endometrial cancer receiving chemotherapy prior to radiation, locoregional disease control was good despite delaying radiation until after 3–6 cycles of chemotherapy and not administering concurrent cisplatin. Chemotherapy delivery was favorable with the chemotherapy-before-radiation approach; it is an alternative to the radiation-before-chemotherapy approach for advanced endometrial cancer. We still observed a high rate of distant failures in type II endometrial cancer, which likely requires novel experimental therapies.

Table 1. Outcomes after Chemotherapy before radiation for women with stage IIIC endometrial cancer receiving combined adjuvant chemotherapy and radiation.

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>All patients N=102</th>
<th>Endometrioid EC N=53</th>
<th>Non-endometrioid EC N=49</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sandwich a N=18</td>
<td>CT-first b N=84</td>
<td>Sandwich a N=6</td>
</tr>
<tr>
<td>3-year OS (%)</td>
<td>70.3</td>
<td>81.7</td>
<td>83.3</td>
</tr>
<tr>
<td>3-year LRR (%)</td>
<td>11.8</td>
<td>6.8</td>
<td>16.7</td>
</tr>
<tr>
<td>3-year DRR (%)</td>
<td>42.9</td>
<td>24.4</td>
<td>0</td>
</tr>
</tbody>
</table>

*a Sandwich (CTx3-RT-CTx3): Planned 3 cycles of chemotherapy followed by radiation and then 3 more cycles of chemotherapy
bCT-first (CTx6-RT): Planned 6 cycles of chemotherapy followed by radiation
Locoregional recurrence includes vaginal, pelvic and paraaortic recurrences

Abbreviations: CT, Chemotherapy; DRR, Distant recurrence rate; EC, Endometrial cancer; LRR, Local recurrence rate; RT, Radiation
29%, \( P < 0.001 \), with propensity for lymphovascular space invasion (LVSI) \( (30\% \text{ vs } 17\%, \ P = 0.002) \) and received more adjuvant treatment \( (46\% \text{ vs } 33\%, \ P = 0.03) \). This group also had significantly lower 3-year RFS \( (79\% \text{ vs } 89\%, \ P = 0.02) \) \( (\text{Figure 1}) \). Although there was no difference in OS \( (P = 0.96) \). In a multivariate model after adjustment for age, stage, LVSI, and adjuvant and neoadjuvant treatment, MMR deficiency remained a statistically significant predictor for worse RFS \( (HR = 1.96, \ CI 1.05–3.67, \ P = 0.035) \). Subgroup analysis showed that MLH1/PMS2 deficient tumors had the lowest 3-year RFS compared to intact and other MMRd tumors \( (76\% \text{ vs } 89\% \text{ vs } 87\%, \ P = 0.02) \).

**Conclusion:** MMRd EEC exhibit more aggressive features compared to MMRI, with worse RFS. This may indicate an inherent difference in tumor biology between MMRd and MMRI endometrial cancer, suggesting the importance of individualized management based on tumor molecular phenotype.

**Fig. 1.** Comparison of recurrence free survival between mismatch repair deficient (MMRd) and mismatch repair intact (MMRI) endometrioid endometrial cancers.

---

**494 - Poster Session**

**Characteristics and outcomes of endometrial cancer in young women: A SEER database analysis**

K. Cotangco\(^a\) and N.L. Neubauer\(^b\). \(^a\)University of Illinois Chicago, Chicago, IL, USA, \(^b\)Northwestern University Feinberg School of Medicine, Chicago, IL, USA

**Objective:** Endometrial cancer incidence is rising; 9%–20% of women younger than 50 years will be diagnosed with endometrial cancer. Risk factors include obesity, chronic anovulation, and insulin resistance. Women younger than 50 years with endometrial cancer have more favorable histologies and earlier stage disease than women older than 50 years. Our objective was to analyze characteristics and outcomes of patients younger than 50 years diagnosed with stage 1 (local) versus stage 2–4 (metastatic) endometrial cancer.

**Method:** The Surveillance, Epidemiology, and End Results (SEER) database was queried to identify African-American and Caucasian women between 20 and 49 years old diagnosed with endometrial cancer in the United States between 1975 and 2016. We collected demographic, stage, and survival data. Mismatch repair protein status was unavailable. We stratified patients by stage of disease and race. Baseline characteristics were compared using \( \chi^2 \) tests. Log rank statistics compared overall survival (OS).

**Results:** We identified 20,699 women with stage 1 disease and 6,935 with stage 2–4 disease. Grade 1 tumors were most common \( (n = 8,698) \). Grade 3 tumors were most common in metastatic disease \( (n = 568) \). Sites of metastatic disease at the time of diagnosis were most common in pelvic lymph nodes (LN) \( (8.3\%) \), followed by lung \( (4.9\%) \), paraaortic LN \( (3.6\%) \), liver \( (1.7\%) \), and brain \( (0.5\%) \). Standard incidence ratios (SIR) for second primary colorectal cancers were significantly increased for local and metastatic disease for both races \( (SIR = 3.39 \text{ vs } 3.7, \ P < 0.05) \) but greater with metastatic disease. African-American women were more likely to have distant metastases \( (13.7\% \text{ vs } 6.7\%, \ P < 0.001) \). Caucasian women had a 5-year survival of 68% versus 49.6% for African-American women. OS was significantly worse \( (P < 0.001) \) for African-American women than for Caucasian women in local and metastatic disease.

**Conclusion:** Grade 1 endometrial adenocarcinoma is the most common histology in women aged 20–49 years. African-American race was significantly associated with increasing stage of disease. African-American women had worse OS, regardless of disease stage, than Caucasian women.
Glutaminase expression is correlated with adverse clinicopathological features and patient outcome in endometrial cancer

S. Asaka, T.T. Yen, Y.A. Shen; J. Hong; R. Asaka; I.M. Shih; T.L. Wang; and S. Gaillard; Johns Hopkins School of Medicine, Baltimore, MD, USA; Taipei Medical University, Taipei, Taiwan; Union Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan, China; Shinsyu University School of Medicine, Matsumoto, Japan; Johns Hopkins Sidney Kimmel Cancer Center, Baltimore, MD, USA

Objective: Cancer cells exhibit altered metabolism influenced by oncogenic mutations and loss of tumor suppressors. Altered glutamine metabolism supports proliferation and survival of cancer cells, and the upregulation of glutaminolysis provides an energetic advantage to cancer cells. Cellular expression of glutaminase (GLS), which catalyzes the conversion of glutamine to glutamate, leads to high rates of glutaminolysis. To investigate the clinical significance of glutamine metabolism in endometrial cancer, we correlated the clinicopathological features of endometrial cancer with GLS expression.

Method: Tissue microarrays, constructed from 92 endometrial cancer hysterectomy specimens, were used to evaluate GLS expression by immunohistochemistry. Mismatch repair proteins, AT-rich interactive domain-containing protein 1A (ARID1A), c-Myc, estrogen receptor, progesterone receptor, and programmed death-ligand 1 (PD-L1) expression in tumor and tumor-infiltrating immune cells (CD8, forkhead box P3 [FoxP3], CD68, PD-L1, and PD-1) were also assessed by immunohistochemistry.

Results: GLS High endometrial cancer (H score ≥ 30) was associated with high-grade (G3) and nonendometrioid (type II) histology (P = 0.0009 and P < 0.0001, respectively), frequent loss of progesterone receptor expression (P = 0.0088), higher CD68+ tumor-associated macrophages (TAMs) (P = 0.0097), presence of myometrial invasion (P = 0.0165), and advanced FIGO stage (P = 0.0142). GLS expression was significantly higher in c-Myc overexpressed endometrial cancers (P < 0.0001). Endometrial cancer with high GLS expression (mRNA) exhibited worse overall survival (P = 0.00412) in The Cancer Genome Atlas (TCGA) dataset.

Conclusion: GLS High endometrial cancer was associated with c-Myc overexpression, increased TAM infiltration, and adverse clinicopathological features. GLS expression may be a biomarker for prognosis and a potential target for the development of novel therapies in advanced endometrial cancer.

A needle in a haystack: Targeting growth factor receptor bound protein-2 (Grb2) as a novel therapeutic in uterine carcinoma

O.D. Lara; C. Rodriguez-Aguayo; E. Bayraktar; P. Amero; S. Ma; L.S. Mangala; C. Ivan; W. Hu; A. Tari Ashizawa; G. Lopez-Berestein; and A.K. Sood; The University of Texas MD Anderson Cancer Center, Houston, TX, USA; Biopath Holdings, Houston, TX, USA; Center for RNAi and non-coding RNA, The University of Texas MD Anderson Cancer Center, Houston, TX, USA

Objective: Adaptor proteins such as growth factor receptor bound protein-2 (Grb2) play important roles in cancer cell signaling but are difficult to target. We used prexigebersen (liposome-incorporated nuclease-resistant antisense oligonucleotides specific for Grb2; in clinical testing) in preclinical models of uterine carcinoma.

Method: A series of in vitro (Western blot, MTT) and in vivo (orthotopic mouse models) experiments were carried out to test the biological effects of prexigebersen in uterine cancer models (Hec1a). We also tested the clinical significance of Grb2 using publicly available high-throughput data.

Results: We first examined Grb2 expression using The Cancer Genome Atlas (TCGA) data and found activating mutations and copy number alterations in 16.28% of uterine serous carcinoma and 2.56% of uterine endometrioid carcinoma tumors. Grb2 amplification was related to decreased patient survival (P < 0.001), suggesting it may be an attractive therapeutic target. Grb2 was expressed in most uterine cancer cell lines (KLE, Hec1a, Ishikawa, and MFE319). Cell viability assay on Hec1a verified sensitivity to Grb2 downregulation compared to control siRNA. In addition, reverse phase protein array (RPRA) analysis of Hec1a cells transfected with siControl or siGrb2 revealed that networks significantly downregulated after siGrb2 transfection include AMPK signaling, PI3K/AKT signaling, and insulin receptor signaling. Next, we evaluated the effects of prexigebersen as monotherapy and in combination with paclitaxel and bevacizumab in the Hec1a model. Tumor growth was significantly decreased in all groups compared to control. The most significant reduction in tumor was seen in the triple combination group, with a 77% decrease in tumor burden compared to control (mean ± SEM: control, 1.67 g ± 0.30 g; paclitaxel, bevacizumab, and prexigebersen group, 0.38 g ± 0.25 g). There was a significant reduction in number of tumor nodules in the triple combination group compared to control (mean ± SEM: control, 13.3 ± 4.3 nodules; triple combination group, 3.6 ± 4.3 nodules) and no effect on mouse weight in any treatment group.

Conclusion: Prexigebersen-based therapy demonstrated robust efficacy in preclinical models. Our findings establish Grb2 as an important target for clinical development.
**Objective:** The aim of this study was to determine the utility of a prognostic scoring system to predict benefit of chemotherapy alone and chemoradiation (CRT) in stage I–IV uterine papillary serous cancer (UPSC).

**Method:** The National Cancer Data Base was queried for cases of stage I–IV UPSC from 2008 to 2015. Patients were grouped into observed, chemotherapy alone, or CRT. Those receiving radiation alone were excluded because they made up less than 10% of patients. Propensity score matching was used to correct for differences in covariates between observation, chemotherapy alone, and CRT. Demographic and surgicopathologic characteristics were used to create a prognostic score using random survival forest.

**Results:** Of 3,399 patients, 692 (20%) underwent observation, 1,309 (39%) received chemotherapy alone, and 1,398 (41%) received CRT. Older age (HR = 1.01), black race (HR = 1.12), increasing stage (HR = 2.34), more positive lymph nodes (HR = 1.90), no lymphadenectomy (HR = 1.30), larger tumor size (HR = 1.30), lymphovascular space invasion (HR = 1.62), and positive peritoneal cytology (HR = 1.71), and observation (HR = 1.99) were associated with worse prognosis. Using the preceding characteristics, except treatment, random survival forest was used to create a prognostic score. Patients were divided into three risk groups (low, score <37; moderate, score ≥37 to ≤174; high, score >174) (Figure 1). To better delineate who may benefit from treatment, survival differences based on intervention were examined in each risk group. There was no difference in OS (overall survival) with any treatment in the low-risk group: observation as reference, chemotherapy alone (HR = 1.29, CI 0.59–2.80, P = 0.53), CRT (HR = 0.77, CI 0.36–1.66, P = 0.50). In the moderate risk group, OS was better with CRT (HR = 0.64, CI 0.48–0.85, P = 0.002) but not with chemotherapy alone (HR = 0.80, CI 0.60–1.06, P = 0.12) compared to the observational group. However, in the high-risk group, OS was improved by both CRT (HR = 0.39, CI 0.29–0.52, P < 0.001) and chemotherapy alone (HR = 0.55, CI 0.42–0.71, P < 0.001) compared to the observational group.

**Conclusion:** UPSC across stages is associated with heterogeneous prognoses. As UPSC is difficult to study in randomized trials because of its relative infrequency, our scoring system may be useful in assisting shared decision making between the patient and her provider.

<table>
<thead>
<tr>
<th>Stage</th>
<th>Low Risk (n = 639)</th>
<th>Moderate Risk (n = 1,725)</th>
<th>High Risk (n = 1,035)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IA</td>
<td>602 (94%)</td>
<td>644 (37%)</td>
<td>9 (1%)</td>
</tr>
<tr>
<td>IB</td>
<td>23 (4%)</td>
<td>332 (19%)</td>
<td>33 (3%)</td>
</tr>
<tr>
<td>2</td>
<td>14 (2%)</td>
<td>193 (11%)</td>
<td>31 (3%)</td>
</tr>
<tr>
<td>3A/B</td>
<td>0 (0%)</td>
<td>183 (11%)</td>
<td>178 (17%)</td>
</tr>
<tr>
<td>3C1/2</td>
<td>0 (0%)</td>
<td>309 (18%)</td>
<td>363 (35%)</td>
</tr>
<tr>
<td>4A/B</td>
<td>0 (0%)</td>
<td>64 (4%)</td>
<td>421 (41%)</td>
</tr>
</tbody>
</table>

**Fig. 1.** Kaplan-Meier curves of different prognostic groups and the percentage of patients from each stage that make up the low, moderate, and high risk groups.
Adjuvant treatment for patients with FIGO stage I uterine serous carcinoma confined to the endometrium

**Objective:** The aim of this study was to investigate the impact of adjuvant treatment on overall survival (OS) of patients with uterine serous carcinoma (USC) confined to the endometrium.

**Method:** Patients diagnosed with FIGO stage I USC confined to the endometrium between 2004 and 2015 who underwent hysterectomy with at least 10 lymph nodes removed were identified from the National Cancer Data Base. Adjuvant treatment patterns (defined as receipt of chemotherapy [CT] and/or radiation therapy [RT] within 6 months from surgery) were investigated, and OS was evaluated for patients diagnosed between 2004 and 2014 who had at least 1 month of follow-up using Kaplan-Meier curves, and compared with the log rank test. A multivariate Cox analysis was performed to control for confounders.

**Results:** A total of 1,729 patients were identified; 48.4% did not receive adjuvant treatment, 20.2% received both CT and RT (CRT), 20.5% CT only and 11% RT only. Patients who received any adjuvant treatment were younger (median 65 vs 66.5 years, \( P < 0.001 \)), more likely to be treated in academic facilities (58.6% vs 51.3%, \( P = 0.002 \)), have private insurance (46.7% vs 40.3%, \( P = 0.02 \)), and less likely to have comorbid conditions (79.7% vs 74%, \( P = 0.005 \)). Five-year OS rates for patients who received CRT \(( n = 294)\) was 91.3% compared to 91.1% for those who received CT only \(( n = 299)\), 86.4% for those who received RT only \(( n = 158)\), and 81.8% for patients who did not receive any adjuvant treatment \(( n = 739)\), \( P < 0.001 \). After controlling for patient race, age, insurance status, treatment at an academic facility, tumor size, presence of comorbid conditions, and history of another tumor, patients who received adjuvant CT \(( \text{HR} = 0.61, 95\% \text{CI 0.40–0.92})\) and CRT \(( \text{HR} = 0.54, 95\% \text{CI 0.34–0.86})\) had better survival compared to those who did not receive any adjuvant treatment, while there was no benefit for RT alone \(( \text{HR} = 0.93, 95\% \text{CI 0.60–1.45})\). There was no difference between patients who received CRT and CT only \(( \text{HR} = 1.17, 95\% \text{CI 0.67–2.06})\).

**Conclusion:** Adjuvant chemotherapy alone is associated with a survival benefit for patients with USC confined to the endometrium. Radiation therapy was not associated with a survival benefit.

Patterns of use and outcomes of sentinel lymph node biopsy in high-grade endometrial cancer

**Objectives:** To investigate the use and the impact on overall survival of sentinel lymph node biopsy (SLN) among patients with clinical early stage high-grade endometrial carcinoma.

**Methods:** Patients diagnosed between 2012-2015 with clinical stage I carcinosarcoma, grade 3 endometrioid, serous, and clear cell endometrial carcinoma who underwent minimally invasive hysterectomy were identified from the National Cancer Database. The performance of sentinel lymph node biopsy (SLN) or standard lymphadenectomy (LND) was assessed and factors associated with the receipt of SLN were evaluated. Overall survival was evaluated for patients diagnosed between 2012-2014 who had at least one month of follow-up with generation of Kaplan-Meier curves and comparison with the log-rank test. A Cox model was constructed to control for confounders.

**Results:** A total of 9219 patients who met the inclusion criteria with a median age of 66 years were identified. SLN was performed in 6.1% \(( n = 519)\). An increase in the use of SLN was noted per year of diagnosis rising from 2.8% and 4.6% in 2012 and 2013 to 6.5% and 9.6% in 2014 and 2015, respectively. Higher rates of SLN performance was noted among academic facilities compared to non-academic (8.2% vs 4.2%, \( P < 0.001 \)), patients with higher income (\( P < 0.001 \)) and stage IA tumors (6.8% vs 4.4%, \( P < 0.001 \)). There were no differences between patients who had SLN and LND in terms of age (\( P = 0.47 \)), race (\( P = 0.10 \)), histology (\( P = 0.58 \)), the presence of medical comorbidities (\( P = 0.68 \)), and tumor size (\( P = 0.11 \)). The rate of positive lymph nodes in the LND and SLN groups was comparable (11.1% vs 11%, \( P = 0.93 \)). Ninety-day mortality rate (0.7% vs 0.3%, \( P = 0.48 \)) and unplanned readmission within 30 days from discharge (2.5% vs 3.2%, \( P = 0.29 \)) were comparable between the two groups. There was no difference in OS between patients who had LND \(( n = 6355)\) and SLN \(( n = 317)\) \(( P = 0.35)\); 3-year OS rates were 82.6% and 84.9%, respectively. After controlling for patient age, histology, race, type of insurance, comorbidities, substage, tumor size, the receipt of radiation therapy and chemotherapy, performance of SLN was not associated with worse survival (HR: 0.97, 95% CI: 0.70, 1.34).

**Conclusions:** An increase in the use of SLN among patients with apparent early stage high-grade endometrial carcinoma is noted with no negative effect on survival.
Objective: Septins are cytoskeletal proteins involved in cell migration, proliferation, and cytokinesis. Methylation of septin-9 is a clinical biomarker in colorectal cancer, and deranged expression of other septins has been described in other malignancies, including gynecologic cancers. We sought to characterize the expression profile of septin paralogs in endometrial cancer and establish their association with mortality. There are currently no clinically available therapies targeting septin protein activity. We have developed a first-in-class small molecule septin inhibitor, UR214-9, and evaluated this compound’s cytotoxic effect against endometrial cancer in vitro. Endometrial cancer also displays aberrant pathway regulation on HER2, FGFR2, PI3K/AKT and/or β-catenin signaling. The effect of UR214-9 on these pathways was also investigated.

Method: Expression of septin paralogs in endometrial cancer and the association with mortality were analyzed using The Cancer Genome Atlas dataset. UR214-9 was identified by structure-activity relationship-guided optimization. Endometrial cancer cell lines were treated with various concentrations of UR214-9 and evaluated against UR214-3, an ineffective compound structurally related to UR214-9, and a conventional septin inhibitor, forchlorfenuron (FCF). Cell proliferation was monitored using a sulforhodamine B assay. Drug effects on protein expressions were evaluated by immunoblot analysis.

Results: We found, in endometrial cancer, the relative gene expression of septin-2 and 6-11 is higher than that in other septins. As well, certain septin expression (2, 8, 10, and 11) is associated with decreased overall survival. We found UR214-9 displayed increased cytotoxicity compared with FCF and UR214-3 in dose- and time-dependent manners (Figure 1A and Figure 1B). We also showed that UR214-9 downregulated HER2 and β-catenin expression. In FGFR2 mutant AN3CA cells, UR214-9 decreased phosphorylation of FRS2, a substrate of FGFR2. UR214-9 treatment was not effective at targeting the PI3K/AKT signaling pathway.

Conclusion: UR214-9 is a novel first-in-class, small-molecule septin inhibitor that demonstrates therapeutic potential in endometrial cancer cell lines and downregulates key pathways including HER2, FGFR2, and β-catenin. This work has developed a novel therapeutic target for the treatment of endometrial cancer.

Fig. 1. (A) Results of initial tests of EC cellular viability after exposure to a panel of novel septin inhibitors. UR214-9 was developed after modification of the structure of UR214-7. (B) Cellular viability after exposure to a modified panel of septin inhibitors, including UR214-9 (shown in green).
Objective: A minority of endometrial cancer patients have robust and durable responses to immunotherapy; however, biomarkers are urgently needed to select which patients will benefit and to spare others from immunotherapy-related toxicity.

Method: We reviewed clinicopathologic and genomic information for 30 endometrial cancer patients with tissue-based sequencing, who received immunotherapy as part of treatment. We used Response Evaluation Criteria in Solid Tumor (RECIST) v1.1 to evaluate response; if imaging was not available (n = 3), clinical response was used. We calculated relative risks (RR) for progression-free survival (PFS), dichotomizing PFS at median (3.9 months) for each molecular biomarker.

Results: Median age at immunotherapy initiation was 66 (range 50–88) years with median 1 (range 0–7) prior line of therapy. Of 30 patients, 13 received 1 or more drugs in combination with immunotherapy (Figure 1). Most had endometrioid (43.3%) or serous (40.0%) histology. Median overall survival from start of immunotherapy was 339 (range 28–872) days. Clinical benefit rate (CBR) by RECIST was 52% (14/27 evaluable patients), with 3 complete responses (CR) (11%), 3 partial responses (PR) (11%), and 6 patients (20%) continuing on immunotherapy at data cutoff. CBR was 50% in serous and 39% in endometrioid. Tumor mutation burden (TMB) >10 predicted response to immunotherapy (RR = 1.9, 95% CI 1.07–3.4, P = 0.03), with 3 of 4 patients with PFS >1 year having high TMB. PD-L1 was not associated with PFS (RR = 0.77, 95% CI 0.25–2.4, P = 0.65). Based on TMB ≥10 and MSI-H, 2 patients had unexpectedly poor responses to immunotherapy. Both had JAK1 alterations, which have been associated with immune evasion. Interestingly, 80% of tumors with CTNNB1 alterations, an activator of WNT/b-catenin pathway, responded to immunotherapy (PFS 5.0–26.1 months: 2 PRs, 2 CRs) despite literature suggesting it is a biomarker for non-T-cell-inflamed tumors.

Conclusion: TMB may be the best biomarker for response to immunotherapy in endometrial cancer; however, molecular alterations should be considered as possible modifiers. PD-L1 was not associated with response in our cohort, although the study is limited by its size.

<table>
<thead>
<tr>
<th>Patient ID</th>
<th>6</th>
<th>6</th>
<th>9</th>
<th>10</th>
<th>12</th>
<th>12</th>
<th>13</th>
<th>20</th>
<th>20</th>
<th>21</th>
<th>26</th>
<th>14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Histology</td>
<td>Endometrioid</td>
<td>Endometrioid</td>
<td>Endometrioid</td>
<td>Serous</td>
<td>Serous</td>
<td>Serous</td>
<td>Serous</td>
<td>Serous</td>
<td>Serous</td>
<td>Serous</td>
<td>Serous</td>
<td>Serous</td>
</tr>
<tr>
<td>TMB</td>
<td>18.3</td>
<td>18.1</td>
<td>8.6</td>
<td>8.2</td>
<td>5.2</td>
<td>5.0</td>
<td>5.0</td>
<td>4.5</td>
<td>3.7</td>
<td>2.6</td>
<td>9.2</td>
<td></td>
</tr>
<tr>
<td>PD-L1</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Characterized Altered Genes</td>
<td>LRRK2</td>
<td>ATM</td>
<td>ARID1A</td>
<td>ARID1B</td>
<td>ATP5B2</td>
<td>CACNA1A</td>
<td>DNA mismatch repair pathway genes</td>
<td>IDH1</td>
<td>IDH2</td>
<td>JAK1</td>
<td>JAK3</td>
<td>MSI-H</td>
</tr>
<tr>
<td>Treatment</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
<td>ID</td>
</tr>
<tr>
<td>PFS (months)</td>
<td>28.1</td>
<td>17.0</td>
<td>16.3</td>
<td>16.0</td>
<td>11.3</td>
<td>11.3</td>
<td>9.3</td>
<td>6.1</td>
<td>5.6</td>
<td>5.1</td>
<td>3.0</td>
<td>2.0</td>
</tr>
<tr>
<td>RECIST best response</td>
<td>CR</td>
<td>CR</td>
<td>N/A</td>
<td>PR</td>
<td>SD</td>
<td>SD</td>
<td>SD</td>
<td>PR</td>
<td>N/A</td>
<td>PR</td>
<td>PD</td>
<td>PD</td>
</tr>
</tbody>
</table>

**Fig. 1.** Clinicopathologic outcomes for endometrial cancer patients (n = 30) who received immunotherapy at the UC San Diego Moores Cancer Center. Patients are sorted by decreasing PFS (months), with notation of MSI-High in red, PD-L1 positive in purple, and RECIST best response with CR, PR, SD or continued response to immunotherapy (arrowhead) in yellow. PFS was determined by RECIST criteria; in the 3 patients without available imaging, clinical response was used (stop date of ID in #24 and continued treatment in #8 and #6).

502 - Poster Session

Methyltransferase-like 14 is associated with decreased progression free survival in advanced-stage endometrioid endometrial cancer
Objective: Methyltransferase-like 3 (METTL3) and methyltransferase-like 14 (METTL14) form a heterodimeric complex to methylate RNA. This chemical modification has been linked with tumor progression in different cancer types. Decreases in METTL3 protein expression or mutations in METTL14 have recently been associated with endometrial cancer. The aim of this study is to investigate whether there is an association between METTL3 or METTL14 expression and clinical outcomes.

Method: Western blotting for METTL3 and METTL14 was performed on 3 endometrioid endometrial cancer cell lines: Ishikawa (grade 1), HEC-1-A (grade 2), and KLE (grade 3). Transfection of METTL14 mutations into cell lines was performed. Patient samples with stage IIIA–IVB endometrioid endometrial cancer who underwent upfront cancer staging were collected. Demographic, clinical, pathologic, and survival outcome data were recorded. Immunohistochemical (IHC) analysis for METTL3 and METTL14 was performed and analyzed by a gynecologic pathologist. Samples were separated into 2 groups based on expression or loss of expression. Associations were investigated using t test, Pearson Χ² test, and Kaplan-Meier survival analysis.

Results: Western blotting revealed decreases in METTL3 and METTL14 expression with increasing grade in endometrial cancer cell lines. Mutant METTL14 transfection did not alter cellular proliferation over wildtype. IHC was performed on 17 patient samples, 1 with stage IIIA, 7 with stage IIIIc1, 6 with stage IIIIc2, and 3 with stage IVB. Seven patients had expression of METTL14, and 10 had loss of expression. METTL14 expression was significantly associated with decreased progression-free survival (PFS, \( P = 0.002 \)). METTL14 expression approached significance for decreased overall survival (OS, \( P = 0.055 \)). METTL3 expression was not associated with differences in PFS or OS (\( P = 0.810 \) and \( P = 0.745 \), respectively). There were no significant differences in age, stage, or grade between patients with METTL14 expression or loss of expression (\( P = 0.677 \), \( P = 0.541 \), and \( P = 0.638 \), respectively).

Conclusion: METTL14 expression is associated with prognosis in endometrioid endometrial cancer. RNA methylation in endometrial cancer is being investigated in further laboratory studies.

503 - Poster Session
Survival outcomes of FIGO stage IIIC and IVB endometrial cancer patients presenting primarily as nodal spreads without peritoneal carcinomatosis
T.W. Kong, S. Kim, J. Kim, J.H. Shim, J.H. Son, J. Paek, S.J. Chang and H.S. Ryu. Ajou University School of Medicine, Suwon, South Korea

Objective: The aim of the study was to evaluate survival outcomes of FIGO stage IIIC and IVB endometrial cancer (EC) patients presenting primarily as nodal spreads without peritoneal carcinomatosis and to compare survival of patients who received dissection of grossly positive lymph nodes (LN) to those with microscopically positive LN.

Method: A total of 56 FIGO stage IIIC and IVB EC patients between July 2003 and February 2018 were included. Sixteen patients with co-existing ovarian malignancy (\( n = 1 \)), peritoneal carcinomatosis (\( n = 14 \)), and lung/bone metastasis (\( n = 1 \)) were excluded. Forty patients received complete staging procedures including pelvic, paraaortic, and supraclavicular lymphadenectomy and were surgically staged according to the 2009 FIGO staging system. The patients were divided into microscopically positive LN patients and macroscopically positive LN patients. Survival was analyzed using Kaplan-Meir method.

Results: Of the 40 patients, 14 (35.9%) had stage IIIIc1; 23 (59.0%) had stage IIIIc2; 2 (5.1%) had stage IVB disease; and 1 patient was lost to follow-up. The median follow-up time was 61 months (range 14 to 185 months). There were 16 patients (41.0%) with microscopic LN involvement and 23 (59.0%) with macroscopic LN involvement. Adjuvant therapies were given to 97.4% of patients (69.2% chemotherapy, 28.2% sequential chemoradiation therapy). The 5-year disease-free survival (DFS) and overall survival (OS) rates were not significantly different between microscopic and macroscopic nodal disease (DFS, 83.3% vs 86.7%, \( P = 0.917 \); OS, 93.8% vs 94.4%, \( P = 0.950 \)). See Figure 1.

Conclusion: Grossly involved LN can be completely resected in FIGO stage IIIC and IV EC patients. The survival rate of advanced EC patients with macroscopic nodal disease was not lower than that of EC patients with microscopic nodal disease, a finding that provides evidence suggestive of a therapeutic benefit for systematic lymphadenectomy and adjuvant chemotherapy in advanced EC patients presenting primarily as nodal spreads without peritoneal carcinomatosis.
A novel model to predict cancer-specific survival in patients with early-stage uterine papillary serous carcinoma (UPSC)
C. Lihua and C. Xi. Fudan University Cancer Center, Shanghai, China

Objective: Stage I–II uterine papillary serous carcinoma (UPSC) has aggressively biological behavior and leads to poor prognosis. However, clinicopathologic risk factors to predict cancer-specific survival of patients with stage I–II UPSC were still unclear. This study was undertaken to develop a prediction model of survival in patients with early-stage UPSC.

Method: Using the Surveillance, Epidemiology, and End Results (SEER) database, we identified 964 patients with FIGO stage I–II UPSC who underwent at least hysterectomy between 2004 and 2015. By considering competing risk events for survival outcomes, we used proportional subdistribution hazards regression to compare cancer-specific death (CSD) for all patients. Based on the results of univariate and multivariate analysis, variables were selected to construct a predictive model, and the results of the model were visualized by nomogram to predict the cancer-specific survival and the response to adjuvant chemotherapy and radiotherapy of stage I–II UPSC patients.

Results: The median age of the cohort is 67 years. Of all patients, 17.1% (n = 165) died of UPSC, and 8.6% died from other causes. On multivariate analysis, age (HR = 1.45, P = 0.021), tumor size (HR = 1.81, P = 0.014), and number of regional nodes removed (HR = 0.52, P = 0.003) were significantly associated with cumulative incidence of CSD. In the age ≥67 years cohort, FIGO stage I–II was a risk factor for CSD (HR = 1.83, P = 0.036), and the number of lymph node resections greater than 10 was a protective factor (HR = 0.50, P = 0.01). Both combination of adjuvant chemotherapy and radiotherapy and adjuvant chemotherapy alone decreased CSD of patients with stage I–II UPSC patients older than 67 years (HR = 0.47, P = 0.022; HR = 0.52, P = 0.024, respectively). The prediction model had great risk stratification ability as the high-risk group had a higher cumulative incidence of CSD than the low-risk group (P < 0.001). In the high-risk group, patients with postoperative adjuvant chemoradiotherapy had improved CSD compared with patients who did not receive radiotherapy or chemotherapy (P = 0.037). See Figure 1.

Conclusion: Our prediction model of CSD based on proportional subdistribution hazards regression shows good performance in predicting cancer-specific survival of early-stage UPSC patients and contributes to guiding the clinical treatment decision.
Objective: The purpose of this study was to compare intraoperative and perioperative narcotic use, recovery room time, and total hospital stay for patients treated with robotic versus laparoscopic surgery for endometrial cancer.

Method: Hospital billing records were used to identify all patients with endometrial cancer treated from January 1, 2018, through July 31, 2019, with either laparoscopy or robotic surgery, without other surgery or need for a minilaparotomy. Total narcotic use was converted to milligrams of morphine IV for the surgical dose and the total amount in recovery. Total time in recovery and length of hospital stay were calculated.

Results: There were 133 laparoscopic and 83 patient robotic surgeries because of differences in physician preference. There was no difference between the groups with respect to estimated blood loss (EBL), EtOH use, or smoking. Robotic patients had a significantly higher BMI (32.9 vs 38.4, \( P < 0.0001 \)). There was no difference between the 2 groups with respect to narcotics in surgery in milligrams of morphine (22.1 vs 20.7 mg, \( P = 0.30 \)), narcotics in recovery (4.25 vs 4.86, \( P = 0.41 \)), or total dose (26.3 vs 25.5 mg, \( P = 0.58 \)). However, robotic patients had a longer recovery room time (124.8 vs 168.4 minutes, \( P < 0.001 \)). Surgical time was longer with the robotic group (188.2 vs 204.7 minutes, \( P = 0.004 \)), but these patients were more likely to have a full lymphadenectomy (21.0% vs 44.9%, \( P = 0.003 \)). Laparoscopic patients were more likely to be discharged the same day (53% vs 18%, \( P = 0.02 \)). Total hospital time was longer with the robotic group, but this was not significant (20.8 vs 22.7 hours, \( P = 0.50 \)). See Figure 1.

Conclusion: There is no difference in narcotic use in the perioperative period with robotic surgery compared to laparoscopy. Recovery time is longer, but total hospital time is not significantly different. Same-day discharges are less frequent, but this may be more related to physician choice than to procedure given that there is no difference in perioperative narcotic use.
Objective: Brain metastases originating from a primary gynecologic malignancy are extremely rare. With the exception of choriocarcinoma, they occur in less than 2% of all gynecologic cancers. Thus, we examined patients with brain metastases from gynecologic malignancies and explored potential prognostic factors in predicting survival.

Method: Patients diagnosed with brain metastases from gynecologic malignancies at a single tertiary care center between 2008 and 2018 were included in this retrospective cohort study. Demographic and clinical data were abstracted from medical records. Survival data were analyzed on a Kaplan-Meier estimator using the log rank (Mantel-Cox) method to assess for significance.

Results: Forty-two patients met inclusion criteria and were grouped by primary cancer site: uterus (n = 24), ovary (n = 9), cervix (n = 5), and gestational trophoblastic neoplasia (n = 4). On univariate analysis, there was no significant difference in brain metastasis-specific progression-free survival (PFS-B, P = 0.4), overall survival after brain metastasis (OS-B, P = 0.7), or overall survival (OS, P = 0.7) when comparing between primary cancer site, stage, grade, or histology (Figure 1). In cervical cancer patients only, having lung metastases at time of brain metastasis diagnosis correlated to worse median OS (10.4 vs 91.2 months, P = 0.04) but did not affect PFS-B (9.1 vs 41.5 months, P = 0.2) or OS-B (1.3 vs 14.9 months, P = 0.06).

Conclusion: There is no difference in survival in patients with brain metastases from gynecologic cancers when compared by primary tumor site, stage, grade, or histology. The presence of lung metastases at the time of brain metastasis diagnosis may have a negative impact on survival in cervical cancer patients, but is not a significant predictor in other types of gynecologic cancers. However, this was a limited sample size and the results should be interpreted in this context. Larger studies are needed to validate these findings and elucidate other potential prognostic variables, which may help direct and inform patient counseling and potential treatment strategies in patients with brain metastases from gynecologic malignancies.
Trends in toxicities for women receiving adjuvant therapy for stage III uterine cancer

L.C. Chen, Y. Huang, F. Khoury Collado, C.M. St. Clair, A.I. Tergas, A. Melamed, J.Y. Hou and J.D. Wright. New York-Presbyterian/Columbia University Medical Center, New York, NY, USA, Columbia University College of Physicians and Surgeons, New York, NY, USA
Objective: Most women with stage III uterine cancer receive adjuvant therapy including chemotherapy, external beam radiation (EBRT), or combination chemoradiation following hysterectomy. We examined trends in short- and long-term toxicities associated with adjuvant therapy to better inform the selection of optimal treatment.

Method: SEER-Medicare was used to identify women age ≥65 years with stage III uterine cancer who received adjuvant chemotherapy, EBRT, or combination therapy following hysterectomy from 2000 to 2015. The association between adjuvant therapy and toxicities, including neurologic, immunologic, gastrointestinal, and genitourinary, was examined using multivariate regression after adjusting for demographic and clinical variables. We also examined the association between adjuvant therapy and hospitalization, emergency department visits, and overall and treatment-specific mortality.

Results: A total of 2,015 patients were identified including 739 (36.7%) who received chemotherapy (with or without brachytherapy), 517 (25.7%) who received EBRT (with or without brachytherapy), and 759 (37.7%) who received combination therapy. The proportion of patients receiving combination therapy or chemotherapy increased over time (Figure 1). Combination therapy was associated with a lower risk of long-term overall mortality compared to chemotherapy (HR = 0.75, 95% CI 0.64–0.88), while chemotherapy and EBRT shared a similar risk for long-term overall mortality (HR = 0.98, 95% CI 0.82–1.16). During the first 6 months of adjuvant therapy, EBRT was associated with a lower risk of toxicity compared to chemotherapy (RR = 0.62, 95% CI 0.49–0.78), while combination therapy and chemotherapy had a similar rate of toxicity (RR = 1.02, 95% CI 0.86–1.21). EBRT and combination therapy had similar risk for hospitalization (RR = 0.88, 95% CI 0.67–1.14 and RR = 0.90, 95% CI 0.72–1.12, respectively) and emergency department visits (RR = 0.81, 95% CI 0.59–1.12 and RR = 0.97, 95% CI 0.76–1.25, respectively) compared to chemotherapy. Combination therapy was associated with a lower risk of 6-month treatment-related mortality (RR = 0.48, 95% CI 0.25–0.93), while EBRT and chemotherapy had a similar risk of 6-month treatment-related mortality (RR = 1.16, 95% CI 0.62–2.15).

Conclusion: The proportion of patients receiving adjuvant combination therapy or chemotherapy has increased over time. Compared to chemotherapy, combination therapy is associated with a lower risk of long-term overall mortality and is not associated with a higher risk of toxicities, hospitalization, or treatment-related mortality.

Fig. 1. Adjuvant therapy modality for stage III uterine cancer patients from 2000 to 2015 in SEER-Medicare.

508 - Poster Session
Disparities in sub-population of Latinas with uterine cancer in U.S.: A study of 23,894 Latinas
aUniversity of California, San Francisco, San Francisco, CA, USA, bCalifornia Pacific and Palo Alto Medical Foundation/Sutter Health Research Institute, San Francisco, CA, USA, cCalifornia Pacific Medical Center, San Francisco, CA, USA, dKaohsiung Veterans General Hospital, Kaohsiung City, Taiwan

Objective: The purpose of this study is to evaluate the risk of different uterine cancer histologies among Latina subpopulations.

Method: Data were obtained from the National Cancer Data Base from 2004 to 2016. Inclusion criteria consisted of histologic code consistent with endometrial cancer (including carcinosarcoma); Hispanic origin with subgroups of Mexican/Chicano, Puerto Rican, Cuban, South or Central American, and Dominicans were extracted from non-Hispanic white women. X² analyses were used for statistics.
Results: Of the 87 patients with endometrioid carcinoma, 2% were non-Hispanic white and 5.1% were Latina. Of the Latina subgroups, the proportion of endometrioid histology was highest for the Mexican/Chicanas, 75.1%; Puerto Ricans, 73.2%; Cubans, 69.9%; and South/Central Americans, 70.0%; Dominicans had the lowest percentage at 67.1%. The proportion of serous carcinoma was highest for Dominicans, 12.6%; followed by Cubans, 9.0%; South/Central Americans, 8.9%; Puerto Ricans, 8.1%; and lowest in Mexicans at 6.8%. Compared to non-Hispanic whites, Latinas had less endometrioid (78.9% non-Hispanic white vs 76.2% Latinas) and more serous (5.8% vs 6.6%), clear cell (1.3% vs 1.6%), and carcinosarcoma (4.6% vs 5.2%) ($P < 0.001$). Compared to Mexicans, Dominicans had a higher proportion of the more aggressive cell types including serous carcinoma (6.8% Mexicans vs 12.6% Dominicans), carcinosarcoma (5.9% vs 6.3%), and clear cell (1.5% vs 2.3%) ($P < 0.001$).

Conclusion: Among Latinas, Mexican and Puerto Rican women are more likely to be diagnosed with endometrioid carcinoma. When compared to non-Hispanic whites, Latinas are more likely to be diagnosed with type 2 endometrial cancers. Dominicans, an ethnically diverse group with Afro-Latina heritage, represent the highest proportion of those with type 2 endometrial histotypes among Latinas.

509 - Poster Session
Using machine learning to create a precision prognostication system for endometrial cancer
A.M. Prassia, Y. Huangb, F. Khoury Colladoc, A.I. Tergasc, A. Melamedc, J.Y. Houc, C.M. St. Clairc and J.D. Wrightc. «Columbia University, New York, NY, USA, ªColumbia University College of Physicians and Surgeons, New York, NY, USA, ºNew York-Presbyterian/Columbia University Medical Center, New York, NY, USA

Objective: A variety of risk stratification systems have been developed to predict prognosis and tailor adjuvant therapy for endometrial cancer. These systems rely on a variety of variables including stage, histology, and age but often classify patients with widely variable risks into similar categories. We used a novel machine learning algorithm to develop a precision prognostic system for high-intermediate and high-risk endometrial cancer.

Methods: The Ensemble Algorithm for Clustering Cancer Data (EACCD) unsupervised machine learning algorithm was applied to women with uterine cancer recorded in the Surveillance, Epidemiology, and End Results database from 2004 to 2010. The prognostic system was created based on TNM stage, histology (endometrial, uterine serous papillary carcinoma, clear cell), grade, and age. The EACCD algorithm utilizes a number of steps including computation of dissimilarity and 2-phase Partitioning Around Medoids (PAM). The concordance (C-index) was used to cut dendrograms and create prognostic groups. Kaplan-Meier cancer-specific survival was employed to visualize the survival function of EACCD-based prognostic groups and AJCC groups.

Results: A total of 28,348 stage I to IIIC patients were identified. Overall 148 combinations were formed based on the applied clinical data. Out of them, 43 combinations with at least 100 patients in each individual combination were included in the computation of the machine learning algorithm (Figure 1). A cluster dendrogram was created from the EACCD. The 6 groups cut from the dendrogram by C-index of 0.65 had the following 5-year survival: group 4 = 98.7%–99.9%, group 6 = 94.9%–96.6%, group 5 = 87.6%–94.8%, group 2 = 74.2%–85.6%, group 1 = 69.5%–74.9%, and group 3 = 43.6%–66.1%. The cancer-specific survival curves for 6 prognostic groups showed good discrimination. The machine learning algorithm resulted in classification of patients with similar AJCC stages into a number of novel prognostic groups based on other clinical factors.

Conclusion: This novel machine learning algorithm demonstrates improved prognostic prediction for patients with endometrial cancer. Using machine learning to create prognostic systems for endometrial cancer allows for the integration of multiple factors to develop a precision prognostication system.
Fig. 1. (A) EACC and AJCC 6th stratification of data from SEER for patients with stage I to III uterine cancer aged ≥ 18. (B) Cluster dendogram of 6 groups from 43 combinations based on EACC machine learning algorithm. (C) Uterine cancer-specific survival of 6 EACC prognostic groups. (D) Uterine cancer-specific survival based on AJCC 6th edition.

### Table 1

<table>
<thead>
<tr>
<th>EACC prognostic groups</th>
<th>Patient combinations</th>
<th>5-year survival</th>
<th>AJCC 6th</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 3</td>
<td>(T2) or (T3a) TN0+UPSC+Grade3+Age≥50</td>
<td>43.6 - 66.1%</td>
<td>II, IIIA, IIIC</td>
</tr>
<tr>
<td></td>
<td>T3aN0+Endometrioid+Grade3+Age≥70</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>T3aN1+Endometrioid+Grade3+Age50-69</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 1</td>
<td>T3aN0 or (N1)+Endometrioid+Grade2+Age≥50</td>
<td>69.5 - 74.9%</td>
<td>IIIA, IIIC</td>
</tr>
<tr>
<td>Group 2</td>
<td>T1b (T2) N0+UPSC+Grade3+Age≥50</td>
<td>74.2 - 85.6%</td>
<td>IB, II, IIIA, IIIC</td>
</tr>
<tr>
<td></td>
<td>T2N0+Endometrioid+Grade3+Age≥50</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(T2N1) or (T3aN0)+Endometrioid+Grade2+Age50-69</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 5</td>
<td>T1aN0+Grade3+Endometrioid+Age≥70 or (UPSC+Age≥50)</td>
<td>87.6-94.8%</td>
<td>IA, IB, II, IIIA</td>
</tr>
<tr>
<td></td>
<td>T1bN0+Grade3+Endometrioid+Age≥70 or (UPSC+Age≥50)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>T2N0+Endometrioid+(Grade1+Age≥70) or (Grade2+Age≥50)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>T3aN0+Endometrioid+Grade2+Age≥70</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 6</td>
<td>T1aN0+Endometrioid+(Grade1+Age≥70) or (Grade2+Age≥50)</td>
<td>94.9-96.6%</td>
<td>IA, IB, II</td>
</tr>
<tr>
<td></td>
<td>T1bN0+Endometrioid+(Grade2+Age≥50) or (Grade1+3+Age50-69)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>T2N0+Endometrioid+Grade2+Age≤50</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>T3aN0+Endometrioid+Grade1+Age50-69</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 4</td>
<td>T1aN0+Endometrioid+(Grade1+Age&lt;70) or (Grade2+Age&lt;70)</td>
<td>98.7 - 99.9%</td>
<td>IA, IB, II</td>
</tr>
<tr>
<td></td>
<td>T1bN0+Endometrioid+Grade1+Age&lt;70</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>T2N0+Endometrioid+Grade1+Age&lt;50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

510 - Poster Session

**Brain metastases in gynecologic cancer: A case control study**

L. Buckingham, M.S. Grant, Y. Zhang and L.H. Clark. *University of North Carolina at Chapel Hill, Chapel Hill, NC, USA*

**Objective:** Excepting choriocarcinoma, brain metastases in gynecologic cancer are extremely rare. We created a 1:1 matched cohort to examine differences between women who did and did not experience brain metastases as a result of gynecologic cancer.

**Method:** Patients diagnosed with brain metastases from gynecologic malignancies from 2008 to 2018 at a single tertiary care center were included in this retrospective cohort study. Matched controls were collected. Demographic and clinical data were abstracted from medical records. Overall survival (OS) and progression-free survival (PFS) were analyzed on a Kaplan-Meier estimator using the log rank method, and Cox proportional hazards regression models were used for multivariate survival analyses.
Results: Forty-three patients met inclusion criteria and were matched to appropriate controls. Groups were well matched for age, date of diagnosis, stage, histology type, and histologic cancer grade (Table 1). Increased age at diagnosis was associated with worse OS in the control group (HR = 1.05, 95% CI 1.01–1.1) but not the brain metastases cohort (HR = 1.00, 95% CI 0.97–1.04). The majority of patients received adjuvant therapy in both groups. Brain metastases patients receiving chemotherapy had a nearly 2-fold increase in median OS (17.6 vs 37.0 months, \( P = 0.03 \)). Median OS and PFS were significantly higher in the matched cohort (PFS 18.2 vs 44.9 months, \( P < 0.001 \); OS 36 vs 64.2 months, \( P = 0.007 \)).

Conclusion: Brain metastases in gynecologic cancer are rare and associated with worse PFS and OS compared to matched controls without brain metastases. Systemic chemotherapy was associated with improved OS in patients with brain metastases, so additional therapy should be considered in patients with brain metastases who are well enough for treatment.

Table 1. Patient and tumor characteristics.

<table>
<thead>
<tr>
<th></th>
<th>Brain met cohort</th>
<th>Matched cohort</th>
<th>( p )-value (Pearson’s coefficient)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total patients (n)</td>
<td>43</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>Median age at diagnosis, GYN</td>
<td>60.3</td>
<td>57.9</td>
<td>0.3 (( r=0.70 ))</td>
</tr>
<tr>
<td>Date of diagnosis, median absolute difference (m)</td>
<td>8.9</td>
<td>0.9 (( r=0.80 ))</td>
<td></td>
</tr>
<tr>
<td>Median age at diagnosis, brain</td>
<td>62.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of gynecologic cancer (n)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uterine</td>
<td>25</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Ovarian</td>
<td>10</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Cervical</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Gestational trophoblastic neoplasia</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Stage (n)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>19</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>16</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Grade (n)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>34</td>
<td>34</td>
<td></td>
</tr>
<tr>
<td>n/a</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Median f/u (m)</td>
<td>26.3</td>
<td>41.2</td>
<td>0.02 (( r=0.40 ))</td>
</tr>
<tr>
<td>Median PFS (m)</td>
<td>18.2</td>
<td>44.9</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Median OS (m)</td>
<td>36.0</td>
<td>64.2</td>
<td>0.007</td>
</tr>
<tr>
<td>PFS, median matched difference (m)</td>
<td>8.7</td>
<td></td>
<td>0.01 (( r=0.16 ))</td>
</tr>
<tr>
<td>OS, median matched difference (m)</td>
<td>11.5</td>
<td></td>
<td>0.02 (( r=0.39 ))</td>
</tr>
</tbody>
</table>

511 - Poster Session
Does the sequencing of adjuvant chemotherapy/radiation therapy for stage III endometrial cancer affect the ability to complete chemotherapy?
B. Bloom, V. Kam, J. Hernandez and V.S. John. aHofstra - North Shore Long Island Jewish School of Medicine, New Hyde Park, NY, USA, bNorthwell Health, New Hyde Park, NY, USA, cHofstra - North Shore Long Island Jewish School of Medicine, Manhasset, NY, USA

Objective: The purpose of this study was to determine whether the sequencing of chemotherapy with radiation therapy in the adjuvant setting for stage III endometrial cancer has an impact on the ability to complete planned chemotherapy.

Method: As part of our Gynecologic Oncology Multidisciplinary Group’s initiative to establish an institutional guideline for the adjuvant treatment of stage III uterine cancer, we undertook a review of stage III cases identified by our tumor registry and departmental data base. We identified 142 cases. Data for analysis were available for 133 cases. Treatment fell into 1 of 3 categories: (1) sequential therapy with 6 cycles of carbo/taxane followed by tumor-directed radiation therapy, (2) concurrent cisplatin x2 with tumor-directed radiation therapy and 4 additional cycles of carbo/taxane, or (3) sandwich therapy with 3 cycles of carbo/taxane followed by tumor-directed radiation therapy followed by 3 cycles of carbo/taxane. We analyzed the treatment records for the ability to complete the prescribed 6
cycles, hypothesizing that there would be no difference. Because the published results of GOG 258 called into question the efficacy of concurrent treatment, we compared only sequential and sandwich therapy, using a $\chi^2$ analysis. Our calculated $\chi^2$ of 2.2 gave a probability level between 0.5 and 0.1, supporting no difference in the ability to complete chemotherapy.

**Results:** In our patient population, no difference in the ability to complete prescribed treatment was observed.

**Conclusion:** In our retrospective review of the identified cohort, we were unable to demonstrate a significant difference in treatment completion based on sequencing of chemotherapy and radiation therapy in the adjuvant setting for stage III uterine cancer. We plan a further analysis to determine effect on dose reduction and outcome.

---

**512 - Poster Session**

**Hysteroscopic morcellation in endometrial cancer diagnosis: Increased risk?**

R. Kelly, G. Contos, C.A. Walker, M. Ayoola-Adeola and I. Winer. *Karmanos Cancer Center/Wayne State University, Detroit, MI, USA, Wayne State University, Detroit, MI, USA*

**Objective:** Operative hysteroscopy requires elevated intrauterine pressures, which could lead to spread of malignant cells into the peritoneal cavity. Currently, there is a paucity of data analyzing clinical outcomes in endometrial cancer following hysteroscopic morcellation. In this study, we sought to determine whether there are increased rates of positive peritoneal cytology, lymphovascular space invasion (LVSI), or surgical upstaging in patients undergoing hysteroscopic morcellation compared to alternative biopsy methods for endometrial cancer.

**Method:** A retrospective chart review of patients from 2013 through 2018 was performed. Exclusion criteria included biopsy at outside institution, stage IV endometrial cancer known prior to biopsy, and missing data regarding biopsy method and histology. Peritoneal cytology results, LVSI, and surgical staging were compared by method of biopsy and histology using $\chi^2$ tests.

**Results:** A total of 297 patients met the inclusion criteria; 194 patients were classified as low grade (FIGO grade 1 and 2) and 103 as high grade (grade 3 and serous, clear cell, and carcinosarcoma) endometrial cancer. Fifth-three patients (18%) underwent hysteroscopy with morcellation. Alternative biopsy methods included hysteroscopy without morcellation ($n = 84$, 28%), endometrial biopsy ($n = 120$, 40%), and dilation and curettage ($n = 46$, 15%). Positive peritoneal cytology was noted in 31 cases (10%) and negative cytology in 156 (51%). Cytology was not performed in 111 cases (37%). In comparing outcomes by histologic subtypes, no difference was seen in positive cytology ($P = 0.537$ and 0.922 for low grade and high grade), stage ($P = 0.578$ and 0.119 for low grade and high grade) or LVSI ($P = 0.414$ and 0.229 for low grade and high grade).

**Conclusion:** Our study demonstrates that hysteroscopy with morcellation is a safe method for diagnosis of both low-grade and high-grade endometrial pathology and does not lead to increased dissemination of malignant cells, increased LVSI, or upstaging of patients.

---

**513 - Poster Session**

**Effectiveness and safety of continuing medical treatment for persistent early endometrial cancer in young women**

Y.T. Kim, A. Cho, J.Y. Park, D.Y. Kim, D.S. Suh, J.H. Kim and Y.M. Kim. *University of Ulsan College of Medicine, ASAN Medical Center, Seoul, South Korea*

**Objective:** Although standard treatment of endometrial cancer is hysterectomy, progestin therapy is an alternative treatment option for young patients who wish to preserve their fertility. According to current guidelines, hysterectomy with surgical staging is recommended if endometrial cancer is still present after 6 to 12 months of progestin-based therapy. In the clinical setting, if patients still want to preserve their fertility, continuing medical therapy can be considered. However, the feasibility of continuing medical treatment for nonresponders of progestin therapy has not been sufficiently established. The aim of this study is to show effectiveness and safety of medical therapy for persistent endometrial cancer in young women.

**Methods:** We retrospectively identified 36 patients with presumed stage IA, grade 1 or 2, endometrioid adenocarcinoma who have persistent disease on the biopsies after 12 months progestin-based therapy (medroxyprogesteron acetate or megestrol acetate). Persistent disease was defined as residual carcinoma or persistent lesion on endometrial biopsy. The patients who had once experienced complete response before 12 months were excluded. Data regarding clinicopathological factors and oncological and obstetrical outcomes following continuous hormonal treatment were extracted from medical records and analyzed using SPSS v21.0.

**Results:** The median age was 33 years, and the median BMI was 29.1 kg/m². Thirty-one patients had grade 1, and 5 patients had grade 2 endometrioid adenocarcinoma. The median follow-up period was 66 months. Complete response (CR) rates were 72%, and median period to CR was 19 months. Ten patients failed to CR. Eight of them underwent hysterectomy; 2 of them still continue medical therapy;
and none died of the disease. Failure to CR was associated with grade. Recurrence occurred in 9 patients, and 7 patients experienced CR after progestin retreatment. During the study period, a total of 4 pregnancies were recorded.

**Conclusion:** Continuing medical treatment appeared to be effective and safe in patients with persistent endometrial cancer after 12 months progestin-based therapy. Therefore, this can be considered for young women who still wish to preserve their fertility despite persistent disease.

514 - Poster Session

Is there a benefit of performing omentectomy for stage I high-grade endometrial cancer?


**Objective:** The aim of this study was to evaluate the role of omentectomy during staging of high-grade endometrial cancer.

**Method:** Patients who presented between 2010 and 2015 with clinical stage I serous, clear cell, carcinosarcoma, or grade 3 endometrioid carcinoma and underwent hysterectomy with adequate lymphadenectomy (defined as at least 10 lymph nodes removed) were selected. Patients who did and did not receive omentectomy were identified, and clinicopathological characteristics were compared. Overall survival (OS) was evaluated for patients diagnosed between 2010 and 2014 who had at least 1 month of follow-up following generation of Kaplan-Meier curves and compared with the log rank test. A Cox model was constructed to control for confounders.

**Results:** A total of 9,097 patients with a median age of 66 years met the inclusion criteria with an omentectomy rate of 36.3%. Patients who underwent omentectomy were older (median 66 vs 65 years, \(P < 0.001\)) and more likely to have open surgery (48.2% vs 27.2%, \(P < 0.001\)), to be of non-white race (\(P < 0.001\)) and to be managed in academic institutions (50% vs 44%, \(P < 0.001\)). Highest rates of omentectomy were observed among patients with serous tumors (53.7%) compared to those with carcinosarcoma (39.9%), clear cell (42.4%), and endometrioid (26.9%) tumors (\(P < 0.001\)). There was no difference in OS between patients who did \((n = 2,799)\) and did not \((n = 4,951)\) receive omentectomy; 3-year OS was 82.3% and 82.2%, respectively \((P = 0.61)\). After controlling for age, race, insurance, presence of comorbid conditions, history of another tumor, histology, presence of lymphovascular invasion, and receipt of adjuvant radiation therapy and chemotherapy, performance of omentectomy was not associated with better survival (HR = 0.94, 95% CI 0.84–1.05).

**Conclusion:** Routine performance of omentectomy may not be associated with a survival benefit for patients with clinical stage I high-grade endometrial cancer.

515 - Poster Session

Patterns and variability in treatment patterns for high-risk endometrial cancer

T.Y. Sia\(^a\), A.I. Tergas\(^b\), C.M. St. Clair\(^b\), F. Khoury Collado\(^b\), J.Y. Hou\(^b\), A. Melamed\(^a\) and J.D. Wright\(^b\). \(^a\)Columbia University College of Physicians and Surgeons, New York, NY, USA, \(^b\)New York-Presbyterian/Columbia University Medical Center, New York, NY, USA

**Objective:** Because of the poor prognosis after treatment with surgery alone, high-risk endometrial cancer patients are usually treated with adjuvant therapy. However, prospective trial results have reported conflicting data, and little is known about current practice patterns. We surveyed gynecologic oncologists in the United States to determine their practice patterns and preferences for adjuvant therapy in women with high-risk endometrial cancer.

**Method:** Members of the Society of Gynecologic Oncology were surveyed to determine treatment preferences for high-risk endometrial cancer, which includes stage I or II serous or clear cell adenocarcinoma, grade 3 deeply invasive endometrioid carcinoma, or grade 3 endometrioid tumors with lymphovascular space invasion (LVSI). A 24-question survey regarding adjuvant therapy recommendations for a healthy 60-year-old patient before and after reviewing the results of PORTEC 3 or GOG 258 was created and e-mailed to 1,214 gynecologic oncologists. Data were collected via REDCap. Results were analyzed using descriptive statistics, and categorical variables were compared with \(X^2\) tests.

**Results:** A total of 53 surveys were completed. The majority of responses were from practitioners in academic institutions (64.2%). Overall, 84.9% of respondents administered chemotherapy as a part of their practice. The most common adjuvant therapy for stage IB grade 3 endometrioid cancer was vaginal brachytherapy (64.6%). Vaginal brachytherapy in combination with chemotherapy was the most commonly chosen adjuvant therapy for stage IB serous carcinoma (68%). Respondents favored chemotherapy with radiation (chemoradiation) for stage IIC grade 3 endometrioid cancer (54%). For stage IIIA serous cancer, respondents were split between chemotherapy, vaginal brachytherapy with chemotherapy, or chemoradiation. Responses after reviewing the results of PORTEC 3 or
GOG 258 changed only for stage IB grade 3 endometrioid cancer, with a higher proportion of providers choosing to perform radiation (12.5% vs 15.9%) and chemoradiation (2.1% vs 6.8%, \( P = 0.014 \)) with fewer performing vaginal brachytherapy alone. See Table 1.

**Conclusion:** Although stage IB grade 3 endometrioid adenocarcinomas are considered high risk, a majority of providers surveyed would perform only vaginal brachytherapy despite the results of clinical trials. Chemoradiation is the preferred adjuvant therapy for stage IIIC grade 3 endometrioid carcinoma while adjuvant therapy patterns vary widely for stage IIIA serous cancers.

**Table 1. Adjuvant therapy recommendations pre and post PORTEC 3 and GOG 258 review.**

<table>
<thead>
<tr>
<th></th>
<th>Stage IB Gr3 Endometrioid</th>
<th>IB Serous</th>
<th>IIIC Gr3 Endometrioid</th>
<th>IIA Serous</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre (%)</td>
<td>Post (%)</td>
<td>Pre (%)</td>
<td>Post (%)</td>
</tr>
<tr>
<td>VB</td>
<td>64.6</td>
<td>56.8</td>
<td>4</td>
<td>4.5</td>
</tr>
<tr>
<td>RT</td>
<td>12.5</td>
<td>15.9</td>
<td>2</td>
<td>2.3</td>
</tr>
<tr>
<td>Chemo</td>
<td>2.1</td>
<td>2.3</td>
<td>12</td>
<td>13.6</td>
</tr>
<tr>
<td>VB + Chemo</td>
<td>18.8</td>
<td>18.2</td>
<td>68</td>
<td>65.9</td>
</tr>
<tr>
<td>Chemo/RT</td>
<td>2.1</td>
<td>6.8</td>
<td>12</td>
<td>9.1</td>
</tr>
<tr>
<td>VB + RT + Chemo</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>4.5</td>
</tr>
<tr>
<td><strong>P Value</strong></td>
<td>0.014*</td>
<td>0.519</td>
<td>0.210</td>
<td>0.784</td>
</tr>
</tbody>
</table>

Data compared with Chi Square Goodness of Fit Test

---

516 - Poster Session

**A survey of patient knowledge on contraception and endometrial cancer risk factors**

**S. Patel**, O.D. Lara, R. Tsaia and M.Y. Williams-Brown, UT Austin Dell Medical School, Austin, TX, USA, NYU Langone, New York, NY, USA, Dell Medical School at The University of Texas at Austin, Austin, TX, USA

**Objective:** The aim of this study was to assess contraception knowledge in a patient population identified to be at high risk for endometrial cancer based on common risk factors. We hypothesize that many high-risk women may be unfamiliar with contraception methods that may reduce their risk of endometrial cancer or may not be choosing contraception based on their medical comorbid conditions.

**Methods:** Women who presented to our academic associated community clinic were prescreened for eligibility. Women identified to be high risk for endometrial cancer based on common risk factors were asked to complete a voluntary questionnaire. Consent was obtained by participation. Patients were administered an anonymous and validated questionnaire on contraception knowledge with added questions on demographic factors and endometrial cancer risk factor knowledge. The anonymous survey results were entered into RedCap. Power of 0.85 and effect size of 0.15 were used. \( T \) tests were used to compare mean scores.

**Results:** The response rate was 84%; 108 women completed the questionnaire. Mean score was 36%, similar to the mean score of 36.4% documented in the studied population for the validated contraception knowledge questionnaire. Forty-eight percent reported not using birth control in the past year. Of the surveyed women who were identified to be high risk for endometrial cancer, women who self-reported a diagnosis of obesity, single, non-Hispanic, completed college or graduate level degree, had a birth control discussion with a health care provider in the past, or used birth control in the past year scored higher on the questionnaire compared to their respective counterparts. See Table 1.

**Conclusion:** Among women with risk for endometrial cancer, many women did not have knowledge about contraceptive methods. Furthermore, these methods may improve cancer risk. Providers may have bias when counseling women and counsel women with certain risk factors such as obesity more than women with other risk factors. Some patients may also be more self-aware. This highlights the importance of education and counseling by the provider for all patients identified to be at high risk for endometrial cancer. This also underlines the opportunity for providers to improve their education and counseling of patients for prevention of endometrial cancer.

**Table 1.**

<table>
<thead>
<tr>
<th></th>
<th>Overall</th>
<th>Physician diagnosis</th>
<th>Hypertension</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>Mean score (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>Overall</td>
<td>108</td>
<td>100%</td>
<td>36%</td>
</tr>
<tr>
<td>Physician diagnosis</td>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Diabetes</td>
<td></td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>Yes</td>
<td>14</td>
<td>12.96%</td>
<td>41.21%</td>
</tr>
</tbody>
</table>

---
517 - Poster Session
Retropertioneal drainage versus no drainage after pelvic lymphadenectomy for short-term outcomes of postoperative in women with gynecologic malignancies
D. Shi and Y. Zhang, Xiangya Hospital of Central South University, Changsha, China

Objective: The postoperative placement of abdominal drainage is generally considered to reduce the incidence of postoperative infection and lymphocele by adequately draining the peritoneal effusion and lymph fluid. However, it is also reported that an indwelling abdominal drainage tube may increase bed rest time, delay intestinal function recovery, and prolong hospital stay. Therefore, the aim of this study was to determine the role of postoperative placement of abdominal drainage among systematic pelvic lymphadenectomy for uterine malignancy patients and whether there is a difference in postoperative safety and complications between patients with and without abdominal drainage.

Method: A total of 305 patients with uterine malignancies (cervical cancer, endometrial cancer) undergoing systematic pelvic and/or abdominal aortic lymphadenectomy from March 2018 to July 2019 in Xiangya hospital were included. These patients were divided into 2 groups according to status of abdominal drainage, 152 in the drainage tube group and 153 in the nondrainage group. In order to analyze short-term outcomes, postoperative pain score, gastrointestinal symptoms, recovery time of intestinal function, postoperative discharge time, and incidence of postoperative lymphocele of the 2 groups were compared.

Results: Compared with systematic pelvic lymphadenectomy for uterine malignancy patients with abdominal drainage tube, patients without abdominal drainage tube achieved shorter hospital stay, shorter recovery time of gastrointestinal function, and lower pain score. There was no significant difference in the incidence of postoperative lymphatic leakage and lymphocele between the 2 groups. Gastrointestinal function recovery time (anal exhaust time, with versus without abdominal drainage tube) was 40.80 hours versus 28.08 hours ($P < 0.05$); the average postoperative hospital stay time was 7.13 days versus 5.75 days ($P < 0.05$); and the incidence of lymphatic leakage and lymphocele was 9.21% (14/152) versus 7.19% (11/153).

Conclusion: Patients without drainage had enhanced recovery after surgery and no increase in postoperative complications. The data support that postoperative placement of abdominal drainage has no benefit for short-term outcomes of patients.

518 - Poster Session
Mismatch repair deficiency is predictive of improved response to radiation therapy in patients with advanced or recurrent endometrial cancer
M.M. AlHillia, J. Sona, C. Carrb, M. Yaoa, C.M. Michenerc and P.G. Rosea. aThe Cleveland Clinic Foundation, Cleveland, OH, USA, bIcahn School of Medicine at Mount Sinai, New York, NY, USA, cCleveland Clinic, Cleveland, OH, USA

Objective: The aim of this study was to evaluate the effect of DNA mismatch repair (MMR) deficiency on survival and response to treatment in patients with advanced or recurrent endometrial cancer.

Method: Advanced (stage III–IV) or recurrent endometrial cancer cases were assessed for MMR deficiency by immunohistochemistry for MLH1, MSH2, MSH6, and PMS2 proteins on endometrial biopsy or hysterectomy. Those with loss of expression of 1 or more MMR proteins were classified as MMR-deficient. The remainder of tumors were classified as MMR-intact. Baseline clinical and pathologic factors were compared between MMR-deficient and MMR-intact patients. Progression-free survival (PFS) and overall survival (OS) were analyzed using Cox proportional hazards.

Results: Between 2013 and 2016, 247 patients were diagnosed with stage III–IV or recurrent endometrial cancer (117 stage III, 42 stage IV, and 78 recurrent). Among all patients, 162 (66.8%) were MMR-intact and 85 (34.3%) were MMR-deficient. No difference in age, BMI, race, menopausal status, or parity was noted between the 2 groups. MMR-deficient patients were more likely to have endometrioid histology (78.6% vs 48.1%, $P < 0.001$) and high-grade tumors (41.2% vs 29.6% grade 3, $P < 0.001$). There was no difference in PFS or OS
between MMR-intact and MMR-deficient patients. When analyzed by type of adjuvant therapy received, no difference in PFS or OS was noted between MMR-deficient or MMR-intact patients who received chemotherapy alone. Two-year OS was significantly improved in MMR-deficient patients receiving radiation therapy with or without chemotherapy (86.3% vs 78.5%, HR = 0.54, 0.31–0.96, P = 0.037). Similarly, patients with recurrent disease had significant improvement in OS with the use of radiation therapy (78.5% vs 68.2%, HR = 0.46, 0.25–0.86, P = 0.015), but no difference in OS was demonstrated with chemotherapy alone.

**Conclusion:** High grade endometrioid histology in patients with stage III or IV endometrial cancer is associated with MMR-deficient status. MMR-deficient is associated with improved survival in patients treated with radiation therapy and can be potentially utilized as a prognostic biomarker in these patients.

---

**519 - Poster Session**  
**Pattern of recurrence and survival rates in patients who underwent surgical staging versus non-surgical staging in type II endometrial cancer**  
**H. Kobany** a, E. Kang b, and P.C. Lim b.  
*University of Nevada School of Medicine, Reno, NV, USA, bCenter of Hope, Reno, NV, USA*

**Objective:** The aim of this study was to analyze patterns of recurrence and determine whether there is a difference in recurrence rate and survival rates in patients who underwent surgical staging versus nonsurgical staging in type II endometrial cancers.

**Method:** A retrospective chart review was performed from 2008 to 2017; 57 patients were identified as type II endometrial cancers. Thirteen patients were eliminated because of loss of follow-up or progression of disease during treatment. Forty-four patients were categorized into staged and nonsurgically staged groups. Various prognostic factors and outcomes such as progression-free survival, pattern of recurrence, and survival outcomes for the 2 groups were determined. Fisher exact test, Kaplan-Meier, and t test were performed to assess differences between the 2 groups.

**Results:** A total of 44 patients were categorized into staged (n = 34) and nonsurgically staged groups (n = 10). For the staged group the average age was 65.52 ± 10.8 years; for the nonsurgically staged group, 73.1 ± 11.5 years. Twenty-one staged patients (61.7%) were stages 1 and 2, while 7 (70.0%) nonsurgically staged patients were stage 1 and 2. Of the staged patients, 14 patients (41.2%) were upstaged to stage 3 and 4 cancers, while 3 patients (30.0%) in the nonsurgically staged group were upstaged. Twenty-five (73.5%) staged patients underwent adjuvant treatment, while 9 (26.5%) patients did not receive treatment. Eight (80.0%) nonsurgically staged patients underwent adjuvant treatment, while 2 (20.0%) patients did not receive treatment. In the staged group, 15 (44.1%) patients had recurrences (13 isolated, 86.7%; 2 to multiple sites, 13.3%), and 19 (52.9%) patients did not have recurrences. In the nonsurgically staged group, 4 (40.0%) patients had recurrences (2 isolated, 50%; 2 multiple sites, 50%), and 6 (60.0%) did not have recurrences. The 3- and 5-year survival rate for staged patients was 62.6%, and 45.4%, respectively. The 3-year survival rate for the nonsurgically staged patients was 26.3%.

**Conclusion:** Type II endometrial cancer patients who underwent complete surgical staging had a higher rate of recurrence than nonsurgically staged patients, although it was not statistically significant. Patients who were surgically staged were upstaged at a higher rate to stages 3 and 4 than nonsurgically staged patients. Progression-free survival was on average 18.5 months for staged patients and 17.3 months for nonsurgically staged patients (P = 0.239). The site of recurrence in multiple sites was noted to be lower in staged patients (13.3%) than in nonsurgically staged patients (50%) but was not statistically significant (P = 0.163). Kaplan-Meier survival analysis showed significantly lower survival rates at 3 years for nonsurgically staged patients than for surgically staged patients.

---

**520 - Poster Session**  
**Does adjuvant treatment increase risk of midurethral sling complications after concomitant surgery for endometrial cancer and stress urinary incontinence?**  

*aWomen & Infants Hospital, Brown University, Providence, RI, USA, bUniversity of Alabama at Birmingham, Birmingham, AL, USA, cWashington University School of Medicine in St. Louis, St. Louis, MO, USA, dThe Mayo Clinic, Phoenix, AZ, USA, eHartford Hospital, Hartford, CT, USA, fJohns Hopkins School of Medicine, Baltimore, MD, USA, gThe University of Texas Southwestern Medical Center, Dallas, TX, USA, hThe Mayo Clinic, Rochester, MN, USA, iUniversity of New Mexico Health Sciences Center, Albuquerque, NM, USA*

**Objective:** The aim of this study was to compare the rate of midurethral sling complications among women who received adjuvant treatment after sling placement at the time of concomitant surgery for endometrial cancer and stress urinary incontinence (SUI).

**Method:** A multicenter, prospective cohort study was conducted across 8 U.S. sites. Women diagnosed with presumed stage I–II endometrial cancer (including EIN) and SUI were eligible. This is a secondary analysis describing midurethral sling complications after
Results: Of the 111 patients who underwent concomitant surgery for endometrial cancer and SUI, 15 (13.5%) received adjuvant radiation treatment and 16 (14.4%) received adjuvant chemotherapy. Among all 111 patients, 6 adverse events (5.4%) related to sling placement were observed during the 12-month follow-up period. One return to the operating room was reported for incomplete emptying 253 days after surgery. Three mesh exposures in the vagina were reported occurring between 42 and 125 days after surgery. Two erosions in the vagina were also reported, 1 on postoperative day 57 and the other on postoperative day 360. None of the participants with complications received radiation or chemotherapy.

Conclusion: Our study demonstrates that complications associated with midurethral slings placed at the time of surgery for endometrial cancer and SUI occur approximately 5% of the time, but adjuvant treatment was not associated with increased sling complications.

521 - Poster Session
Using deep learning with convolutional neural network approach to identify the invasion depth of endometrial cancer in myometrium using MR images: A pilot study
C.C. Chang. Tri-service General Hospital, Taipei, Taiwan; National Defense Medical Center, Taipei, Taiwan

Objective: Artificial intelligence (AI) is a rising technology with the power to improve the way we analyze diagnosis through medical imaging data. The discrepancy between preoperative magnetic resonance imaging (MRI) staging and postoperative pathological staging of endometrial cancer remains unmet. This study aimed to validate the accuracy of AI to detect the depth of uterine myometrial invasion using deep learning techniques with convolutional neural networks (CNN) on MRI.

Method: This was a retrospective database evaluation of 72 patients with surgical-pathologically stage I carcinoma endometrium (53 stage IA, 19 stage IB). A total of 4,896 slices of MRI including T2-weighted imaging and contrast-enhanced T1-weighted imagery with detailed radiology report were obtained from these patients. Seventy-two patients were randomly divided into 3 groups, namely, training set, validation set, and testing set. Gynecologists labeled 33% (24 patients) of the MRI as a training set to train the deep learning model, 70.8% for T2WI by the trained deep learning model. Sixteen of 72 patients with the preoperative clinic-radiological staging and postoperative surgical-pathological staging discrepancy was noted; the diagnostic accuracy of clinical radiologists was 77.8% in this study. Our deep learning model achieved the same image discrimination rate as the radiologists. There are no significant differences between radiologists’ diagnosis and AI results in both contrast-enhanced T1WI and T2WI (P = 0.856 and P = 0.39, respectively). Different subtypes do not affect the accuracy between the radiologists and AI (P = 0.413 and P = 0.549, respectively).

Conclusion: AI has a potential role in assisting radiologists in evaluating the myometrial invasion depth of endometrial cancer by MRI. Using deep learning for image interpretation of endometrial cancer is an upward trend. Selection and establishment of the deep learning model are essential to improving its accuracy.

522 - Poster Session
Molecular classification of endometrial carcinoma across Canada: Variation in practice and opportunities to move towards consistency of care

Objective: The Cancer Genome Atlas (TCGA)-inspired molecular classification of endometrial carcinoma enables consistent classification of tumors, provides prognostic and predictive information for patients and clinicians, identifies women who may have inherited cancer syndromes, and enables stratification of clinical trials to study treatment efficacy within biologically like tumors. Herein we characterize the molecular subtype distribution, management, and outcomes of recently diagnosed (2016) endometrial carcinomas.
managed across Canada and assess conventional management compared to how molecular classification may be implemented in direct
care, reducing over-treatment in women whose endometrial carcinoma may be cured by surgery alone and avoiding under-treatment,
with implications for both patient outcomes and health resources.

**Method:** The Proactive Molecular risk classifier for Endometrial Cancer (ProMisE) subtype was determined by immunohistochemistry
for mismatch repair (MMR) and p53 proteins and focused sequencing for mutations in polymerase epsilon (POLE) gene. We collected
representative tumor specimens, clinicopathologic data, surgical management, adjuvant therapy, hereditary cancer program (HCP)
referrals, and outcome data for all endometrial carcinomas diagnosed in 2016 from participating centers.

**Results:** A total of 1,453 endometrial carcinomas from 24 centers have been identified. Complete molecular and outcome data are
reportable for 273 women at time of this submission. Distribution of ProMisE subtypes and clinicopathological features associated with
molecular subtype are consistent with previously published population-based and institutional cohorts. Pathology practice, surgical
management, adjuvant therapy, and HCP referrals and frequency of surveillance varied tremendously across centers (Table 1).

**Conclusion:** Unacceptably high variation in practice exists in endometrial carcinoma, mostly secondary to challenges in current
histomorphologic classification and risk stratification systems. Molecular classification is reproducible, provides prognostic value, and
can enable biologically informed decision making to be studied in the setting of future clinical trials. Anticipated outcome of integration
of ProMisE classification includes reducing disparity in practice and improving outcomes for women with the most common gynecologic
cancer in the developed world.

| Table 1. Univariable association of clinicopathologic characteristics by molecular subtype. |
|--------------------------------------------------|---------|---------|---------|---------|
| Variable                                         | Total   | MMRd    | p53abn  | p53wt   |
| Total                                            | 273     | 84 (30.8%) | 57 (20.9%) | 124 (45.4%) | 8 (2.9%) |
| Age at dx (categorised)                         |         |         |         |         |         |
| <40                                              | 8 (2.9%) | 1 (1.2%) | 0 (0%)  | 7 (5.6%) | 0 (0%)  |
| 40-60                                            | 87 (31.9%) | 23 (27.4%) | 9 (15.8%) | 49 (39.5) | 6 (7.5%) |
| >60                                              | 178 (65.2%) | 60 (71.4%) | 48 (42.4%) | 68 (54.8%) | 25 (25.0%) |
| Obese (BMI ≥30)                                  | 149 (63.9%) | 45 (65.2%) | 27 (49.1%) | 75 (74.3%) | 2 (25.0%) |
| Histologic subtype                               |         |         |         |         |         |
| Endometroid                                      | 207 (75.8%) | 75 (89.3%) | 7 (12.2%) | 118 (95.2%) | 6 (75%)  |
| Non-endometroid                                  | 66 (24.2%) | 9 (10.7%) | 50 (86.0%) | 6 (4.8%) | 27 (25%) |
| - Serous                                         | 35 (12.8%) | 3 (3.6%) | 31 (54.3%) | 1 (0.8%) | 0 (0%)   |
| - Clear cell                                     | 4 (1.5%) | 0 (0%) | 3 (53.3%) | 1 (0.8%) | 0 (0%)   |
| - Carcinosarcoma                                 | 6 (2.2%) | 0 (0%) | 6 (10.5%) | 0 (0%) | 0 (0%)   |
| - Dediff/Undiff                                  | 4 (1.5%) | 3 (3.36%) | 1 (1.8%) | 0 (0%) | 0 (0%)   |
| - Mixed IC with serous and/or CCC               | 14 (5.1%) | 2 (2.4%) | 8 (14.0%) | 2 (1.6%) | 2 (25%)  |
| - Other*                                         | 3 (1.1%) | 1 (1.2%) | 1 (1.8%) | 1 (0.8%) | 0 (0%)   |
| Tumour grade                                     |         |         |         |         |         |
| Grade 1/2                                        | 183 (67.0%) | 64 (76.2%) | 3 (5.3%) | 112 (90.3%) | 4 (50%)  |
| Grade 3                                          | 90 (33.0%) | 20 (23.8%) | 54 (94.7%) | 12 (9.7%) | 4 (50%)  |
| FIGO stage                                       |         |         |         |         |         |
| I                                                | 208 (76.2%) | 66 (78.6%) | 33 (57.9%) | 102 (82.3%) | 7 (87.5%) |
| II-IV                                           | 54 (19.8%) | 16 (19.0%) | 21 (36.8%) | 16 (12.9%) | 1 (12.5%) |
| LVI                                              |         |         |         |         |         |
| Negative                                         | 166 (60.8%) | 41 (48.8%) | 35 (61.4%) | 85 (68.5%) | 5 (62.5%) |
| Positive                                         | 94 (34.4%) | 40 (47.6%) | 19 (33.3%) | 32 (25.8%) | 3 (37.5%) |
| - Focal                                          | 7 (2.6%) | 4 (4.8%) | 1 (18%) | 1 (0.9%) | 1 (12.5%) |
| - Extensive                                      | 11 (40%) | 3 (3.6%) | 1 (18%) | 5 (40%) | 2 (25%)  |
| - Extent NOS                                     | 76 (27.8%) | 33 (39.2%) | 17 (29.8%) | 26 (20.9%) | 0 (0%)   |
| LND performed?                                   |         |         |         |         |         |
| Yes                                              | 116 (42.5%) | 38 (45.8%) | 43 (75.4%) | 36 (29.0%) | 3 (37.5%) |
| No                                               | 148 (54.2%) | 45 (54.2%) | 11 (19.3%) | 83 (67.0%) | 5 (62.5%) |
| Adjuvant Rx?                                     | 124 (45.4%) | 38 (45.2%) | 44 (77.2%) | 38 (30.6%) | 4 (50%)  |
| MMR HIC testing reported locally                 | 51 (18.7%) | 19 (22.6%) | 7 (12.3%) | 24 (19.4%) | 1 (12.5%) |
| p53 HIC testing result reported locally          | 60 (22.0%) | 13 (15.5%) | 33 (57.9%) | 14 (11.3%) | 0 (0%)   |
| HCP referral made                                | 32 (11.7%) | 17 (20.2%) | 7 (12.3%) | 7 (5.6%) | 1 (12.5%) |

*Other* histology included intestinal differentiated mucinous adenocarcinoma of the endometrium, a mixed endometroid, MMMT and
dedifferentiated carcinoma and a mixed serous and clear cell carcinoma.

**Missing data (FIGO stage, LVI, LND status) for non-surgically managed patients were considered in the calculations for percentage
values above.

523 - Poster Session
Phase II trial of vaginal cuff brachytherapy followed by dose-dense chemotherapy in early-stage endometrial cancer patients
with enriched, high-intermediate risk factors for recurrence
T. Castellano, J.B. Maxwell, A. Walter, J.S. Thompson and L.M. Landrum. *The University of Oklahoma Health Sciences Center, Oklahoma
Objective: The purpose of this study was to determine the feasibility of treatment with vaginal cuff brachytherapy (VCB) followed by 3 cycles of dose-dense paclitaxel and carboplatin chemotherapy (ddPC) in an enriched, high-intermediate-risk population of patients with early-stage endometrial cancer following at least hysterectomy.

Method: A phase II clinical trial of patients with presumed early-stage endometrial cancer were treated with VCB (2,100 cGy) followed by 3 cycles of carboplatin (AUC 6) and paclitaxel (175 mg/m²) following surgery. The primary endpoint was proportion of patients completing both VCB and ddPC. Based on the 87% and 91% completion of therapy rates in the GOG 249 protocol arms, the regimen will be considered feasible if 85% of enrolled patients complete the study. Secondary outcomes include short- and long-term treatment toxicities, recurrence rate, and progression-free survival. Toxicity assessments were patient reported as well as those resulting in delays or dose modifications.

Results: A total of 39 patients were screened, of the 32 evaluable patients included, the median age was 64.5 years; the median BMI was 35.1; a majority 18/32 (56.3%) were pure endometrioid histology; 18/32 (52.4%) were stage Ib; and 21/32 (65.6%) were fully staged including lymphadenectomy. In total, 4/32 (12.5%) participants were removed from study for renal insufficiency, paclitaxel reaction, treatment refusal, and withdrawal of consent. Median time to VCB completion was 11 days with 29/32 (90.6%) patients completing all 3 fractions of VCB. Acute toxicities with VCB included fatigue (19%) and dysuria (19%). In total, 28/32 (87.5%) received any chemotherapy, and 26/32 (81.3%) completed 3 cycles without delay. Grade 3 or 4 ddCT toxicities included decreased absolute neutrophil count (17%) and infusion reaction (10%). At a median follow-up of 11 months, 91% of patients remained progression free. Three patients experienced a recurrence; they occurred both locally and distant.

Conclusion: Adjuvant therapy with both VCB and ddCT is feasible and well-tolerated in a high-risk population with endometrial carcinoma. Data collection and maturation is ongoing.

---

Financial Toxicity and Disparities

**524 - Poster Session**
**Trends in referral and management of abnormal Pap tests by race at an academic colposcopy clinic**

S. Alimena, B.L. Manning-Geist, N. Penas, A. Vitchens and S. Feldman. Massachusetts General Hospital, Boston, MA, USA, Brigham and Women’s Hospital and Harvard Medical School, Boston, MA, USA

Objective: This study examined management of abnormal Pap tests by race among women referred to an academic colposcopy clinic, given that minority women have higher rates of cervical cancer and poorer outcomes.

Method: A prospective registry of patients referred for abnormal Pap or human papilloma virus (HPV) testing to an academic colposcopy clinic was queried from 2008 to 2018. Patients were managed according to ASCCP guidelines. Women with missing race, missing cytology results, prior hysterectomy, or history of cervical, vulvar, or vaginal cancer before their first visit were excluded. Poisson and logistic regression models were performed to evaluate the associations between race and colposcopy, loop electrosurgical excision procedure (LEEP), and cancer rates. Models were adjusted for referral Pap cytology, HPV status, year of visit, age, insurance, pregnancy, number of sexual partners, and smoking status.

Results: A total of 4,506 women were included (56.1% white, 43.9% non-white), with an average age of 33.9 ± 12.4 years. Referral rates for high-grade cytology were higher among white (22.5%) than among non-white women (17.5%, \( p = 0.0006 \)), and positive HPV testing was also more likely among white (7.8%) than among non-white women (6.0%, \( p < 0.001 \)). The colposcopy incidence rate was slightly higher among black (IRR adjusted = 1.11, 95% CI 1.03–1.19, \( p = 0.006 \)) and Hispanic women (IRR adjusted = 1.13, 95% CI 1.06–1.21, \( p = 0.003 \)) than among white women (see Table 1). Hispanic women were significantly more likely to undergo LEEP (OR adjusted = 1.26, 95% CI 1.01–1.58, \( p = 0.04 \)). However, no significant differences in diagnoses of cancer, ACIS, or high-grade histology were noted by race during the study period.

Conclusion: Minority women in our clinic undergo an increased number of interventions compared to white women after controlling for confounding factors, but overall had similar rates of cancer as white women. The increased number of procedures may reflect the successful work of our patient navigator in helping patients comply with care or patient preferences for care.

Table 1. Poisson regression analysis for the association between race and the number of colposcopies performed per patient.

<table>
<thead>
<tr>
<th>Race</th>
<th>Number of colposcopies</th>
<th>Crude IRR (95% CI)</th>
<th>Crude p-value</th>
<th>Adjusted* IRR (95% CI)</th>
<th>Adjusted* p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>2,456</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>1,094</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-white</td>
<td>856</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mean ± SD</td>
<td>IRR (Reference)</td>
<td>95% CI</td>
<td>P-value</td>
<td></td>
</tr>
<tr>
<td>------------------------</td>
<td>-----------</td>
<td>-----------------</td>
<td>--------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>1.55 ± 1.18</td>
<td>1.00 (Reference)</td>
<td>&lt;0.0001</td>
<td>&lt;0.0001</td>
<td></td>
</tr>
<tr>
<td>Non-white</td>
<td>1.76 ± 1.29</td>
<td>1.14 (1.09-1.19)</td>
<td>0.0001</td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>1.79 ± 1.30</td>
<td>1.16 (1.09-1.23)</td>
<td>0.20</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>1.76 ± 1.32</td>
<td>1.14 (1.06-1.22)</td>
<td>0.06</td>
<td>0.09</td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>1.67 ± 1.25</td>
<td>1.08 (0.96-1.20)</td>
<td>0.06</td>
<td>0.06</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>1.72 ± 1.22</td>
<td>1.11 (1.00-1.25)</td>
<td>0.06</td>
<td>0.006</td>
<td></td>
</tr>
</tbody>
</table>

SD, standard deviation; IRR, incidence rate ratio.
*Adjusted for year of visit, age, insurance, number of sexual partners, pregnant at initial visit, smoking status, referral cytology and HPV status.

---

525 - Poster Session
Impact of social services on depression and treatment outcomes amongst women with locally advanced cervix cancer
E.T. Evansa, K.G. Essela, S.E. Johnstona, D. Zhaoa, K.N. Mooreb and L.L. Holmana. aThe University of Oklahoma Health Sciences Center, Oklahoma City, OK, USA, bThe University of Oklahoma Stephenson Cancer Center, Oklahoma City, OK, USA

Objective: The purpose of this study was to examine the impact of interventions targeted at depression and sociodemographic barriers to care on outcomes of patients with locally advanced cervical cancer (LACC) undergoing primary chemoradiation.

Method: We conducted a retrospective review of all patients undergoing primary chemoradiation for LACC at our tertiary care center from January 2017 to January 2019. The Patient Health Questionnaire-9 (PHQ-9) is a screening tool for depression that has been validated for use in cancer patients. It includes a broad spectrum of major depressive disorder symptoms graded on a scale from 0 to 27. PHQ-9 scores were obtained at the initial visit and reviewed following treatment completion. Social services available included medication, financial, insurance registration, and transport and lodging assistance, as well as emergency funds.

Results: Of the 55 patients who met inclusion criteria, median age at diagnosis was 47 years (range 27–82 years); 36 patients (65%) were Caucasian; and 22 (40%) were stage IB. At the time of initial visit, the median PHQ-9 score was 7.5 (range 0–25), and 14 patients (25.45%) had a score of 15 or more. Following treatment completion, PHQ-9 scores improved by 2.17 points with a median PHQ-9 score of 5 (range 0–27). Thirty-seven patients (67.27%) utilized at least one social service. Higher initial PHQ-9 score resulted in an increased risk of death: for each point in initial PHQ-9 score, the risk of death increased by 15% (P = 0.03). Higher PHQ-9 score at diagnosis was associated with higher pain scores (P = 0.02). A decrease in PHQ-9 from initial to post-treatment evaluation was associated with an improvement in pain (P = 0.03). Patients who utilized social services trended toward a PHQ-9 fall of 2.50 points, while those who did not trended toward a PHQ-9 rise of 1.50 points (P = 0.66). When stratified by income, patients with a median income <$50,000 who used social services experienced a PHQ-9 score drop of 4 points, whereas those who did not had a PHQ-9 score rise of 1.5 points, but this was not significant (P = 0.09). Therapy duration, distance from hospital, and insurance status were not associated with initial nor change in PHQ-9 score (P > 0.05).

Conclusion: High PHQ-9 scores, as a measure of depression, are associated with worse outcomes among patients with LACC undergoing primary chemoradiation. Efforts targeted at alleviating social and demographic barriers to care may improve depression among the most resource-poor patients.

---

526 - Poster Session
Crowd-sourcing as a novel tool to measure financial toxicity in patients with ovarian cancer
K.M. Essella,b, C.N. Jansena, H. Stack-Dunnbiera and M.R. Hackerab, aBeth Israel Deaconess Medical Center, Boston, MA, USA, bHarvard Medical School, Boston, MA, USA

Objective: Our objective was to use a novel online crowd-sourcing method to measure financial toxicity; quality of life (QOL); and cost-coping strategies among individuals diagnosed with ovarian cancer.

Method: We administered an online survey via Facebook that included demographic and disease questions, the Comprehensive Score for Financial Toxicity (COST) tool, and the EQ-5D-3L to measure health-related QOL. Based on our prior work, we defined high financial toxicity as a COST score ≤23. We assessed correlation (r) of the COST scores with self-reported overall health and QOL. We calculated risk ratios (RR) and 95% confidence intervals (CI) for the associations between high financial toxicity and cost-coping strategies. Data are presented as percentage or median (interquartile range).
**Results:** Of 576 people who clicked the link, 317 completed the survey, for a response rate of 55%. We excluded 11 who did not have ovarian cancer and 117 with incomplete data. Among the 189 respondents, 90% were white; median age at diagnosis was 55 (49–62) years; and 67% had stage III or IV disease. Most had private insurance (66%), and 26% had Medicare only. Median annual income was $60,000 to <$80,000; median COST score was 23 (14–32); and 51% reported high financial toxicity. Financial toxicity did not vary by geographic region (P = 0.29). Greater financial toxicity was significantly correlated with poorer health (r = 0.31, P < 0.001) and worse QOL (r = 0.50, P < 0.001). High financial toxicity was significantly associated with cost-coping strategies, such as spending less on basic goods (RR = 4.5, 95% CI 2.4–8.3), borrowing money for medical expenses (RR = 6.3, 95% CI 2.8–14.2), and delaying or avoiding care (RR = 7.0, 95% CI 2.7–17).

**Conclusion:** Among a national cohort of well-insured ovarian cancer patients surveyed through a novel crowd-sourcing method, 51% had high financial toxicity. High financial toxicity was significantly associated with worse QOL and overall health, as well as several cost-coping strategies, such as borrowing money and delaying or avoiding medical care.

---

**527 - Poster Session**

**Stage at presentation and travel time in patients with cervical cancer treated at a tertiary care center with rural referral network**

J. Kelley, C. McBride, M. DeSarno, E. Everett, C. Wong and E. Cantillo. *University of Vermont College of Medicine, Burlington, VT, USA, University of Vermont Medical Center, Burlington, VT, USA, University of Vermont, Burlington, VT, USA*

**Objective:** The purpose of this study was to determine whether travel greater than 1 hour for gynecologic oncology specialist care has an impact on stage at presentation, overall survival (OS), or progression-free survival (PFS) for patients with cervical cancer treated at a rural tertiary referral center.

**Method:** This is a retrospective cohort study of 143 patients treated at the University of Vermont Medical Center (UVMMC) with cervical cancer from 2008 to 2018, with data obtained from the UVMMC Cancer registry. Median income by zip code was obtained from U.S. Census data and analyzed with 2-sample Wilcoxon tests. Stage, length to first treatment, insurance type, and comorbid conditions were analyzed with logistic regression. Kaplan-Meier curves were used for analysis of OS and PFS.

**Results:** Of the 143 patients analyzed, 79 lived more than 1 hour away, while 64 lived less than 1 hour away. Patients traveling >1 hour from UVMMC were 4.5 times more likely to present with stage III than with stage I disease (P = 0.002). Of patients <1 hour away, 62% presented at stage I compared to 43% living >1 hour away. Median income by zip code for those living >1 hour away from UVMMC was significantly less than that for those traveling <1 hour (mean $53,925 compared to $63,356, respectively, P < 0.0001). Age, race, smoking status, BMI, insurance status, hypertension, diabetes, and marital status were not significantly different between the 2 groups. Patients who lived >1 hour from UVMMC had a significantly shorter time (in days) from their first gynecologic oncology consultation to their first date of treatment, with a mean of 16 days compared with 25 days (P = 0.01). OS and PFS were decreased for patients traveling >1 hour for treatment (HR = 1.66 and 1.84, respectively), but this was not statistically significant (P = 0.13).

**Conclusion:** This study showed that patients with cervical cancer living more than 1 hour from a gynecologic oncologist present at a later stage than those who travel less than 1 hour. Although OS and PFS were not statistically significantly decreased for patients traveling more than 1 hour compared to those who traveled less than 1 hour, this is likely due to the small sample size, as we know that stage has an impact on OS. Additional research needs to be performed to identify barriers to health care delivery in rural catchment areas.

---

**528 - Poster Session**

**Implementation of culturally competent and peer-driven counseling to increase breast and cervical cancer screening in the Gulf Coast region of Alabama**

S.A. Stringfellow, L. Minchew, J.A. Lowman, A. White, T. Poosarla and J.Y. Pierce. *Mitchell Cancer Institute, University of South Alabama, Mobile, AL, USA*

**Objective:** In Alabama, women have been shown to have mortality from breast cancer higher than the U.S. average, and black women are twice as likely as white women to die from cervical cancer. Despite the Alabama Breast and Cervical Cancer Early Detection Program (ABCCEDP) providing free screenings to eligible women, screening rates have remained unchanged in recent years. This project seeks to demonstrate that provision of peer support may address cultural and health literacy needs for cancer prevention education, increase motivation for screening attendance, and improve cancer screening adherence.

**Method:** A racially and ethnically diverse group of breast and cervical cancer survivors and lay health educators was trained on these cancers, screening needs and behaviors, and other health literacy topics. Survivors received training in sharing their testimony of the journey from cancer detection through treatment to engage women to participate in cancer screening. Cancer survivors were partnered
with lay health educators to promote the benefits of cancer screening while serving as peer counselors and providing patient navigation for services. Surveys were conducted both on training evaluation and educational event evaluations to determine appropriateness of the content as well as motivation to seek screening after participation in the events.

**Results:** Within 6 months of implementation, 7 events were held by 10 survivor/lay health educator dyads reaching a total of over 300 women in the community. Training for our survivors showed an increase in knowledge of breast and cervical cancer topics from 70% to 90%. The average age of attendees was 60 years. Of these women, 66% reported having had a breast/pelvic examination in the last year; 71% reported having had a mammogram in the last 2 years; and 71% reported having had a Pap smear within the past 3 years. The most commonly cited barrier to care was cost of the examination and doctor visit, as reported by 63% of participants. Of all attendees, 68% reported improved self-efficacy as a result of the program.

**Conclusion:** This pilot program demonstrates the feasibility of implementing a culturally competent and peer mentorship program to increase the health literacy and screening rates among populations of rural, low socioeconomic, and/or ethnically diverse communities.

---

**529 - Poster Session**

**Financial toxicity begins early in the treatment course and correlates with gynecologic cancer patients’ quality of life and self-reported health status**

M.I. Liang, M. Pisu, S.S. Summerlin, T.K.L. Boitano, C. Blanchard, S. Bhatia and W. Huh. *University of Alabama at Birmingham, Birmingham, AL, USA*

**Objective:** We sought to evaluate the trajectory of financial toxicity in gynecologic cancer patients, hypothesizing that it would worsen as costs accumulated, and to determine the correlation between financial toxicity and other patient-reported outcomes.

**Method:** We conducted a longitudinal survey of gynecologic cancer patients starting a new line of therapy for primary/recurrent disease and administered surveys at baseline, 3 months, and 6 months. We used the Comprehensive Score for Financial Toxicity (COST) of <26 as a threshold for financial toxicity with a higher score indicating less financial toxicity; the Functional Assessment of Cancer Therapy-General (FACT-G) to measure quality of life (QOL) with a higher score indicating better QOL; and self-reported health on a scale of 1 (poor) to 5 (excellent). We calculated descriptive statistics, repeated measures logistic regression models, one-way repeated ANOVA, and correlation coefficients.

**Results:** With 121 baseline participants, 111 (92%) completed follow-up at 3 months and 90 (74%) at 6 months. Average age was 59 years; 29% were minorities; 50% had income <$40,000; 7% were uninsured; and 31% used financial assistance during the study period. Compared to 54% of patients with financial toxicity at baseline, the proportion of financial toxicity did not differ at 3 months (50%, $P = 0.27$) and decreased at 6 months (46%, $P = 0.04$). There was no significant change in average COST over the study period ($P = 0.33$) (Figure 1), even when adjusted for age, income, and any use of financial assistance ($P = 0.30$). Findings were similar when stratified by baseline presence ($P = 0.10$) or absence of financial toxicity ($P = 0.48$) (Figure 1). There was no significant change in average QOL score (70.8, 71.0, 72.8, $P = 0.68$) or self-reported health status (2.8, 2.7, 2.8, $P = 0.55$) over the study period. Less financial toxicity strongly correlated with better QOL ($r = 0.53$, $r = 0.61$, $r = 0.60$, $P < 0.01$) and moderately correlated with better self-reported health score ($r = 0.30$, $r = 0.44$, $r = 0.52$, $P < 0.01$) at all time points.

**Conclusion:** The frequency of financial toxicity decreased by 8% at 6 months. Patients with and without financial toxicity at baseline did not have a significant change in average financial toxicity score during the 6 months after starting a new treatment. Financial toxicity score correlated with other patient-reported outcomes throughout treatment. These findings endorse the early timing of financial toxicity interventions and the potential for reducing financial toxicity to improve patient QOL.
**Objective:** The aim of this study was to identify possible racial disparities in care and clinical risk factors associated with delayed referral or treatment in women with uterine cancer in a racially diverse patient population at an urban academic medical center.

**Method:** Demographic and clinicopathologic data were abstracted from patients' records who had primary staging surgery or neoadjuvant chemotherapy for uterine cancer at our institution from January 2016 to July 2017. Time from presentation to referral to gynecologic oncology and treatment as well as time from diagnosis to referral and treatment were recorded. Bivariate analysis was performed to assess the association between clinical variables and delayed referral or treatment (defined as greater than or equal to 14 days and 28 days, respectively).

**Results:** A total of 171 patients were included. A nonsignificant trend toward delayed referral was noted for non-white compared to white patients ($P = 0.09$). The median time from diagnosis to referral was 8 days for white patients and 10.5–11 days for non-white patients; this difference was not statistically significant ($P = 0.75$). Patients with early-stage (I or II) cancer were more likely to be referred (OR = 0.21, 95% CI 0.08–0.59) or treated late (OR = 0.28, 95% CI 0.09–0.88) than those with late-stage (III and IV) cancer. Patients initially evaluated in an outpatient gynecology clinic were more likely to experience delays in referral (OR = 4.11, 95% CI 1.55–10.91) or treatment (OR = 12.7, 95% CI 1.95–18.82) than those evaluated in the emergency department. For time from diagnosis to treatment, patients initially evaluated in an outpatient clinic were more likely to experience delays in treatment (OR = 2.48, 95% CI 1.06–5.8). See Table 1.

**Conclusion:** While there was no statistically significant association between race and a delay in referral or treatment (time from presentation to referral or treatment), there was a trend toward delay in both. Non-white patients had longer median time between diagnosis and referral than white patients, although this was not statistically significant and could be due to our limited sample size. Clinical risk factors for delay in referral and treatment included initial presentation at an outpatient gynecologic clinic and early-stage disease. Next steps currently in progress include looking at median time between presentation to referral and treatment.

**Table 1.** Clinical characteristics of patients included in the study classified by time to referral to gynecologic oncology.
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Timely Referral* (N = 28)</th>
<th>Delayed Referral (N= 142)</th>
<th>OR</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>64.1 ± 11.6</td>
<td>65.0 ± 11.4</td>
<td>0.70</td>
<td>0.56-1.02</td>
<td>0.70</td>
</tr>
<tr>
<td>Missed appointments</td>
<td>0.5 (0, 5)</td>
<td>1 (0, 3)</td>
<td>0.97</td>
<td>0.30-2.80</td>
<td></td>
</tr>
<tr>
<td>Number of imaging studies prior to presentation</td>
<td>2 (1, 3)</td>
<td>2 (1, 3)</td>
<td>0.70</td>
<td>0.30-2.80</td>
<td></td>
</tr>
<tr>
<td>Time from diagnosis to treatment (days)</td>
<td>29.5 (16, 37)</td>
<td>70 (45, 142)</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>6 (21.4)</td>
<td>27 (19.0)</td>
<td>-</td>
<td>-</td>
<td>0.91</td>
</tr>
<tr>
<td>Black</td>
<td>11 (39.3)</td>
<td>64 (45.1)</td>
<td>1.29</td>
<td>0.43-3.86</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>7 (25.0)</td>
<td>36 (25.4)</td>
<td>1.14</td>
<td>0.34-3.82</td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>4 (14.3)</td>
<td>15 (10.6)</td>
<td>0.83</td>
<td>0.20-3.50</td>
<td></td>
</tr>
<tr>
<td>Dichotomized race</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.09</td>
</tr>
<tr>
<td>White</td>
<td>6 (21.4)</td>
<td>27 (19.0)</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Non-white‡</td>
<td>22 (78.6)</td>
<td>115 (81.0)</td>
<td>1.16</td>
<td>0.43-3.15</td>
<td></td>
</tr>
<tr>
<td>Stage§</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Early stage (I and II)</td>
<td>9 (39.1)</td>
<td>90 (75.0)</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Late stage (III and IV)</td>
<td>14 (60.9)</td>
<td>30 (25.0)</td>
<td>0.21</td>
<td>0.08-0.59</td>
<td></td>
</tr>
<tr>
<td>Histology</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.02</td>
</tr>
<tr>
<td>Endometrioid</td>
<td>9 (32.1)</td>
<td>80 (56.3)</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Non-endometrioid†</td>
<td>19 (67.9)</td>
<td>62 (43.7)</td>
<td>0.37</td>
<td>0.15-0.88</td>
<td></td>
</tr>
<tr>
<td>Site of initial evaluation&amp;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.009</td>
</tr>
<tr>
<td>Emergency department</td>
<td>10 (35.7)</td>
<td>17 (12.6)</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Outpatient gynecology clinic</td>
<td>16 (57.1)</td>
<td>112 (83.0)</td>
<td>4.11</td>
<td>1.55-10.91</td>
<td></td>
</tr>
<tr>
<td>Inpatient admission</td>
<td>2 (7.1)</td>
<td>6 (4.4)</td>
<td>1.76</td>
<td>0.29-10.85</td>
<td></td>
</tr>
<tr>
<td>Time to treatment#</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Timely treatment</td>
<td>13 (50.0)</td>
<td>5 (3.7)</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Delayed treatment</td>
<td>13 (50.0)</td>
<td>132 (96.4)</td>
<td>26.40</td>
<td>6.47-107.69</td>
<td></td>
</tr>
</tbody>
</table>

Unless otherwise noted, continuous data in white are presented as median (interquartile range). Data with plus-minus values represent means ± standard deviation. Categorical data in grey are presented as N (%) associated with odds ratios and 95% confidence intervals.

*Timely referral is defined as less than 14 days from diagnosis to referral. Delayed referral is defined as greater than or equal to 14 days from diagnosis to referral.

‡A combination of all three non-white ethnic groups (Black, Hispanic, Asian)

§Based on N = 143 observations (28 patients with unstaged or missing staging information)

†A composite of all other non-endometrioid histologies

&Based on N = 163 observations (8 patients with unknown site of initial evaluation)

#Timely treatment is defined as less than 28 days from diagnosis to surgery or chemotherapy. Delayed treatment is defined as greater than or equal to 28 days from diagnosis to treatment.

531 - Poster Session

**Higher distress scores associated with reduced ability to complete prescribed gynecologic cancer therapy**

N.C. Nyakudarika, E.L. Pineda, R. Machicado, M. Zakhour, A.K. Sinno, and C.H. Holschneider. University of California, Los Angeles, Los Angeles, CA, USA, Olive View-UCLA Medical Center, Sylmar, CA, USA, Olive View-UCLA Medical Center, Los Angeles, CA, USA, David Geffen School of Medicine at UCLA, Los Angeles, CA, USA

**Objective:** The association of social determinants of health with oncologic outcome is extensively described in the literature. The mechanism by which these social determinants have a direct impact on oncologic outcome is not clearly known. The aim of this study is to investigate whether a priori patient-reported distress levels, as measured by validated toolkits, correlate with treatment interruption and nonadherence to care.

**Method:** This Institutional Review Board-approved cross-sectional study was conducted at a safety net hospital between August 2018 and February 2019. The National Comprehensive Cancer Network (NCCN) Distress Thermometer (DT) was administered and supplemented by surveys adapted from the Health Leads Screening Toolkit and the Emotion Thermometers Tool (ETT). Survey responses were analyzed, and data were abstracted to quantify referrals to ancillary services, emergency room visits, hospital admissions, and adherence to recommended treatments in the 3 months before and after survey administration. Statistical analysis was performed using nonparametric tests.

**Results:** The study included 122 patients; the majority were Hispanic (60.5%). Patients receiving treatment (n = 42) were more likely to screen positive for distress (NCCN DT ≥ 5 or ETT ≥ 5) than those in post-treatment surveillance (n = 80): NCCN DT (40.5% vs 27.5%, P =
Results:
Interviews were audio-recorded, transcribed, and summarized. Semistructured utilizing 6 questions focused on personal challenges and strategies related to accessing and obtaining cancer care. Twenty women with confirmed (19) or suspected (1) gynecologic malignancy were interviewed. Of the 20 participants, 11 were aware of local or regional alternative sites for cancer care; 5 had prior unfavorable experiences at another facility. Barriers to travel included time, cost, securing child care and companionship for appointments, navigating to the cancer center, and physical discomfort. Participants frequently cited social support and companionship as important facilitators of travel for care and in some cases relied on donated or loaned money and vehicles. Participants reported significant energy expenditure scheduling around travel, coordinating vacation/time off from work with arrangements, and arranging overnight stays near the cancer center. Suggestions for care improvement included travel vouchers, transportation provided by the cancer center, signage and personnel to help with navigation, and appointments later in the day. Participants were generally supportive both of in-person oncologist outreach to rural areas and appointments via telemedicine, although a few preferred the current infrastructure.

Conclusion: Patients who travel long distances for gynecologic cancer care take on significant burdens related to travel and rely heavily on social and financial support. Interventions should be developed and evaluated to reduce the burden of long-distance travel and develop efficient methods of outreach, including telemedicine.

Table 1. Challenges and barriers to travelling for cancer care identified by participants.

<table>
<thead>
<tr>
<th>Challenges and barriers</th>
<th>Illustrative quotes (interview ID)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timing and duration of the trip</td>
<td>“Mostly it’s just timing. Sometimes I have to be here at, you know, nine o’clock in the morning or 10, which means I have to get up at six. Where normally I work a second shift, and so that’s kind of a ‘try to wake up, try to wake up,’ …Time constraint is definitely an issue.” (#11)</td>
</tr>
<tr>
<td>Securing companionship during the trip, which is especially important in the event of acute illness or side effects</td>
<td>“With this new chemo I’m taking, I don’t really have to have anybody with me, but that was a little scary at first when I did come down by myself… with the other kind of chemo that I was taking, if you should happen to get sick, then you got about an hour and a half’s drive.” (#18)</td>
</tr>
<tr>
<td>Difficulties navigating</td>
<td>“Just the drive itself, the distance. Sometimes traffic’s a pain, but the biggest pain is parking…the road closures don’t help. I’m directionally challenged. I have to figure out a route, and as they change the work areas and stuff, it’s been a challenge, but I’m able to navigate it.” (#10)</td>
</tr>
<tr>
<td>Mode and/or cost of travel</td>
<td>“It was harder before he got his raise and stuff, but now we’re a little bit more comfortable… It’s easier for check-ups because you know there’s not so much expense involved, it’s every three months.” (#03)</td>
</tr>
<tr>
<td>Childcare</td>
<td>“My biggest concern is scheduling. I have two children, so I try to schedule around what their schedule is and when their school is, someone to take care of them. That’s my greatest concern is scheduling—if it was closer it would be easier. I could go during the day while they were at school, but because it is a greater distance, it becomes a barrier. My smallest one does have to have someone with him off the bus and such. That’s my greatest concern is just scheduling so someone’s with my child – my children.” (#19)</td>
</tr>
</tbody>
</table>
Objective: The aim of this study was to evaluate the impact of socioeconomic factors on treatment, genetic testing, and survival of advanced-stage high-grade ovarian, tubal, or peritoneal cancer at a NCI-designated tertiary cancer center.

Method: A retrospective cohort study was performed from April 2013 to March 2018. Patients with advanced disease were triaged to receive primary debulking surgery (PDS) or neoadjuvant chemotherapy (NACT). Socioeconomic, insurance (private, Medicare, Medicaid, self-pay), and clinicopathologic data were abstracted from the electronic medical record. Descriptive statistics were used to compare clinicopathologic data. Regression analyses were used to determine impact on genetic testing and progression-free survival (PFS).

Results: A total of 761 patients were included. Most patients were white (85%), married (71%), and unemployed (58%), had a college degree or higher level of education (70%), and were covered by Medicare (45%). Most patients were diagnosed with stage IIIIC disease (48%), were BRCA negative (69% vs 16% BRCA positive), and received NACT (74%). For genetic testing, 494 patients (65%) underwent testing; 34 (4.5%) were not offered testing; 31 (4.1%) declined testing; and 26% were unknown. Genetic testing was not associated with degree or higher level of education (70%), and were covered by Medicare (45%). Most patients were diagnosed with stage IIIC disease (P = 0.052), race (P = 0.24), marital status (P = 0.46), educational level (P = 0.81), or type of insurance (P = 0.08). Patients who were self-pay versus private and Medicare insurance had a lower likelihood of receiving PDS (18% vs 31% and 24%, P = 0.02) or any tumor reductive surgery (59% vs 91% and 80%, P < 0.001), but had no impact on stage at diagnosis. On multivariate analysis, self-pay status (HR = 1.85, 95% CI 1.19–2.92, P = 0.007), poor ECOG status (HR = 1.22, 95% CI 1.05–1.43, P = 0.01), undergoing PDS (HR = 0.67, 95% CI 0.50–0.90, P = 0.008), and residual disease >1 cm at the time of TRS (HR = 1.67, 95% CI 1.09–2.55, P = 0.02) were significantly associated with PFS outcomes.

Conclusion: When treated at a tertiary cancer center, disparities in being offered genetic testing were not evident; however, there was disparity with surgical management and progression-free survival based on self-pay status in patients with advanced-stage disease.

534 - Poster Session
Black women disproportionately suffer throughout cancer treatment: Results from a prospective patient-reported outcomes program in gynecologic malignancy
R. Clark Sisodiaa, A.J. Bregarb, E.L. Eisenhauerc, A. Goodma, W.B. Growdond and M.G. del Carmenc. "Gillette Center for Gynecologic Oncology/Massachusetts General Hospital, Boston, MA, USA, "Harvard Medical School, Boston, MA, USA, "Massachusetts General Hospital, Boston, MA, USA, "Massachusetts General Hospital/Harvard University, Boston, MA, USA

Objective: The collection of patient-reported outcomes (PROs) is associated with improved outcomes in patients with malignancy. To date, little research has examined the PROs of black women undergoing treatment for gynecologic malignancy. This study describes the results of black women with gynecologic malignancy participating in a large, prospective PRO program.

Method: Our practice implemented routine collection of PROs throughout the treatment and surveillance of all women with gynecologic malignancy. All patients received the European Organization for the Research and Treatment of Cancer (EORTC) QLQ-C30 and the Patient Reported Outcome Measurement Information System (PROMIS) Emotional/Instrumental Support Questionnaires. Patients also received a disease-specific PRO measure. PROMs were available in the online portal prior to appointment and on tablets in clinic. Results were immediately available to medical providers in the electronic health record (Epic Systems). Patient race was self-reported by patients and available in the electronic health record. Both linear and logistic regressions were performed, controlling for age and disease site.

Results: A total of 1,811 patients were assigned PROMs between January 2018 and May 2019. Of these, 84% were white (n = 1,518), and 4% were black (n = 72). Most patients had disease of the ovary (30.85%, n = 397), followed by uterus (24.6%, n = 316), cervix (22.7%, n = 293), and vulva (6.2%, n = 80). PROMs were completed 77% (n = 1,393) of the time; there was no difference by race. Black women
have significantly lower emotional support \((-3.4, P = 0.006)\) and significantly less help with daily activities \((-3.9, P = 0.038)\). On the EORTC QLQ-C30, black women were more likely to have “extremely poor” health \((OR = 8.5, 3.4–21.5)\) and “extremely poor” quality of life \((OR = 5.1, 1.8–14.1)\). Black women also experienced higher rates of disease interference in their family life, social activities, and cognition (Table 1).

**Conclusion:** Knowledge about the experiences of black women with gynecologic cancer has been minimized by underrecruitment to clinical trials and by a paucity of clinical PRO programs. In our large prospective study, black women report markedly less support than white woman. Black women also disproportionately suffer more from their disease and its treatment than their white counterparts. These data provide a unique glimpse, from the patients own voice, into their differential experience of women receiving oncologic care.

**Table 1.** Response, by race, to EORTC QLQ-C30, PROMIS emotional support and PROMIS instrumental support in women with gynecologic malignancy.

<table>
<thead>
<tr>
<th>EORTC QLQ-C30:</th>
<th>Black (vs. white)</th>
<th>Black (vs. white)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have trouble remembering things</td>
<td>2.8 (1.1, 7.1)</td>
<td></td>
</tr>
<tr>
<td>Answer: Quite a bit or very much</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How much has your disease interfered</td>
<td>2.7 (1.1, 6.6)</td>
<td></td>
</tr>
<tr>
<td>with your family life?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Answer: Quite a bit or very much</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How much has your disease interfered</td>
<td>2.7 (1.2, 5.8)</td>
<td></td>
</tr>
<tr>
<td>with social activities?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Answer: Quite a bit or very much</td>
<td></td>
<td></td>
</tr>
<tr>
<td>How much has your disease interfered</td>
<td>2.1 (0.7, 6.2)</td>
<td></td>
</tr>
<tr>
<td>with your financial health?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Answer: Quite a bit or very much</td>
<td></td>
<td></td>
</tr>
<tr>
<td>In the last 7 days, I feel that I</td>
<td>8.5 (3.4, 21.5)</td>
<td></td>
</tr>
<tr>
<td>have very poor health</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Int the last 7 days, I feel I have</td>
<td>5.1 (1.8, 14.1)</td>
<td></td>
</tr>
<tr>
<td>very poor quality of life</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROMIS emotional support, short form</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I (rarely or never) have someone</td>
<td>3.0 (1.5, 6.3)</td>
<td></td>
</tr>
<tr>
<td>who will listen</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I (rarely or never) have someone</td>
<td>1.7 (0.73, 4.0)</td>
<td></td>
</tr>
<tr>
<td>who can confide in</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I (rarely or never) have someone</td>
<td>3.3 (1.5, 6.9)</td>
<td></td>
</tr>
<tr>
<td>who makes me feel appreciated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I (rarely or never) have someone</td>
<td>2.1 (0.9, 4.7)</td>
<td></td>
</tr>
<tr>
<td>to talk to when I have a bad day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional score</td>
<td>-3.4 (P = 0.006)</td>
<td></td>
</tr>
<tr>
<td>PROMIS instrumental support, short</td>
<td></td>
<td></td>
</tr>
<tr>
<td>form I (rarely or never) have someone</td>
<td>2.7 (1.4, 5.2)</td>
<td></td>
</tr>
<tr>
<td>who can help me if I am confined to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>bed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I (rarely or never) have someone</td>
<td>3.4 (1.7, 6.9)</td>
<td></td>
</tr>
<tr>
<td>who can take me to the doctor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I (rarely or never) have someone</td>
<td>2.5 (1.3, 4.8)</td>
<td></td>
</tr>
<tr>
<td>who can help with the daily chores</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I (rarely or never) have someone</td>
<td>2.3 (1.1, 4.6)</td>
<td></td>
</tr>
<tr>
<td>who can run errands</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instrumental score</td>
<td>-3.9 (P = 0.38)</td>
<td></td>
</tr>
</tbody>
</table>

535 - Poster Session
Comparing overall survival in women diagnosed and treated for a gynecological sarcoma at a private versus county hospital
S.S. Meinhardt, S. Oesch, M.J. Carlson, J.S. Lea and D.S. Miller. The University of Texas Southwestern Medical Center, Dallas, TX, USA

**Objective:** Sarcomas are rare heterogeneous mesenchymal tumors that account for approximately 3% of all gynecological cancers with aggressive features, diverse histological subtypes, and poor clinical outcomes. The aim of this study was to determine whether treatment in a private versus county hospital was an independent risk factor in patients with gynecological sarcomas.

**Method:** A retrospective chart review was conducted at 2 tertiary care hospitals using ICD9/10 codes to identify 35 county and 35 private hospital patients diagnosed with leiomyosarcoma (LMS), endometrial sarcoma (ESS), or adenosarcoma (AS) from 2009 through 2017. Exclusions included diagnosis of carcinosarcoma, incorrectly coded charts, and nongynecological sarcomas. Overall survival (OS) was calculated using the Kaplan-Meier method and compared using the log rank test. A Student t test for continuous variables and \(\chi^2\) analysis for categorical variables were performed to calculate statistical differences in etiological and prognostic factors.

**Results:** Of 70 patients with a gynecological sarcoma, 54% were managed at a county hospital and 45% at a private hospital. The 5-year OS rates for private and county hospitals were 68% \((95\% CI 0.50–0.82)\) and 61% \((95\% CI 0.43–0.76)\), respectively. There was no statistical difference between the 2 survival curves \((P < 0.799, 95\% CI 0.64–2.28)\). Factors that were significant predictors of worse survival in county patients included later stage at diagnosis \((P < 0.002)\), younger age at diagnosis \((P < 0.03)\), higher gravidity \((P < 0.004)\), higher parity \((P < 0.042)\), diabetes \((P < 0.03)\), alcohol use \((P < 0.003)\), and history of leiomyoma \((P < 0.01)\). See Figure 1.

**Conclusion:** Treatment of an aggressive cancer in a private hospital was not a significant independent predictor of 5-year OSI outcomes; however, county patients were more likely to present with significant predictors of worse survival.
Exploring provider density and socioeconomic factors contributing to HPV vaccination uptake among Virginia residents
J.N. Staples, S. Nelamangala, S. Morris and K. Wells. University of Virginia, Charlottesville, VA, USA

Objective: Despite strong CDC recommendations and a state school requirement, nearly half of all adolescents in Virginia have not completed the HPV vaccine series. Using ArcGIS software, we aimed to explore the relationship between provider density, socioeconomic and demographic factors, and HPV vaccination uptake in the state of Virginia.

Method: HPV vaccination rates among adolescents 11–17 years were retrieved at the zip code level from the Virginia Immunization Information System. Chloropleth maps of vaccination rates were produced using ArcGIS, a geographic information system (GIS) for working with maps and geographic information. The ArcGIS Hot Spot Analysis tool identified spatial clusters of zip codes with high and low vaccination rates. Student t test was used to compare provider density and various socioeconomic indicators between statistically significant clusters of higher (z-score ≥+2) or lower (z-score ≤ −2) than expected vaccination rates.

Results: High series completion rates were noted in central Virginia and the eastern shore. Regions of northern Virginia, including Shenandoah and Page counties, had lower than expected initiation and completion rates. Regions with significantly lower initiation rates had a lower number of primary care providers, were less educated, and had a lower median household income (MHI). While regions with lower initiation rates among males were noted to have a lower black and Hispanic population, there was no difference in minority makeup among these for regions with low female initiation rates. Regions with significantly lower series completion had a higher MHI and more education, but there was no difference in provider density or black and Hispanic population. See Figure 1.

Conclusion: Regional socioeconomic indicators are significant predictors of HPV vaccination, but may have contrasting implications for series initiation and completion. These findings emphasize the utility of spatial analysis and GIS methodology for identifying cancer prevention disparities.

Fig. 1. Survival functions.
537 - Poster Session
Geographic disparities and postoperative complications in ovarian cancer surgery
A.S. Zamoranoa, M. Greenwadea, M.M. Mullena, S.P. Huepenbecker, J.C. Cripe, M. Dandulakisb, P.H. Thaker, M.A. Powell, D.G. Mutch and L.M. Kurokia. aWashington University School of Medicine in St. Louis, St. Louis, MO, USA, bThe University of Maryland School of Medicine, Baltimore, MD, USA

Objective: Geographic disparities have been associated with poorer survival in ovarian cancer patients, but improved outcomes are seen with treatment at high-volume surgical centers. We sought to investigate the association between limited access to medical care on postoperative complications after cytoreductive surgery at a tertiary care hospital.

Methods: We performed a retrospective cohort study of stage III–IV ovarian cancer patients who underwent cytoreductive surgery between January 1, 2010, and January 1, 2017, at a single academic, tertiary care hospital. Patient access to care was determined using a Health Professional Shortage Area for primary care designation established by the Health Resources and Services Administration. Primary outcome was a composite of 30-day surgical and medical complications (Table 1). Secondary outcomes were extended hospital stay (>6 days), intensive care unit (ICU) admission, discharge needs (home health or discharge to a skilled nursing facility) and 30-day readmission. Descriptive statistics and X² analyses were used to analyze differences between women who live in primary care-shortage versus no primary care-shortage areas.

Results: Among 219 ovarian cancer patients, 54% lived in a primary care-shortage area. Compared to women with access to primary care, those without were more likely to have Medicaid insurance, reside in rural areas with higher poverty rates, and live significantly further from our hospital both in distance and time (median 70 vs 18 miles, 102 vs 30 minutes, \( P < 0.01 \)). Cancer stage, receipt of neoadjuvant chemotherapy, operating time, number of radical procedures, and achievement of optimal cytoreduction were similar between groups. Living in a primary care-shortage area had no impact on 30-day surgical (32% vs 26%) or medical complications (12% vs 12%). Primary care-shortage patients were more likely to have an extended hospital stay (26% vs 14%, \( P = 0.03 \)), without increases in discharge needs, ICU admission, or readmission.

Conclusion: Our NCI-designated cancer center serves a large area; over half of ovarian cancer surgery patients have poor access to primary care and travel great distances from rural and impoverished communities for cancer care. These factors did not affect 30-day complication rates, suggesting treatment at an academic, tertiary care hospital may overcome geographic disparities at the expense of longer hospital stays, highlighting the importance of attention to patients' potential nonmedical needs.

Table 1. Demographics and postoperative complications.

<table>
<thead>
<tr>
<th></th>
<th>Total cohort N=219</th>
<th>PC-shortage (n=119)</th>
<th>No PC-shortage (n=100)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (median)</td>
<td>63</td>
<td>63</td>
<td>62</td>
<td>0.59</td>
</tr>
<tr>
<td>Race (n, %)</td>
<td></td>
<td></td>
<td></td>
<td>0.73</td>
</tr>
<tr>
<td>White</td>
<td>197 (89.95)</td>
<td>107 (89.92)</td>
<td>90 (90.00)</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>13 (5.74)</td>
<td>9 (7.64)</td>
<td>5 (5.00)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>9 (4.11)</td>
<td>4 (3.46)</td>
<td>5 (5.00)</td>
<td></td>
</tr>
<tr>
<td>Insurance Status (n, %)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medicare</td>
<td>89 (40.64)</td>
<td>51 (42.86)</td>
<td>38 (38.00)</td>
<td>0.47</td>
</tr>
</tbody>
</table>
Discrepancies between author- and industry-reported disclosures of financial relationships in gynecology oncology research

Objective: The aim of this study was to investigate the concordance between author disclosures of financial and commercial interests and the data available on reported industry transactions present in the Centers for Medicare and Medicaid Services (CMS) Open Payments database (OPD).

Method: This is a retrospective observational study. Data were collected for authors with Oral and Featured abstract presentations at the 2019 SGO Annual Meeting, including number of abstracts published and the nature of the listed disclosures. These data were compared to data available for each author in the OPD in 2018, which included the amount and nature of all industry payments. The aim of this study was to investigate the concordance between author disclosures of financial and commercial interests and the data available on reported industry transactions present in the Centers for Medicare and Medicaid Services (CMS) Open Payments database (OPD).

Results: A total of 528 authors were identified; 377 were based in the United States and were explicitly unaffiliated with industry. Of these 377 authors, 360 (95.5%) had no disclosures listed, while 17 (4.5%) had one or more disclosures listed. For authors without disclosures, 173 (48%) had industry payments recorded in the OPD. In total, 184 (53.5%) presenting authors were found to have financial payments in the OPD, accounting for more than $43 million (median $6,213.46, IQR $213.48–$171,065.01). Most payments (3,278/6,653, 49.3%) were categorized as “Research or Associated Research Payments,” while 30% were for “Food and Beverage” and 15% were for “Travel and Lodging”; 58 authors had only “Food and Beverage” industry payments. Of 12 authors with multiple abstracts and at least 1 disclosure listed, 11 (91.7%) had discordance in reported disclosures between their own abstracts. Interestingly, of 28 authors explicitly affiliated with industry, only 3 disclosed this relationship in their abstracts.

Conclusion: Many authors at the SGO Annual Meeting did not correctly disclose some or all of their industry relationships, and those that did often failed to correctly disclose those relationships across their presented work. The majority of industry payments were related to research transactions.
**539 - Poster Session**  
**Interventions targeting work-related concerns and linkage to appropriate financial resources are needed for gynecologic cancer patients starting a new line of treatment**  
M.I. Liang, M. Pisu, S.S. Summerlin, T.K.L. Boitano, C. Blanchard, S. Bhatia and W. Huh. *University of Alabama at Birmingham, Birmingham, AL, USA*

**Objective:** We aimed to evaluate the trajectory of financial toxicity for gynecologic cancer patients starting a new treatment to identify targetable areas for future interventions.

**Method:** We administered surveys to gynecologic cancer patients at baseline, 3 months, and 6 months after starting a new line of therapy for primary/recurrent disease. We used Comprehensive Score for Financial Toxicity (COST) <26 as a threshold for financial toxicity with higher score indicating less financial toxicity. The 11 COST items each were scored from 0 (more concern) to 4 (less concern). Financial assistance was defined as setting up a payment plan or receiving assistance for copay, medication, transportation, or lodging. We categorized patients into two groups: stable/worsened financial toxicity versus improved financial toxicity by comparing the last COST (at either 3 or 6 months) to baseline COST. We performed descriptive statistics and bivariate analyses.

**Results:** There were 121 baseline participants, with 111 (92%) who completed follow-up at 3 months and 90 (74%) at 6 months. There were 32 (26%) participants whose COST was ≥26 throughout the study period. There were 48 (43%) participants (10 unchanged COST, 38 decreasing COST) with stable/worsened financial toxicity (average −5.4 points) and 64 (57%) participants with improved financial toxicity (average +6.1 points). We found no differences in patient characteristics between groups. There were 34 (31%) participants who reported receiving financial assistance during the study period with 29 (26%) reporting assistance between 0 and 3 months and 15 (14%) between 3 and 6 months. Receiving financial assistance was not associated with improved financial toxicity ($P = 0.17$). At 6 months, patients with stable/worsened financial toxicity demonstrated higher levels of concern with work-related COST items than those with improved financial toxicity, “frustrated that I cannot work or contribute as much” (mean 1.8 vs 2.9, $P < 0.01$) and “concerned about keeping my job or income” (mean 2.8 vs 3.6, $P = 0.01$).

**Conclusion:** Forty percent of gynecologic cancer patients experience stable/worsening financial toxicity during the first 6 months after starting a new treatment and are more likely to have work-related concerns, which should be targeted in future interventions. Only a third of patients received financial assistance, which was not associated with improved financial toxicity. Future studies should evaluate how provision of financial assistance can be optimized to decrease financial toxicity.

**540 - Poster Session**  
**Patient perspectives on clinical trial participation: A pilot survey of gynecologic cancer survivors**  
A. Ellis$^{ab}$ and M.J. Scroggins. $^{a}$Ovarian Cancer National Alliance, Washington, DC, USA, $^{b}$SHARE: Self-Help for Women with Breast or Ovarian Cancer, New York, NY, USA, $^{c}$International Gynecologic Cancer Society (IGCS), Louisville, KY, USA

**Objective:** With historically low clinical trial enrollment, wasted human and financial resources when trials do not accrue, and thus the inability to complete and derive usable data from trials, it is imperative to have a clear understanding of reasons supporting participation and of barriers to participation. Much is written about clinical trial participation and barriers; however, most studies are not specific to gynecologic cancer. As a pilot study to collect preliminary data to precede deeper assessment, we conducted an online survey inviting women with a history of gynecologic cancer to share their experiences with and perception of clinical trials.

**Method:** A 26-question survey was distributed through survivor networks and social media and open June 24 to August 9, 2019. There were 203 visits to the survey site, and 189 completed surveys.

**Results:** Survey respondents included survivors of most of the gynecologic cancers, nearly half (49%) experienced recurrent disease. Of the respondents, 95% identified as white, and 94% were from the United States (see Table 1). One-third of respondents (34.55%) had participated in a clinical trial—86% learned about the trial from their physicians and 85% indicated that they would participate again. Most respondents (66%) did not participate in a clinical trial, and 50% noted that they had never had a discussion about clinical trials with their physician or health care team.

**Conclusions:** Women with gynecologic cancers have very different experiences and perceptions of clinical trials that affect the likelihood of participation. With 50% of nonparticipants indicating a lack of discussion about clinical trials with their physician, an area of further assessment and potential intervention is the effect of increased physician-initiated clinical trial discussion on trial participation. It is hypothesized that increased discussion would result in higher levels of participation, thus presenting implications both for patient and for physician education around communication about clinical trials.

**Table 1.**
### Survey respondent demographics (n = 189)

<table>
<thead>
<tr>
<th>Age Ranges</th>
<th>Cancer diagnosis</th>
<th>Cancer diagnosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>31-40</td>
<td>6 (3.17%) Cervical cancer</td>
<td>3 (1.59%)</td>
</tr>
<tr>
<td>41-50</td>
<td>20 (10.58%) Endometrial or uterine cancer</td>
<td>44 (23.38%)</td>
</tr>
<tr>
<td>51-60</td>
<td>64 (33.86%) Fallopian tube cancer</td>
<td>13 (6.88%)</td>
</tr>
<tr>
<td>61-70</td>
<td>80 (42.33%) Ovarian cancer</td>
<td>132 (69.84%)</td>
</tr>
<tr>
<td>71 and older</td>
<td>19 (10.05%) Primary peritoneal cancer</td>
<td>10 (5.29%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Cancer Stage</th>
<th>Cancer Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>African American</td>
<td>4 (2.12%) Stage I</td>
<td>30 (15.87%)</td>
</tr>
<tr>
<td>American Indian or Alaskan Native</td>
<td>1 (0.53%) Stage II</td>
<td>14 (7.41%)</td>
</tr>
<tr>
<td>Asian or Pacific Islander</td>
<td>3 (1.59%) Stage III</td>
<td>99 (52.38%)</td>
</tr>
<tr>
<td>Caucasian</td>
<td>180 (95.24%) Stage IV</td>
<td>5 (2.65%)</td>
</tr>
<tr>
<td>Hispanic or Latino</td>
<td>3 (1.59%) Unknown</td>
<td>5 (2.65%)</td>
</tr>
<tr>
<td>Other, not answered</td>
<td>3 (1.59%) Other</td>
<td>9 (4.76%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prior participation in a clinical trial</th>
<th>Cancer Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>65 (34.39%) Stage I</td>
</tr>
<tr>
<td>No</td>
<td>124 (65.61%) Unknown</td>
</tr>
</tbody>
</table>

How those who participated in clinical trials learned about their study? (n = 65, more than one answer was permitted)

| My doctor             | 56 (86.15%) |
| My own research       | 9 (13.85%)  |
| Other (fill in)       | 4 (6.15%)   |
| Clinical trial matching service | 2 (3.08%) |
| Family or friend      | 2 (3.08%)   |
| Support group         | 1 (1.54%)   |

Reasons selected for non-participation in clinical trials (n = 65, more than one answer was permitted)

| My medical team/doctor never talked to me about clinical trial participation | 63 (50.40%) |
| Other (fill in)                                                            | 48 (38.40%) |
| I was interested, but did not qualify                                      | 18 (14.40%) |
| I do not want to get placebo                                               | 14 (11.20%) |
| I was interested, but the location was too far                             | 9 (7.20%)   |
| I was interested, but the trial I wanted was not available                  | 5 (4.00%)   |
| I am not interested in experimental therapies or treatments                | 4 (3.20%)   |
| I do not want to be randomized                                             | 3 (2.40%)   |
| I was interested, but my insurance didn’t cover it                         | 2 (1.60%)   |
| I do not trust the medical system                                          | 2 (1.60%)   |

Sample of comments related to non-participation in clinical trials

<table>
<thead>
<tr>
<th>Feel like it’s the last resort and I’m not there yet.</th>
<th>Will try clinical trials after exhausting proved treatments first.</th>
<th>Clinical trial for my specific situation not available in my area.</th>
</tr>
</thead>
<tbody>
<tr>
<td>I would not want a placebo if I had a recurrence of cancer.</td>
<td>There were no trials for my kind of cancer.</td>
<td>No clinical trial in my country.</td>
</tr>
<tr>
<td>Thus far, participation was not advised for me. I would be interested in the future, however, if I recur and there is an appropriate trial.</td>
<td>Did not learn about it soon enough after frontline – my doctor did not tell me about it.</td>
<td>There are too many women begging for trials but are turned away due to non-measurable disease.</td>
</tr>
<tr>
<td>I chose not to do it because one of the side effects of the treatment was death and to get it you had to be in the hospital a few days.</td>
<td>I did not want to try one, 350 mile one way trip to providing hospital. Wanted to stay local.</td>
<td>I wanted to but didn’t learn about it in time and couldn’t get all the pre-trial testing done within the time frame after frontline that was specified by the trial rules.</td>
</tr>
</tbody>
</table>

---

### 541 - Poster Session

Geographic distance greater than 50 miles is associated with better overall survival for ovarian cancer patients treated at a frontier state NCI-designated cancer center

S.S. Petersen<sup>a</sup>, S. Srisutivi<sup>b</sup>, A. Jewell<sup>a</sup>, L.A. Spoozak<sup>a</sup>, J.A. Chapman<sup>a</sup>, S. Fitzgerald<sup>a</sup> and D. Khabele<sup>a</sup>.<sup>a</sup>University of Kansas Medical Center, Kansas City, KS, USA, <sup>b</sup>The University of Kansas School of Medicine, Kansas City, KS, USA
**Objective:** The aim of this study was to examine the impact of geographic distance on survival outcomes for patients receiving treatment for ovarian cancer at an NCI-designated cancer center (NCI-CC).

**Methods:** Patients who received all their treatment for ovarian cancer at a single institution from 2010 to 2015 were identified. Age at diagnosis, insurance status, and distance from the patient’s home to the institution were abstracted. Clinical data including stage at diagnosis, debulking status, chemotherapy cycles, Charlson comorbidity index, dates of diagnosis, recurrence, and death were obtained. Median income was estimated using the 2013 American Census Survey. Patients treated at other institutions and those with nonepithelial pathology were excluded. Overall survival (OS) and progression-free survival (PFS) were generated by Kaplan-Meier survival curves and Cox proportional hazard models using SAS v9.4.

**Results:** Of 203 patients identified, 157 lived <50 miles and 46 lived >50 miles away. Median OS was 64 months, and median PFS was 18 months. The 5-year survival was 50.1% for patients who lived <50 miles and 66.7% for those who lived >50 miles away. There was no difference in age or stage at diagnosis, debulking status, adjuvant therapy, recurrence rates, comorbid conditions, insurance status, or treatment duration between groups. Mean estimated median income was significantly greater in the <50 miles group than in the >50 miles group ($67,238 vs $46,736, P = 0.0004). Patients who lived >50 miles had a lower rate of death than those who lived <50 miles away (HR = 0.42, 95% CI 0.23–0.77, P = 0.005) after adjusting for age, stage of disease, debulking status, median income, and comorbid conditions.

**Conclusions:** Although estimated median income was significantly lower, geographic distance >50 miles was associated with better OS for ovarian cancer patients who received all their care at a frontier state NCI-CC. Survival outcomes for patients who received partial treatment are underway.

---

**542 - Poster Session**

Are minority women less likely to participate in clinical trials?


*University of Virginia, Charlottesville, VA, USA, University of Alabama at Birmingham, Birmingham, AL, USA, Kaiser Permanente Northern California Gynecologic Oncology Group, San Francisco, CA, USA, Walter Reed National Military Medical Center, Bethesda, MD, USA, Johns Hopkins School of Medicine, Baltimore, MD, USA, University of Virginia Health System, Charlottesville, VA, USA*

**Objective:** Given the disparity that exists in enrollment of minorities to oncology clinical trials, the objective of our study was to assess whether race is associated with willingness to participate in gynecologic oncology clinical trials in a rural Southern academic medicine setting.

**Method:** A single-institution prospective survey study was performed at an academic medical center. Women presenting to the gynecologic oncology clinic with a current or prior diagnosis of gynecologic malignancy were approached to participate. The validated Attitudes to Randomized Trials Questionnaire (ARTQ) assessed willingness to participate in clinical trials. A chart review was performed to abstract relevant demographic and clinical data. Demographic and clinical characteristics were compared between those willing and unwilling to participate in clinical trials with a Χ² test for categorical variables and Wilcoxon rank sum tests for continuous data.

**Results:** We enrolled 156 participants (50% white, 50% non-white) from May 2017 to January 2018. The minority group included 35% non-Hispanic black, 9% Hispanic, 4% Asian, and 2% other. Median age was 63 years with endometrial cancer being the most common diagnosis (48%). On initial screen, only 35% were willing to participate in a clinical trial. Willingness to participate did not differ between race, age, marital status, education level, cancer type, stage, or mode of treatment. Rates improved to 82% after the women were provided additional educational information. Following education, white women and those with more education were significantly more willing to participate in clinical trials than their minority and less educated counterparts.

**Conclusion:** The majority of subjects were initially unwilling to participate in clinical trials. After education, minority women were less willing to participate than white women, suggesting that different tools are needed for recruitment of minorities to gynecologic oncology clinical trials.

---

**543 - Poster Session**

Cascade genetic testing for hereditary cancer syndromes: A systematic review and meta-analysis


*Weill Cornell Medical College, New York, NY, USA, University of California, Los Angeles, Los Angeles, CA, USA, The University of Texas MD Anderson Cancer Center, Houston, TX, USA*

**Objective:** Given the disparity that exists in enrollment of minorities to oncology clinical trials, the objective of our study was to assess whether race is associated with willingness to participate in gynecologic oncology clinical trials in a rural Southern academic medicine setting.

**Method:** A single-institution prospective survey study was performed at an academic medical center. Women presenting to the gynecologic oncology clinic with a current or prior diagnosis of gynecologic malignancy were approached to participate. The validated Attitudes to Randomized Trials Questionnaire (ARTQ) assessed willingness to participate in clinical trials. A chart review was performed to abstract relevant demographic and clinical data. Demographic and clinical characteristics were compared between those willing and unwilling to participate in clinical trials with a Χ² test for categorical variables and Wilcoxon rank sum tests for continuous data.

**Results:** We enrolled 156 participants (50% white, 50% non-white) from May 2017 to January 2018. The minority group included 35% non-Hispanic black, 9% Hispanic, 4% Asian, and 2% other. Median age was 63 years with endometrial cancer being the most common diagnosis (48%). On initial screen, only 35% were willing to participate in a clinical trial. Willingness to participate did not differ between race, age, marital status, education level, cancer type, stage, or mode of treatment. Rates improved to 82% after the women were provided additional educational information. Following education, white women and those with more education were significantly more willing to participate in clinical trials than their minority and less educated counterparts.

**Conclusion:** The majority of subjects were initially unwilling to participate in clinical trials. After education, minority women were less willing to participate than white women, suggesting that different tools are needed for recruitment of minorities to gynecologic oncology clinical trials.
Objective: In order to fully realize the benefits of cancer genetic testing and disease prevention, genetic testing must be extended to disease-free at-risk relatives with cascade testing. Standard methods for applying cascade testing are lacking, and there is a paucity of literature on rates of testing uptake among disease-free at-risk relatives. The aim of this review was to assess methods and uptake for disease-free at-risk relatives for published strategies of oncologic cascade testing.

Method: A complete systematic search of online databases (PubMed, EMBASE, MEDLINE, and the Cochrane Library) was performed without a date limit. The final meta-analysis used a DerSimonian-Laird random effects model to estimate the weighted prevalence of oncologic cascade testing uptake among disease-free at-risk relatives.

Results: A total of 1,631 studies were screened; 109 full-text studies were assessed for eligibility; and 19 were included in the meta-analysis. Among 6,783 disease-free at-risk relatives, the prevalence of cascade testing uptake was 54.3% (95% CI 46.8–61.8%) (Figure 1). Strategies described to facilitate cascade testing included family education sessions, family information services, contact of disease-free at-risk relatives by mailed letters, web-based genetic counseling for disease-free at-risk relatives, and individualized genetic counseling of disease-free at-risk relatives. Individualized genetic counseling of disease-free at-risk relatives had the highest success rate with genetic testing of 62.4% (95%CI 48.0%–76.8%). Web-based genetic counseling had the lowest success rate, achieving genetic testing for 37.4% of disease-free at-risk relatives (95% CI 17.1%–57.7%).

Conclusion: Cascade testing has the potential to improve individual and population health outcomes; however, realizing such benefits relies on successful testing strategies. Testing uptake varies based on the way disease-free at-risk relatives are contacted and offered testing. Web-based and family outreach methods result in modest testing uptake, while individualized counseling results in the greatest testing uptake. These findings may help physicians and researchers consider methods of extending genetics services to disease-free at-risk relatives.

Fig. 1. Proportion meta-analysis plot of uptake of cascade genetic testing among at-risk relatives (ARR).
Objective: Universal Lynch syndrome (LS) screening in endometrial cancer (EC) has been recommended. We sought to explore different testing strategies as part of a statewide LS screening initiative.

Method: In this multiinstitutional statewide initiative (targeted enrollment 700), germline hereditary cancer panel gene testing is performed for all subjects. Tumor immunohistochemistry (IHC) for mismatch repair (MMR) proteins (MLH1, PMS2, MSH6, MSH2) with MLH1 methylation testing as indicated, as well as research-based tumor only next-generation sequencing, are also undertaken. We report our interim analysis.

Results: To date, germline testing for cancer susceptibility has been completed for 295 subjects enrolled at 3 participating centers. MMR gene mutations were identified in 9 patients (3.1%): 5 in PMS2, 2 in MSH2, 1 in MSH6, and 1 in MLH1. All LS tumors were endometrioid histology. One patient who previously had a colon cancer and whose endometrial cancer lacked MSH6 expression, had an MSH6 variant of uncertain significance, which is suspicious for pathogenicity. IHC abnormalities were seen in 29.8% of patients, none of which were serous cancers. Combined IHC and methylation testing predicted 20 cases with MMR mutations, only 7 of which proved to have LS. Eight of 9 LS probands were previously unaware of their LS diagnoses or of their families’ increased hereditary cancer risk.

Conclusion: Universal germline testing in this EC cohort identified an LS rate of 3.1% with PMS2 being the most frequent cause of LS. Nearly all LS patients were not aware they had LS, and cascade testing is underway. Although upfront germline testing provides a streamlined approach to LS screening, it does not identify somatic/epigenetic MMR defects that may have clinical significance. Ultimately, tumor sequencing may provide the most comprehensive information, as it identifies both inherited and tumor-specific MMR abnormalities.

---

Table 1. Barriers to uptake of cascade genetic testing among at-risk relatives (n = 36).

<table>
<thead>
<tr>
<th>Reason</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Could not be reached by telephone</td>
<td>7</td>
<td>19.4</td>
</tr>
</tbody>
</table>

545 - Poster Session

Barriers to uptake of oncologic cascade genetic testing: Results of a prospective cohort study


Objective: Cascade testing for familial cancer syndromes has historically been difficult to execute. While probands disclose genetic results to more than 80% of at-risk relatives, less than 30% use recommended genetic services. As part of a facilitated cascade testing pathway, we evaluated barriers to completion of cascade testing.

Method: Patients diagnosed with germline cancer-associated mutations were enrolled in an Institutional Review Board-approved facilitated cascade testing pathway whereby the genetics team worked with the patient to identify at-risk relatives and offered telephone genetic counseling and mailed saliva kit testing. Six-month telephone follow-up interviews were utilized to explore reasons at-risk relatives declined genetic testing.

Results: Among the 102 identified at-risk relatives, 36 (30%) did not complete genetic testing. Table 1 outlines reasons genetic testing was not performed. Following telephone genetic counseling, 16 at-risk relatives requested a mailed saliva kit with the plan to complete testing but did not return the saliva kit. Follow-up telephone interviews with these at-risk relatives revealed that 6 did not complete testing because of fear of positive results; 3 were concerned about genetic discrimination; and 3 believed the mutation was not relevant to his/her health. Four at-risk relatives who had not returned the saliva kit stated that they were still interested in genetic testing and the reminder telephone call prompted completion of genetic testing.

Conclusion: Thirty percent of at-risk relatives did not complete oncologic cascade testing when offered via telephone genetic counseling and saliva kit testing. The most commonly cited barriers were concern about genetic discrimination (6, 17%) and fear of positive test results (6, 17%). Four (11%) at-risk relatives remained interested in cascade testing and completed testing when reminded by the telephone interview. Our results demonstrate that efforts to improve uptake of cascade genetic testing should address concerns about genetic discrimination, cost of testing, and fear of positive results, and include a follow-up system to remind at-risk relatives about the option to complete genetic testing.

Table 1. Barriers to uptake of cascade genetic testing among at-risk relatives (n = 36).

<table>
<thead>
<tr>
<th>Reason</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Could not be reached by telephone</td>
<td>7</td>
<td>19.4</td>
</tr>
</tbody>
</table>
Concerned about genetic testing 3 8.3
Already completed genetic testing 3 8.3
Not interested in genetic testing 3 8.3
Concerned about cost associated with genetic testing 2 5.6
Awaiting results of family member’s genetic testing 1 2.8
Difficulty with using the saliva kit 1 2.8

At-risk relative initially agreed to genetic testing but did not return saliva kit

- Fear of positive result 6 16.7
- Concerned about genetic discrimination 3 8.3
- Believed mutation not relevant to his/her health 3 8.3
- Follow-up telephone call resulted in completion of genetic testing 4 11.1

546 - Poster Session
Cascade genetic testing: What are the quality of life implications for at-risk relatives undergoing genetic testing?

Objective: The ultimate impact of genetic testing is the ability to identify relatives carrying the mutation before they develop cancer, maximizing disease prevention and early detection. However, there is a paucity of literature on quality of life (QOL) in this testing context. We sought to evaluate the QOL implications for at-risk relatives undergoing cascade testing.

Method: At-risk relatives were identified as part of a prospective trial of facilitated cascade genetic testing for cancer-associated germline mutations. At-risk relatives were contacted by a genetics team and offered telephone genetic counseling and testing via mailed saliva kits. Results were disclosed by telephone, and all at-risk relatives underwent post-test genetic counseling with the genetics study team and a certified genetic counselor. QOL was evaluated at time of results disclosure and 6-month follow-up using the Satisfaction with Decision Scale (SDS), Hospital Anxiety and Depression Scale (HADS), and The Multidimensional Impact of Cancer Risk Assessment (MICRA).

Results: Among 95 contacted at-risk relatives, 66 (70%) completed genetic testing and 39 (41%) completed both genetic testing and QOL surveys. At results disclosure, 26% (10/39) of at-risk relatives reported borderline to abnormal levels of anxiety, and 10% (4/39) reported borderline to abnormal levels of depression. At 6 months, levels of both anxiety and depression decreased (10% and 3%, respectively). At time of result disclosure, 100% (39/39) of at-risk relatives reported being adequately informed about the option for genetic testing and 95% (37/39) reported satisfaction with their decision to undergo testing. At 6-month follow-up, 82% (32/39) reported clearly understanding their cancer risk, and 85% (33/39) reported clearly understanding their choices for cancer prevention and early detection. See Figure 1.

Conclusion: At-risk relatives undergoing cascade genetic testing report high levels of satisfaction with the decision to undergo testing. Both anxiety and depression were reported at time of result disclosure but improved at follow-up assessment. Despite post-test genetic counseling, some at-risk relatives remain uncertain about their cancer risk and opportunities for cancer risk reduction. Practitioners providing cascade genetic testing should be aware of potential anxiety and depression and the importance of comprehensive post-test genetic counseling.
Distress and anxiety associated with identifying germline cancer-associated mutations with cascade genetic testing


Weill Cornell Medical College, New York, NY, USA. Icahn School of Medicine at Mount Sinai, New York, NY, USA

Objective: Cascade genetic testing is essential for identifying inherited cancer-associated mutation in at-risk relatives. However, the new diagnosis of a pathogenic mutation can lead to anxiety and distress, and strategies to mitigate this have not been well studied. We sought to evaluate immediate and long-term distress and anxiety among at-risk relatives found to have a pathogenic mutation on cascade genetic testing.

Method: We conducted a prospective trial of facilitated cascade genetic testing for cancer-associated germline mutations. At-risk relatives were identified and contacted by a genetics team and offered telephone genetic counseling and testing via mailed saliva kits. Results were disclosed by telephone, and all at-risk relatives underwent post-test genetic counseling with the genetics study team and a certified genetic counselor. Rates of anxiety were measured using the Hospital Anxiety and Depression Scale (HADS) and distress by The Multidimensional Impact of Cancer Risk Assessment (MICRA). Anxiety and distress were evaluated at time of results disclosure and at 6-month follow-up.

Results: Among at-risk relatives who underwent genetic testing, 41% (27/66) were found to have a mutation. At least 1 survey instrument was completed by 52% (14/27) of at-risk relatives found to have a mutation and 59% (23/39) of those with negative testing. At-risk relatives found to have a mutation had significantly higher distress scores compared to those who did not at results disclosure (6.5 and 2.3, respectively, \( P = 0.029 \)). However, at 6-month follow-up, the mean distress levels between positive and negative mutation carriers were no longer significant (5.5 and 2.2, \( P = 0.077 \)). Twenty-three percent (3/13) of at-risk relatives with mutations had abnormal anxiety at time of results disclosure. At 6-month follow-up, 10% (1/10) reported abnormal anxiety. See Table 1.

Conclusion: Identifying a mutation through cascade genetic testing results in clinically significant distress and anxiety for many at-risk relatives. However, at 6-month follow-up, distress and anxiety were improved and similar to that reported by at-risk relatives with negative testing. The psychosocial impact of cascade genetic testing for at-risk relatives must be carefully considered in the design of cascade implementation strategies.

<table>
<thead>
<tr>
<th>MICRA Distress Score</th>
<th>HADS Anxiety Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial 6-Month</td>
<td>Initial 6-Month</td>
</tr>
</tbody>
</table>

Table 1. Comparing the Multidimensional Impact of Cancer Risk Assessment (MICRA) distress scores and Hospital Anxiety and Depression Scale (HADS) anxiety scores among mutation carriers at time of result reveal and 6-month follow-up. MICRA scoring as sum of ten distress focused questions ranging 0-5 for each; higher score associated with greater distress. HADS scoring as sum of seven anxiety focused questions ranging 0-3 for each; >7-10 demonstrates borderline anxiety, >11 abnormal.
Objective: To compare test acceptability and compliance of two surveillance strategies in a high-risk group of women who were all BRCA mutation carriers over a 23-month follow-up period, (1) a new surveillance strategy based on assessment of serum CA-125 and HE4 every 4 months using a Risk of Ovarian Cancer Algorithm (ROCA) and (2) standard of care (SOC) surveillance with a CA-125 blood test and a pelvic ultrasound examination every 6 months were conducted.

Method: We recruited women from a large integrated health care system in California for this nonrandomized cohort study. Women selected their preferred surveillance arm. Compliance was evaluated by patient for each arm. We also assessed self-reported distress using the Impact of Event Scale (IES).

Results: There were 159 women in the ROCA arm and 43 in the SOC arm. Overall, compliance was higher in the ROCA arm (83.2%) than in the SOC arm (51.9%) (\(P < 0.0001\)). See Table 1. Based on the IES, ROCA arm women reported fewer feelings about intrusion and avoidance at 12 months compared to baseline; the difference approached significance for intrusion (7.6% vs 4.1% severe, \(P = 0.034\)). In contrast, SOC women had unchanged IES scores at 12 months post baseline.

Conclusion: This pilot study suggests that women preferred blood tests for ovarian cancer surveillance; compliance was high with blood tests performed every 4 months in the ROCA arm. Moreover, ROCA women had lower stress scores over time. Regular serum biomarker testing was feasible and acceptable to patients in this cohort. Given the lack of clinical utility and poor compliance shown with traditional ultrasound and CA-125 tests, further investigation is warranted of longitudinal biomarker surveillance for early detection of ovarian cancer in women with BRCA mutations.
<table>
<thead>
<tr>
<th>Compliant blood draws</th>
<th>N compliant</th>
<th>N potentially compliant</th>
<th>% Compliant</th>
<th>N Compliant</th>
<th>N potentially Compliant</th>
<th>% Compliant</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>95</td>
<td>123</td>
<td>77.2%</td>
<td>25</td>
<td>35</td>
<td>71.4%</td>
</tr>
<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt;</td>
<td>92</td>
<td>114</td>
<td>80.7%</td>
<td>20</td>
<td>30</td>
<td>66.7%</td>
</tr>
<tr>
<td>4&lt;sup&gt;th&lt;/sup&gt;</td>
<td>80</td>
<td>89</td>
<td>89.9%</td>
<td>13</td>
<td>16</td>
<td>81.3%</td>
</tr>
<tr>
<td>5&lt;sup&gt;th&lt;/sup&gt;</td>
<td>47</td>
<td>56</td>
<td>83.9%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6&lt;sup&gt;th&lt;/sup&gt;</td>
<td>32</td>
<td>34</td>
<td>94.1%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>346</td>
<td>416</td>
<td>83.2%&lt;sup&gt;5&lt;/sup&gt;</td>
<td>58</td>
<td>81</td>
<td>71.6%</td>
</tr>
</tbody>
</table>

<sup>1</sup> Compliance is defined as having a test done within 30 days of the target date

<sup>2</sup> 149 baseline blood draws were not eligible to be compliant

<sup>3</sup> 43 baseline blood draws were not eligible to be compliant

<sup>5</sup> Comparison of compliance between ROCA group (83.2%) and SOC group (51.9%): P<0.0001

<table>
<thead>
<tr>
<th>SOC</th>
<th>121 Ultrasounds (43 women)</th>
<th>121 sets of ultrasounds &amp; blood tests (43 women)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>N of Ultrasounds</td>
<td>% potentially compliant</td>
</tr>
<tr>
<td>N of compliant tests</td>
<td>79&lt;sup&gt;3&lt;/sup&gt;</td>
<td>121</td>
</tr>
<tr>
<td>Compliant tests</td>
<td>N compliant</td>
<td>N potentially compliant</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>19</td>
<td>34</td>
</tr>
<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt;</td>
<td>13</td>
<td>29</td>
</tr>
<tr>
<td>4&lt;sup&gt;th&lt;/sup&gt;</td>
<td>10</td>
<td>16</td>
</tr>
<tr>
<td>Overall 2&lt;sup&gt;nd&lt;/sup&gt;-4&lt;sup&gt;th&lt;/sup&gt;</td>
<td>42</td>
<td>79</td>
</tr>
</tbody>
</table>

<sup>3</sup> 42 baseline ultrasounds were not eligible to be compliant

<sup>4</sup> 42 pairs of baseline ultrasounds and blood draws were not eligible to be compliant

<sup>5</sup> Comparison of compliance between ROCA group (83.2%) and SOC group (51.9%): P<0.0001

---

**549 - Poster Session**

**Assessing barriers to genetic screening for hereditary breast, ovarian, and colon cancer in high-risk populations**


**Objective:** The aim of this study was to identify barriers to genetic testing among individuals with a high risk of certain hereditary cancers based on National Comprehensive Cancer Network (NCCN) criteria.

**Method:** University of Minnesota Institutional Review Board approval was obtained. Through the university’s Driven to Discover platform, attendees at the 2019 Minnesota State Fair were asked to take a REDCap-based survey. The survey used branching logic to identify participants who were high risk based on personal or family cancer history. These participants were asked further questions about their referral history and access to genetic counseling.

**Results:** A total of 1,649 fair-goers participated. Of those, 1,096 (66%) had heard of hereditary cancer syndromes. Of all participants, 712 (43%) met NCCN criteria for referral to genetic counseling. Of this group, only 192 (27%) knew they were high risk. Participants were more likely to know they were high risk if they had a provider they identified as “their doctor” (84% vs 75%, *P* = 0.012), went to their doctor at least once per year (87% vs 79%, *P* = 0.049), talked to their doctor about their family history (94% vs 82%, *P* < 0.01), or knew most/all details of their family history (79% vs 70%, *P* = 0.020). Of the high-risk participants, 92 (13%) had been referred to a
The PARP inhibitor niraparib demonstrates preclinical activity against HRD-deficient carcinosarcomas

L.R. Tymon-Rosarioa, P. Manaraa, A. Manzanoa, L. Zammataro, E. Bonazzoli, E. Perrone, S. Bellone, L.B. Alexandrovb, B. Zeybek, C. Han, G. Altwerger, G. Menderes, E.S. Ratner, D.A. Silasi, G.S. Huang, M. Azodi, P.E. Schwartz and A.D. Santina. aYale University School of Medicine, New Haven, CT, USA, bUCSD Health Sciences, La Jolla, CA, USA

Objective: Carcinosarcoma of the ovary and uterus represent rare, highly aggressive malignancies associated with poor survival outcomes. PARP inhibitors represent novel treatment options for cancers with underlying impaired DNA repair via homologous recombination mechanisms. We used whole exome sequencing (WES) data from a large cohort of carcinosarcoma patients to investigate whether ovarian (OCS) and uterine carcinosarcoma (UCS) possess the mutational signature of homologous recombination deficiency (HRD) and whether there may be a role for HRD-directed therapies.

Method: WES data from 68 patients with UCS and OCS were analyzed for HRD by means of non-negative matrix factorization using SigProfiler. In addition, fully WES primary carcinosarcoma cancer cell lines from 8 patients were tested in cell-viability assays to determine sensitivity or resistance to treatment with olaparib and niraparib. GraphPad Prism was used for statistical analysis in obtaining mean IC50 values. Differences in mean IC50 values were evaluated by the 2-tailed unpaired Student t test.

Results: A total of 68 patients with uterine (n = 44) and ovarian (n = 24) carcinosarcomas were identified; 61 patients had OSC or USC with a serous histologic carcinomatous component (39.3% OCS vs 60.7% UCS). HRD was significantly more common in OCS than in USC (58% vs 30%, P = 0.002). Of our 8 primary CS cell lines, 2 were HRD (both ovarian in origin), while the remaining 6 were homologous recombination proficient (HRP) (5 UCS vs 1 OCS). All CS cell lines tested were resistant to treatment with olaparib with no statistically significant difference in mean IC50 values between HRD and HRP cell lines (P = 0.16). In contrast, both HRD cell lines demonstrated high sensitivity to niraparib in vitro (mean ± SEM = 1.1 μM ± 0.05) and demonstrated a statistically significant difference in the mean IC50 values when compared to HRP cell lines (mean ± SEM = 3.2 μM ± 0.07, P = 0.02).

Conclusion: Our preclinical studies demonstrate for the first time significant niraparib activity against primary OCS cell lines harboring genetic signatures of HRD. Differential activity between olaparib and niraparib has been previously demonstrated in human tumors, which could be attributable to the higher cell membrane permeability and volume distribution of niraparib. These data support niraparib as a novel, potentially effective treatment option for OCS patients with HRD tumors. Our findings warrant further in vivo studies with niraparib in the treatment of HRD OCS.

Tumor infiltrating lymphocytes in brain metastases from gynecological malignancies


Objective: Tumor-infiltrating lymphocytes (TILs) are emerging predictors of response to immunotherapy and checkpoint inhibitors. However, it is currently unknown whether TILs are present in the tumor microenvironment in patients with brain metastases from gynecological malignancies. How the distribution of TILs in the brain may differ from primary disease site is unknown.

Method: This was a retrospective review of institutional health databases from 1995 to 2019 to identify patients with confirmed diagnosis of brain metastasis from gynecological malignancies. A clinical database of information on presentation and surgical and clinical outcomes was created. Archival formalin-fixed, paraffin-embedded surgical specimens from 13 primary resections and 15 brain metastasis resections were retrieved from the institutional repository. Immunohistochemistry was performed for PD-L1 and TILs including CD4, CD8, CD45RO, CD68, CD163, and FOXP3.

Results: We identified 44 patients with brain metastases from gynecological malignancies. Primary site included ovarian (47.7%), endometrial (43.2%), fallopian tube (4.5%), and cervical (4.5%). Median time from primary diagnosis to brain metastasis diagnosis was 2.1 years (95% CI 1.2–3.5). Median age at brain metastasis diagnosis was 68.0 years (range 37.2–86.2 years). Median survival from brain metastasis diagnosis was 8.0 months (95% CI 3.3–12.7 months). TILs were present in 11 of 15 metastases (73.3%).
metastasis diagnosis was 6.8 months (95% CI 2.6–14.7 months). Compared to patients with 1 brain metastasis, hazard of death for 2 is 3.94 ($P = 0.007$), for 3 is 5.18 ($P = 0.02$), and for more than 3 is 5.87 ($P = 0.002$). Of the 13 evaluated primary specimens, 7.7% were PD-L1 positive. Positive TILs were seen in CD4 (76.9%), CD8 (92.3%), CD45RO (92.3%), CD68 (100%), CD163 (100%), and FOXP3 (46.2%). Of the 15 evaluated brain metastasis specimens, 13.3% were PD-L1 positive. Positive TILs were seen in CD4 (60.0%), CD8 (93.3%), CD45RO (73.3%), CD68 (86.7%), CD163 (100%), and FOXP3 (35.7%).

**Conclusion:** Survival from gynecological malignancy brain metastasis remains dismal. Immunohistochemistry of PD-L1 and TILs revealed a similar tumor microenvironment between primary site and brain metastasis. Clinical trials evaluating the potential role for immunotherapy and checkpoint inhibitors in patients with brain metastasis from gynecological malignancies are encouraged.

---

## 552 - Poster Session

**Breast cancer after ovarian cancer in BRCA mutation carriers**


**Objective:** The aim of this study was to evaluate the incidence of breast cancer diagnosis following an epithelial ovarian cancer (EOC) diagnosis in women with deleterious BRCA mutations. See Table 1.

**Method:** This was a retrospective cohort study of all women in a large integrated health care system with BRCA mutations who were diagnosed with EOC from 1997 to 2017. Primary outcome was rate of subsequent breast cancer diagnosis. Secondary outcomes included risk factors associated with development of breast cancer, median time to detection following EOC, and method of detection. Clinical data were collected from the electronic medical record, and descriptive statistics were performed.

**Results:** Two-hundred and eighty-six women with BRCA-associated EOC were identified. Fifty-two women had a risk-reducing mastectomy and were excluded. Of the 234 remaining, 34 (15%) women were diagnosed with breast cancer following EOC. Median age of EOC diagnosis was 53 years for women with subsequent breast cancer and 56 years for those without subsequent breast cancer. There were fewer early-stage EOC in the group without subsequent breast cancer (16%), compared to the group who did develop breast cancer (38%). There were 28 new cases of breast cancer and 6 recurrences. Most patients had advanced-stage EOC (44%), and 33 (97%) received chemotherapy. Twelve (35%) had a family history of breast cancer, and 8 (24%) had a family history of ovarian cancer. Twelve (35%) cases of breast cancer were detected on screening mammogram, 4 (12%) on screening MRI, and 10 (29%) presented with a palpable lump. Twenty-four (82%) had invasive cancer, and 6 (29%) had ductal carcinoma in situ (DCIS); 29 (85%) were early-stage (0–2) disease. Twenty-four (71%) women underwent regular screening mammogram, and 7 (21%) had screening MRI in addition to mammogram. The median interval from ovarian cancer to breast cancer diagnosis was 92 months for new and 62 months for recurrent breast cancers, with 5 cases diagnosed within 2 years, 14 within 5 years, and 25 within 10 years. See Table 1.

**Conclusion:** Most breast cancer following BRCA-associated ovarian cancer will be diagnosed on mammogram or present with a palpable lump and are early stage. The median interval to breast cancer diagnosis was 8 years, with most cases being diagnosed within 10 years of ovarian cancer.

**Table 1.** Patient characteristics.

<table>
<thead>
<tr>
<th></th>
<th>Breast cancer after ovarian cancer</th>
<th>No breast cancer after ovarian cancer</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 34 (15%)</td>
<td>N = 200 (85%)</td>
<td></td>
</tr>
<tr>
<td>Median age at ovarian cancer diagnosis (yrs)</td>
<td>53</td>
<td>56</td>
</tr>
<tr>
<td>Gene mutation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BRCA 1</td>
<td>21 (62)</td>
<td>119 (60)</td>
</tr>
<tr>
<td>BRCA2</td>
<td>13 (38)</td>
<td>81 (40)</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>24 (70)</td>
<td>124 (62)</td>
</tr>
<tr>
<td>Black</td>
<td>2 (6)</td>
<td>16 (8)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>2 (6)</td>
<td>19 (10)</td>
</tr>
<tr>
<td>Asian</td>
<td>2 (6)</td>
<td>27 (14)</td>
</tr>
<tr>
<td>Ashkenazi</td>
<td>1 (3)</td>
<td>10 (5)</td>
</tr>
<tr>
<td>Other/unknown</td>
<td>3 (9)</td>
<td>4 (1)</td>
</tr>
<tr>
<td>BMI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;18.5</td>
<td>2 (6)</td>
<td>13 (7)</td>
</tr>
<tr>
<td>18.5–24.9</td>
<td>14 (41)</td>
<td>75 (38)</td>
</tr>
<tr>
<td>25–29.9</td>
<td>12 (35)</td>
<td>61 (31)</td>
</tr>
<tr>
<td>&gt;30</td>
<td>6 (18)</td>
<td>48 (24)</td>
</tr>
<tr>
<td>Stage</td>
<td>Fam history breast cancer*</td>
<td>Fam history of ovarian cancer*</td>
</tr>
<tr>
<td>-------</td>
<td>---------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>I</td>
<td>12 (35)</td>
<td>8 (24)</td>
</tr>
<tr>
<td>II</td>
<td>16 (8)</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>118 (60)</td>
<td>32 (48)</td>
</tr>
<tr>
<td>IV</td>
<td>48 (24)</td>
<td></td>
</tr>
</tbody>
</table>

*In first-degree family member; stage unknown for 5 subjects in breast cancer cohort and 3 subjects in non-breast cancer cohort, BMI unknown for 3 subjects in non-breast cancer cohort.

553 - Poster Session
CCNE1 amplification among metastatic sites in patients with gynecologic high-grade serous carcinoma
B. Margolis*, M. Buldo-Licciardi†, F. Dao‡, S. Ramaswami* and D.A. Levine*. *NYU Langone Health, New York, NY, USA, †New York University School of Medicine, New York, NY, USA

Objective: Amplification of CCNE1 is present in ~20% of high-grade serous cancers of gynecologic origin (HGSC) and is associated with chemotherapy resistance and poor prognosis. The timing of amplification in serous tumorigenesis and heterogeneity across anatomic sites is unclear. We characterized CCNE1 amplifications among multiple anatomic sites to understand disease heterogeneity and implications for treatment resistance.

Method: Patients with CCNE1-amplified HGSC tumors who underwent primary surgical cytoreduction for metastatic disease were identified from institutional records. Poor responders (diagnosis to death <3 years) were screened for CCNE1-amplified tumors using digital droplet polymerase chain reaction (ddPCR). Four ovarian cases with known diploid CCNE1 served as negative controls. Tumor DNA was extracted from archival slides dissected for tumor content of >50%. DNA was quantified with Qubit, and CCNE1 copy number was determined by QX200 Droplet Digital PCR System (ddPCR).

Results: Four (22%) of 18 patients identified from 2010 to 2016 with multiple metastatic sites, available pathology material, and an overall survival of <3 years were found to have increased CCNE1 copy number by ddPCR. Three additional patients were identified through recent molecular characterization. Among the 7 HGSC cases (2 uterine, 5 ovarian) with increased copy number, 4 showed CCNE1 amplification (copy number >5), and 3 had CCNE1 gain (copy number 3–5). Six of 7 cases showed consistent copy number among all metastatic sites. One case showed CCNE1 amplification in the primary site, but only copy number gain in all metastatic sites. This was a uterine serous carcinoma case, and all additional sites were lymph node metastases. Nonamplified cases had diploid CCNE1 copy number across all metastatic sites with the exception of 1 case that showed CCNE1 gain in 2 sites with lower tumor content. Normal tissue control samples consistently revealed a diploid CCNE1 copy number. See Figure 1.

Conclusion: There was little heterogeneity in CCNE1 copy number across synchronous metastatic sites. CCNE1 amplification appears to be an early genomic event. Future work will need to correct for tumor content and investigate heterogeneity across metachronous metastases.

![Figure 1](image-url)

**Fig. 1.** CCNE copy number variation determined by digital droplet PCR for multiple sites of patients with known CCNE1 amplified and diploid high grade serous tumors. UC, uterine cancer; OC, ovarian cancer; NC, negative control (diploid CCNE1).
Why do patients decline cascade testing in families with an identified mutation associated with hereditary gynecologic cancers?
1New York University School of Medicine, New York, NY, USA, 2NYU Langone Health, New York, NY, USA, 3New York University, New York, NY, USA

Objective: We sought to prospectively evaluate the feasibility of obtaining genetic testing for at least 1 first- or second-degree family member of a proband known to have actionable germline mutation associated with endometrial and/or ovarian cancer through a coordinated referral system. We also identified barriers to genetic assessment in family members. Here we report initial probands screened and their reasons for declining cascade testing.

Method: Patients with a diagnosed pathogenic or suspected pathogenic mutation associated with ovarian and/or endometrial cancer were identified from the gynecologic oncology and genetics clinics. If patients did not consent to the study, their reasons for declining participation were documented. Patients who provided consent were asked to contact their first- and/or second-degree relatives to disclose their genetic testing results and advise them to contact our center for a referral to a genetic counselor. The number of relatives per proband who contacted us for a genetic counseling referral was recorded. In addition to providing the referral, we followed up with relatives to determine whether they attended their genetic counseling appointment, received genetic testing, or took any cancer risk-reducing measures based on their results.

Results: This study opened in March 2019. To date, we have screened 71 patients and enrolled 26 (37%). Among the 45 patients who were screened but not enrolled, 48.9% (n=22) reported that their reason for declining participation in the study was that their family members had already received genetic testing. Other common reasons for declining participation were family members refusing testing (17.8%, n=8) or no eligible family members (17.8%, n=8) (Table 1).

Conclusion: The majority of probands declined participation in this facilitated cascade testing protocol. The most common reason for lack of participation was family members already having genetic testing or not having eligible family members. Patients who declined participation because family members refused testing could benefit from counseling on how to best to communicate with their relatives. Genetic testing for both patients and their relatives is critical to provision of appropriate cancer screening and prevention services. Knowledge of these barriers is important to further improve cascade testing among family members.

Table 1. Patients’ reasons for declining participation in study, n = 45.

<table>
<thead>
<tr>
<th>Reason for Declined Participation</th>
<th>Number (%) of Patients Reporting Reason*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Family members have already received genetic testing</td>
<td>22 (48.9)</td>
</tr>
<tr>
<td>Family members refuse testing</td>
<td>8 (17.8)</td>
</tr>
<tr>
<td>Patient does not have any eligible family members (family members are deceased, under age 18, or not known to patient)</td>
<td>8 (17.8)</td>
</tr>
<tr>
<td>Patient is not in contact with or does not want to discuss genetic testing results with family members</td>
<td>7 (15.6)</td>
</tr>
<tr>
<td>Patient wants to postpone enrolling in study and/or notifying family of genetic results</td>
<td>3 (6.7)</td>
</tr>
<tr>
<td>Patient is not eligible based on genetic testing results</td>
<td>3 (6.7)</td>
</tr>
<tr>
<td>Family lives outside of United States</td>
<td>3 (6.7)</td>
</tr>
<tr>
<td>Patient uninterested in learning about study</td>
<td>2 (4.4)</td>
</tr>
<tr>
<td>Patient does not speak English</td>
<td>2 (4.4)</td>
</tr>
<tr>
<td>Family member who is eligible is not thought to have mutation</td>
<td>1 (2.2)</td>
</tr>
</tbody>
</table>

*Numbers sum to more than the total due to reporting more than one reason for declining participation

Sexual health and menopausal symptoms at one year after risk-reducing salpingo-oophorectomy compared to ovarian retention: The PROSper study
aUniversity of California, San Francisco, San Francisco, CA, USA, bUCSF Helen Diller Family Comprehensive Cancer Center, San Francisco, CA, USA

Objective: The purpose of this study is to determine whether risk-reducing salpingo-oophorectomy (RRSO) impairs sexual function and worsens menopausal symptoms compared with ovarian retention among women age 35–50 years with hereditary ovarian cancer gene mutations.
Method: The PROSper (Prospective Research on Salpingo-oophorectomy) Study is a prospective cohort study of 100 women age 35–50 years with BRCA1 or BRCA2 mutations who have elected to undergo either RRSO or nonsurgical management. Over 1 year of follow-up after RRSO, changes in sexual function and menopausal symptoms were assessed with standardized questionnaires: the Sexual Health Outcomes in Women Questionnaire (SHOW-Q) and the Menopause-Specific Quality of Life (MENQOL) questionnaire. Multivariate models were used to evaluate differences in the change of these outcomes between women who underwent RRSO and age-matched controls who retained their ovaries.

Results: One hundred women enrolled in the study, 58 who selected ovarian preservation and 42 who underwent RRSO. The average age in the ovarian retention group was 39.47 versus 42.07 years in the RRSO group ($P < 0.001$). Before surgery, baseline MENQOL scores for the ovarian retention and RRSO groups were 1.98 and 2.5, respectively, indicating worse menopausal symptoms in the RRSO group (Table 1). After 1 year, the RRSO group had greater change in the MENQOL score compared with women who retained their ovaries (+0.21 vs +0.34, $P < 0.01$). Baseline sexual function scores were also worse in the RRSO group (75.6 for the non-RRSO group and 66.2 for the RRSO group). One year after surgery, there were no statistically significant differences in any domain of sexual function between the RRSO and ovarian retention group in multivariate models that controlled for baseline clinical factors and hormone use.

Conclusion: In the first year after surgery, women age 35–50 years with BRCA1 or BRCA2 mutations who underwent RRSO did not have significant changes in sexual function compared with women who retained their ovaries. Women who underwent RRSO did have statistically significant worsening of menopausal symptoms compared with the ovarian retention group, but the clinical significance of these small differences in MENQOL score is unknown.

Table 1. MENQOL and SHOW-Q scores at baseline and at one year.

<table>
<thead>
<tr>
<th></th>
<th>No RRSO</th>
<th>RRSO</th>
<th>Multivariable model ADDING ON STUDY HORMONE USE</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>MENQOL Total Score [1 - 8], Mean (SD)</td>
<td>1.93 (0.95)</td>
<td>2.14 (1.31)</td>
<td>0.21</td>
<td>2.5 (1.39)</td>
</tr>
<tr>
<td>SHOW-Q Orgasm frequency and quality scale, Mean (SD) [0-100]</td>
<td>66.6 (29.6)</td>
<td>58.4 (34.1)</td>
<td>-8.14</td>
<td>63.5 (34.1)</td>
</tr>
<tr>
<td>SHOW-Q Pelvic problem interference with, Mean (SD) [0-100]</td>
<td>4.78 (10.4)</td>
<td>4.78 (9.93)</td>
<td>0</td>
<td>11.0 (16.5)</td>
</tr>
<tr>
<td>SHOW-Q Sexual desire scale [0-100], Mean (SD)</td>
<td>64.1 (30.4)</td>
<td>61.5 (31.0)</td>
<td>-2.62</td>
<td>49.6 (34.2)</td>
</tr>
<tr>
<td>SHOW-Q Satisfaction with sex [0-100], Mean (SD)</td>
<td>69.0 (29.9)</td>
<td>66.0 (27.3)</td>
<td>-3.01</td>
<td>53.0 (34.9)</td>
</tr>
<tr>
<td>SHOW-Q Total [0-100], Mean (SD)</td>
<td>75.6 (17.1)</td>
<td>73.6 (16.8)</td>
<td>-2.04</td>
<td>66.2 (23.4)</td>
</tr>
</tbody>
</table>

1Multivariable model that controls for age, race/ethnicity, history of depression or anxiety, presence of sexual partner, hormone use

556 - Poster Session
Assessment of strategies to identify Lynch syndrome in women with synchronous endometrial and ovarian cancers
S.R. Kim, A. Pollett, A.A. Tone, M. Aronson, M. Cesari, B.A. Clarke, L. Eiriksson, T. Hart, S. Holter, R.H. Kim, A. Lytwyn, M. Maganti, L. Oldfield, T. Pugh, E. Van de Laar, D. Vicus and S.E. Ferguson. University of Toronto, Toronto, ON, Canada, Mount Sinai Hospital, Toronto, ON, Canada, Sunnybrook Odette Cancer Centre, University Health Network, Toronto, ON, Canada, Princess Margaret Cancer Centre, Hamilton Health Sciences, Hamilton, ON, Canada, Sunnybrook Odette Cancer Centre, Toronto, ON, Canada

Objective: Synchronous endometrial and ovarian cancers are reported in 5%–10% of endometrial or ovarian cancers, but the incidence of Lynch syndrome and the optimal strategy to identify it is not well established in this population. Most centers favor reflex mismatch repair (MMR) testing of the endometrial cancer only. We aim to examine the proportion of cases that are MMR-deficient (MMRd) or microsatellite-instable (MSI-H) in the endometrium and ovary and assess the concordance between the 2 tumor sites.
Methods: Women with newly diagnosed endometrial cancer ($n = 668$) and nonserous/nonmucinous ovarian cancer ($n = 212$) were prospectively recruited from 3 cancer centers in Ontario, Canada. Of these, 30 were found to have concurrent endometrial cancer and ovarian cancer. Tumors were reflexively assessed for MMR deficiency by immunohistochemistry (IHC) and MSI testing. All women underwent germline testing for mutations in the MMR pathway.

Results: Out of 30 patients, 11 (37%) were either MMRd or MSI-H, with 5 (17%) confirmed to have a pathogenic germline mutation: 3 $MSH6$, 1 $MLH1$, and 1 $PMS2$. MMR testing by IHC took place in both ovary and endometrium in 26 patients, and results were discordant between 2 sites in 2 patients (8%, MMRd in endometrial cancer but MMR intact and equivocal in ovarian cancer). MSI testing in both sites was done in 24 patients, and results were discordant in 2 patients (8%, MSS in endometrial cancer but MSI-H in ovarian cancer). Out of the 5 patients with confirmed Lynch syndrome, performing IHC alone on endometrium would have missed the diagnosis in 1 patient, and performing MSI testing alone on endometrium would have missed the diagnosis in 3 patients, all of whom had an $MSH6$ mutation (Table 1).

Conclusion: The incidence of Lynch syndrome was high in women with synchronous endometrial cancer and ovarian cancer (17%). Given the discordance in IHC and MSI results at the 2 tumor sites, both tumors should be tested by MSI and IHC; however, because of the high mutation rate consideration should be given to germline testing in all women with synchronous endometrial cancer and ovarian cancer.

Table 1. Concordance of mismatch repair (MMR) immunohistochemistry (IHC) and microsatellite instability (MSI) results between ovary and endometrium for five cases with Lynch syndrome.

<table>
<thead>
<tr>
<th>Case</th>
<th>Germline Mutation</th>
<th>MMR IHC in Ovary</th>
<th>MMR IHC in Endometrium</th>
<th>MSI in Ovary</th>
<th>MSI in Endometrium</th>
<th>MMR IHC Concordance between Ovary and Endometrium</th>
<th>MSI Concordance between Ovary and Endometrium</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$MSH6$</td>
<td>$MSH6$ deficient</td>
<td>$MSH6$ deficient</td>
<td>$MSI-H$</td>
<td>MSS</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>2</td>
<td>$MSH6$</td>
<td>$MSH6$ deficient</td>
<td>$MSH6$ deficient</td>
<td>$MSI-H$</td>
<td>MSS</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>3</td>
<td>$MLH1$</td>
<td>$MLH1/PMS2$ deficient</td>
<td>$MLH1/PMS2$ deficient</td>
<td>$MSI-H$</td>
<td>$MSI-H$</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>4</td>
<td>$PMS2$</td>
<td>Intact</td>
<td>Intact</td>
<td>MSS</td>
<td>MSS</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>5</td>
<td>$MSH6$</td>
<td>$MSH6$ equivocal</td>
<td>$MSH6$ deficient</td>
<td>$MSI-H$</td>
<td>$MSI-H$</td>
<td>N</td>
<td>Y</td>
</tr>
</tbody>
</table>

557 - Poster Session
Patterns of genetic profiling for ovarian cancer among gynecologic oncology providers
A.R. Mallena, K. Clineb, B. Caoc, H.R. Williamsd, M.H. Vettere, A.L. Burasa, S. Reada, T. Rutherfordb, B. Fridleyc, M.M. Shahzadc, S. Vadaparampi, and M.L. Andereb. | Moffitt Cancer Center-University of South Florida, Tampa, FL, USA, | University of South Florida College of Medicine, Tampa, FL, USA, | H. Lee Moffitt Cancer Center & Research Institute, Tampa, FL, USA, | Georgia Regents University, Augusta, GA, USA, | The Ohio State University, James Cancer Hospital, Columbus, OH, USA

Objective: Genetic profiling is an emerging standard of care for ovarian cancer patients. However, the optimal logistics of when and how genetic testing should be integrated into clinical practice remain unclear.

Method: SGO members were invited to participate in an anonymous, 40-item online survey. Responses were tabulated and associations between categorical endpoints evaluated by using X$^2$ or Fisher exact tests. Associations between continuous and categorical variables were assessed by using Kruskal-Wallis tests.

Results: A total of 370/1,751 (21.1%) SGO members completed the survey. Respondents were predominantly female (74.1%) and full SGO members (69.5%) with a median age of 40 years (range 27–79 years) and median experience of 6 years (range 0–44 years). They practiced in both academic ($n = 206, 55.7$%) and community ($n = 164, 44.3$%) settings; 53.2% practiced at a NCI-designated cancer center. Nearly all respondents ($n = 327, 96.7$%) agreed that universal germline testing was relevant for all epithelial ovarian cancer patients. Most (85.7%) ensure patients undergo testing within 3 months of diagnosis and utilize genetic counselors for pretesting counseling (85.8%) and to order tests (77.2%). A majority (76.3%) also agreed that universal somatic testing was important and relevant for all histologic subtypes (66.5%). Some (8.0%) reported somatic profiling should be done only when germline testing is not completed. Only 30.8% reported access to a genetics tumor board, despite the fact that 72.0% would be interested in participating (21.5% remotely). Academic and community providers reported similar levels of comfort providing genetic counseling (50.7% vs 49.3%,
However, a greater proportion of academic providers were familiar with cascade testing (60.6% vs 39.4%, $P < 0.01$), discuss the implications of cascade testing with their patients (61.0% vs 39.0%, $P < 0.01$), and participate in a genetics tumor board (67.0% vs 33.0%, $P < 0.01$).

**Conclusion:** Gynecologic oncologists participate actively and are key stakeholders in the genetic profiling of ovarian cancer patients. Practice patterns suggest that community-based providers may benefit from additional resources to support the genetic counseling and testing of their patients. Future efforts should be directed toward developing platforms to address this key need.

---

**558 - Poster Session**

**Concordance between targeted hotspot and full-exon next generation sequencing tests in ovarian and endometrial tumors**

A.I. Londono$^a$, M. Foxall$^a$, A.A. Katre$^a$, C.H. Yeh$^a$ and R.C. Arenda$^a$. $^a$University of Alabama at Birmingham, Birmingham, AL, USA, $^b$Circulogene, Birmingham, AL, USA

**Objective:** Smaller hotspot-based next-generation sequencing (NGS) panels have emerged to provide clinically actionable information and guide targeted therapy. The objective of this study was to determine the concordance between 2 commercially available NGS tests: Circulogene 50-gene hotspot panel (CG50, target size 22 kb) and FoundationOne® 324-gene full exon panel (F1, target size 793 kb) on archival tumor from patients with gynecologic malignancies. These 2 tests differ in many aspects—panel composition, sequencing chemistry, and bioinformatics.

**Method:** The CG50 and F1 panels were performed on archival FFPE collected from 68 patients with gynecologic cancer. Baseline characteristics including age, stage, and type of cancer were collected. F1 was run between March 2016 and January 2017. The median age of the tumor blocks at that time was 9.3 months (range 1.0–284.1 months). CG50 was run on the same blocks in December 2018. Four samples by CG50 resulted in quantity not sufficient due to exhausted tumor tissue. Assessment for concordance between CG50 and F1 was performed on overlapping regions. Congruence of CG50 relative to F1 at the patient and gene level was determined.

**Results:** Ovarian (67.6%) and endometrial (23.5%) cancer were the most frequent sites of origin, and the majority of cases were stage III–IV (88.2%); median age was 31.3 (range 17.3–79.3) years. Fifty-six out of 64 samples shared mutations by both tests demonstrating a 98.2% sensitivity with PPV of 88.9% and overall 87.5% concordance at the patient level. The CG50 test showed 86.0% sensitivity and 99.8% specificity with PPV and NPV of 95.3% and 99.2% at the gene level, and overall 99.0% concordance with F1. For genes that have targeted drugs available or in development (i.e., KRAS, BRAF, PIK3CA, AKT1), there was 100% concordance between the 2 platforms. CG50 reported at least 1 detected mutation across all 64 samples. Only 1 F1 sample reported no detectable mutations across the common gene regions. See [Table 1](#).

**Conclusion:** While the F1 test recently received FDA approval, these data suggest that alternative panels with smaller targeted hotspot NGS platforms can also be used as an alternative platform if the F1 panel is not feasible or available. CG50 displayed high concordance with F1 at both patient and gene levels, which helps to validate that the CG50 panel parallels the F1 panel in clinical utility.

<table>
<thead>
<tr>
<th>F1 CDx</th>
<th>Circulogene</th>
<th>Patient-level</th>
<th>Gene-level</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Sensitivity</td>
<td>Sensitivity</td>
</tr>
<tr>
<td>P</td>
<td>56</td>
<td>98.20%</td>
<td>86.00%</td>
</tr>
<tr>
<td>N</td>
<td>1</td>
<td>87.50%</td>
<td>99.20%</td>
</tr>
</tbody>
</table>

**Table 1.** Concordance between targeted hotspot and full-exon next generation sequencing tests in ovarian and endometrial tumors.

---

**559 - Poster Session**

**Developing an epigenetic biomarker for early detection of ovarian cancer**

R.C. Arend, M. Foxall and A.I. Londono. University of Alabama at Birmingham, Birmingham, AL, USA
Conclusion: Our study, while limited in scale with a small study size, provides a good indication that a true epigenetic pattern exists in women with primary malignant ovarian cancer and 24 age-matched controls with benign tumors. DNA was extracted and analyzed using the Illumina MethylEPIC microarray assay to measure DNA methylation at >850,000 CpG loci.

Results: Linear regression models were run at each of the >850,000 CpGs independently, with corrections for age, ethnicity, and 4 principal components of variance, but there were no statistically significant genome-wide differences between the malignant and the benign samples, likely due to the limit in power with the small sample size. However, the top gene indicated by this analysis was ZC3H12D, a zinc-finger gene linked to lymphoma. A machine learning approach was then used to analyze the top 379 CpGs from our regression analysis. The top gene using this model was MX1, a gene involved in immune regulation by the cytokine interferon, which regulates immune responses to pathogens.

Conclusion: Our study, while limited in scale with a small study size, provides a good indication that a true epigenetic pattern exists in the immune system that distinguishes patients with malignant tumors from those with benign tumors. Additional data are required to further validate and optimize our current models, although these data provide compelling evidence that an epigenetic biomarker should be investigated further for early ovarian cancer detection.

Objective: Given the difficulty in early detection of ovarian tumors and the negative impact of late detection on patient survival rates, there is a vital need for early detection strategies. There is growing interest in immune cells and their surveillance and regulation of cancer growth. The objective of this study was to compare the gene expression and epigenetic patterns in white blood cells isolated from patients with ovarian cancer to age-matched women with pelvic masses without ovarian cancer. Our goal was to use this exploratory analysis to further generate data to determine whether any early-detection biomarkers should be developed further using these epigenetic patterns.

Method: Under Institutional Review Board approval, blood was collected from a total of 64 patients. Buffy coats were isolated from 40 women with primary malignant ovarian cancer and 24 age-matched controls with benign tumors. DNA was extracted and analyzed using the Illumina MethylEPIC microarray assay to measure DNA methylation at >850,000 CpG loci.

Results: Linear regression models were run at each of the >850,000 CpGs independently, with corrections for age, ethnicity, and 4 principal components of variance, but there were no statistically significant genome-wide differences between the malignant and the benign samples, likely due to the limit in power with the small sample size. However, the top gene indicated by this analysis was ZC3H12D, a zinc-finger gene linked to lymphoma. A machine learning approach was then used to analyze the top 379 CpGs from our regression analysis. The top gene using this model was MX1, a gene involved in immune regulation by the cytokine interferon, which regulates immune responses to pathogens.

Conclusion: Our study, while limited in scale with a small study size, provides a good indication that a true epigenetic pattern exists in the immune system that distinguishes patients with malignant tumors from those with benign tumors. Additional data are required to further validate and optimize our current models, although these data provide compelling evidence that an epigenetic biomarker should be investigated further for early ovarian cancer detection.

---

560 - Poster Session

Barriers to hormone replacement therapy following prophylactic bilateral salpingo-oophorectomy in BRCA1/2 mutation carriers

L.B. DiSilvestro, J. Haddad, K.M. Robison, L.B. Beffa, J. Laprise, J. Scalia Wilbur, C. Raker, E. Hofstatter, D. Dalela, A.K. Brown, L. Bradford, M. Tolland and A.R. Stuckey. aWomen & Infants Hospital, Brown University, Providence, RI, USA, bYale University School of Medicine, New Haven, CT, USA, cHartford Hospital, Hartford, CT, USA, dUniversity of Massachusetts Medical Center, Worcester, MA, USA, eTufts University School of Medicine, Boston, MA, USA

Objective: The aim of this study was to identify barriers to hormone replacement therapy (HRT) use among women with BRCA1 and BRCA2 mutations after prophylactic bilateral salpingo-oophorectomy (BSO).

Methods: A cross-sectional survey of BRCA1 and BRCA2 mutation carriers was conducted at Women and Infants Hospital, Yale Medical Center, Hartford Healthcare, and Maine Medical Center. The survey was administered electronically via email using REDCap with 2 reminder emails. There were 2 to 23 fixed-response questions per 7 domains: demographics, genetic testing, prophylaxis, childbearing, partnering, and HRT following BSO. Data were analyzed with Fisher exact test.

Results: The survey was completed by 126 BRCA mutation carriers unaffected by cancer (34% response rate). Of these, 60 had a prophylactic BSO. Three patients had the surgery between 25 and 34 years (5%), 33 between 35 and 44 years (55%), and 19 between 45 and 54 years of age (32%). Only 26 patients (40%) reported ever using HRT. The average age of starting HRT was 40 years, and 79% initiated HRT within 6 weeks of surgery. HRT was prescribed by obstetrician gynecologists and gynecologic oncologists at similar rates (58% and 63%, respectively). Among all women who had a prophylactic BSO, 62% reported having seen contradictory information in the media about long-term consequences of HRT. Similarly, 57% reported being scared of these consequences. Sixteen patients who never used HRT, a third (34%) reported that HRT was not discussed by a provider (vs 0% of HRT users, \( P = 0.0002 \)), whereas 63% of HRT users reported that no provider discouraged HRT use (vs 3.3% of never HRT users, \( P = 0.0001 \)).

Conclusion: BRCA mutation carriers frequently undergo prophylactic BSO at young ages, and less than half report HRT use. This study highlights barriers to HRT use, such as physician bias and patient fear, and identifies potential areas to improve both patient and provider education.

---

561 - Poster Session

Reproductive decision making and partnering in BRCA1/2 mutation carriers

Objective: The aim of this study was to determine the association between having a BRCA1 or BRCA2 mutation and decision making surrounding family planning.

Method: A cross-sectional survey was conducted of BRCA1 and BRCA2 mutation carriers at Women and Infants Hospital, Yale Medical Center, Hartford Healthcare, and Maine Medical Center. The survey was administered electronically via email using REDCap with 2 reminder emails. There were 2 to 23 fixed-response questions per 7 domains: demographics, genetic testing, prophylaxis, childbearing, partnering, and HRT following BSO. Both genders were included. Data were analyzed with Fisher exact test.

Results: The survey was completed by 126 BRCA mutation carriers unaffected by cancer (34% response rate). Of these, 31 were 18–34 years of age, and 95 were 35 years or older. Eighty-three percent were female, and 22% were single or divorced. Of participants who were younger than 35 years, 57% reported that their BRCA mutation had “a great deal of impact” on their reproductive plans, compared to only 15% of participants older than 35 years (P < 0.0001). Participants younger than 35 years more frequently reported “a great deal of urgency” to being in a committed relationship (32% vs 1.4%, P < 0.0001) or to having a family (42% vs 15%, P < 0.0001), when compared to patients 35 years or older. While almost half of participants (44%) reported a great deal of guilt about the possibility of passing on their genetic mutation to their children, participants had similar rates of interest in having more children regardless of family history. Participants younger than 35 years (58% vs 29%, P = 0.018) had a greater interest in family planning and partnering in this population. Participants with prior genetic testing were more likely to have inclusion of 3 generations (58% vs 37%, P = 0.02). Five used preimplantation genetic diagnosis (PGD), and 9 reported they would have used PGD if provided the option.

Conclusion: The BRCA mutation had a significant impact on reproductive plans and caused a great deal of urgency to start a family in carriers who received genetic testing results prior to age 35. Fertility options were not commonly discussed with mutation carriers by health care providers. Our study reflects the complex decision making in BRCA1 and BRCA2 mutation carriers and the intricacies of family planning and partnering in this population.

562 - Poster Session

Quality of the oncologic family health history in a gynecologic oncology clinic


Objective: Despite a growing understanding of familial cancer, multiple studies demonstrate that the quality of family health history as currently collected in a clinic setting is inadequate to assess disease risk. We sought to evaluate the quality of family health history in a gynecologic oncology clinic.

Method: We reviewed the medical records for 151 new patients presenting to a gynecologic oncology clinic for new patient appointments between April 2019 and June 2019. Family health history is collected verbally during the patient interview. Family health history was evaluated for the following quality measures: (1) 3 generations, (2) relative gender, (3) relative lineage (maternal vs paternal), (4) relative current status (alive vs deceased), (5) age at cancer diagnosis for relatives with cancer history, and (6) pertinent negative (absence of hereditary cancers).

Results: Among 151 patients, the median age was 51 years (range 23–93 years). Forty-five (30%) had a cancer diagnosis at time of clinic presentation, and 33 (22%) had previously undergone genetic testing. One hundred and thirty-eight (91%) had family health history documented in the medical record. Sixty-four (42%) included 3 generations, 111 (74%) relative gender, 84 (56%) relative lineage, 40 (29%) relative current status, and 62 (41%) pertinent negatives. Among 90 patients reporting cancer in their family, 19 (17%) included age at cancer diagnosis. Age, cancer diagnosis, and family cancer history were not associated with quality of family health history. Patients with prior genetic testing were more likely to have inclusion of 3 generations (58% vs 37%, P = 0.04) and age at relative's cancer diagnosis (30% vs 11%, P = 0.02).

Conclusion: Our data are consistent with the literature suggesting that standard collection of family history may not adequately capture oncologic family health history. Proposed challenges in family health history collection include lack of patient preparation, time requirements, and lack of family health history standardization. A prospective evaluation of a web-based family health history collection tool to address these issues is ongoing.

563 - Poster Session

Increased DACH1 mutation frequency in Kentucky endometrial cancer patients
Objective: DACH1 is a rarely studied tumor suppressor gene that is frequently mutated in melanoma and bladder and prostate cancer; however, scant data exist in the endometrial cancer population likely because of its low mutation frequency in cBioPortal. The objective of this work was to determine the frequency of somatic mutations, particularly in DACH1, in patients with endometrial cancer at the University of Kentucky Hospital and to compare mutation frequency with that of other publicly available data resources.

Method: Clinical and genomic data stored in the Kentucky Cancer Registry were obtained for 55 patients with endometrial cancer from the University of Kentucky Hospital. Whole exome sequencing results and clinical outcomes were analyzed and then compared to 1,799 endometrial cancer patients in cBioPortal to identify gene mutation frequencies and the association of somatic mutation combinations with clinical outcomes.

Results: In the University of Kentucky Hospital sample, mean age was 64 years, ranging from 31 to 90 years. At the time of diagnosis, 75% were stage I–II and 25% stage III–IV. Histologically, the sample comprised 29 endometrioid patients, 12 carcinosarcoma, 9 serous, 2 papillary serous, 1 clear cell, 1 mucinous, and 1 malignant mesonephroma. DACH1, CLK4, ATM, SAMD3, HERC2, RYR2, PTPN13, and KNTC1 were more frequently mutated in the University of Kentucky Hospital population (see Table 1) when compared to cBioPortal data, while similar or slightly lower frequencies were found in other common cancer-associated genes including PIK3CA, TP53, PTEN, and ARID1A. In addition, in the cBioPortal sample, significant co-occurrence was found between DACH1 and SAMD3, ARID1A, ATM, HERC2, CLK4, KNTC1, and PTPN13 (P < 0.001) and PIK3CA (P = 0.014) when assessed with Fisher exact test, while PTEN (P = 0.068) and TP53 (P = 0.104) did not rise to statistical significance.

Conclusion: The Kentucky Cancer Registry data are unique in the composition of patients primarily from the Kentucky region. We have identified somatic mutation frequencies in DACH1, SAMD3, and CLK4 in our population that are 10 times that reported in publicly available databases, with many of the significantly co-occurring gene mutations having critical roles in cell cycle regulation. The frequency and clinical significance of these mutations in endometrial cancer merits further study.

Table 1. Frequencies of gene mutations in the UKH patient population vs cBioPortal (cBP).

<table>
<thead>
<tr>
<th>Gene</th>
<th>UK</th>
<th>cBioPortal</th>
</tr>
</thead>
<tbody>
<tr>
<td>DACH1</td>
<td>30.2%</td>
<td>2.7%</td>
</tr>
<tr>
<td>CLK4</td>
<td>34%</td>
<td>2.7%</td>
</tr>
<tr>
<td>ATM</td>
<td>26.5%</td>
<td>16%</td>
</tr>
<tr>
<td>SAMD3</td>
<td>43.4%</td>
<td>5.1%</td>
</tr>
<tr>
<td>PIK3CA</td>
<td>35.8%</td>
<td>45.9%</td>
</tr>
<tr>
<td>TP53</td>
<td>30.2%</td>
<td>42.3%</td>
</tr>
<tr>
<td>PTEN</td>
<td>47.2%</td>
<td>53%</td>
</tr>
<tr>
<td>ARID1A</td>
<td>35.8%</td>
<td>38.7%</td>
</tr>
<tr>
<td>HERC2</td>
<td>30.2%</td>
<td>12.6%</td>
</tr>
<tr>
<td>RYR2</td>
<td>30.2%</td>
<td>16.9%</td>
</tr>
<tr>
<td>PTPN13</td>
<td>28.3%</td>
<td>7.7%</td>
</tr>
<tr>
<td>KNTC1</td>
<td>26.4%</td>
<td>8.2%</td>
</tr>
</tbody>
</table>

564 - Poster Session
Molecular profiling in a large cohort of gynecologic neuroendocrine tumors
E.K. crane, P. Ramos, J.H. Farley, R.W. Naumann, D.L. Tait, R.V. Higgins and J. Brown. Levine Cancer Institute, Carolinas Medical Center, Charlotte, NC, USA, *Caris Life Sciences, Irving, TX, USA, †University of Arizona Cancer Center at St. Joseph’s Hospital and Medical Center, a Dignity Health Member, Phoenix, AZ, USA, ‡Levine Cancer Institute, Charlotte, NC, USA

Objective: Neuroendocrine tumors (NETs) of the gynecologic tract have historically represented rare, aggressive tumors with a poor prognosis, high rates of recurrence despite multimodal treatment, and limited therapeutic options. The objective of this study was to identify potential therapeutic targets for gynecologic NETs through molecular profiling of a large cohort of patients.

Method: Molecular testing results (including gene mutation, gene fusion, copy number variation [CNV], and immunohistochemistry [IHC]) for patients with gynecologic NETs were retrieved from the CARIS Life Sciences database. Proportion of patients with positive test results was calculated.

Results: In the CARIS database we identified 120 patients with gynecologic NETs. Origin of tumor was cervical in 70 patients (54%), uterine in 31 (24%), ovarian/fallopian tube in 21 (16%), vaginal in 6 (5%), and vulvar in 1 (1%). In a DNA 592 gene panel, the following aberrations were observed in mutational analyses: TP53 (43%), ARID1A (37%), PIK3CA (19%), PTEN (18%), RB1 (13%), and CTNNB1 (10%). In IHC, PTEN (83%), and PD1 (50%) had high expression, and mismatch repair proteins were largely expressed (94%). ER and PR staining was generally low (6% and 5%, respectively). CNV was also infrequent, with CCNE1 amplifications being the most common event (8%). Microsatellite instability was rare (8%), and tumor mutational load was low (96%), which was consistent across subsets of NETs analyzed by tumor site. No clinically relevant fusions were identified.

Conclusion: To date, this is the largest cohort of gynecologic NETs that have been molecularly described. Unfortunately, these tumors are molecularly heterogeneous with few actionable alterations.
Can RNA expression profiles help predict risk of recurrence in high-intermediate risk endometrial cancer patients?


Objective: There is a lack of consensus regarding the need for and the most appropriate type of adjuvant treatment for patients with high–intermediate risk endometrial cancer. Approximately 20% of these women will recur, but being able to identify those patients remains challenging. The objective of this project was to compare RNA expression from a cohort of high–intermediate risk endometrial cancer patients who recurred to those who did not recur, and to identify a genetic signature of those who are at high risk of recurrence.

Method: The medical records of all endometrial cancer patients diagnosed between 2000 and 2010 were reviewed. Patients who met criteria for high–intermediate risk endometrial cancer according to GOG 99 and were observed after surgery were included in our study. Tumors from initial diagnosis from 15 patients who recurred were matched based on stage, grade, race, age, presence or absence of lymphovascular space invasion (LVSI), depth of invasion, and size of the tumor. RNA was extracted from FFPE, and NanoString was performed on all samples using the PanCancer Pathway Panel. Molecular profiles of the 2 groups were compared by using Advanced Analysis Software. Genes were evaluated using a fold change of 1.5 and $P < 0.05$.

Results: A total of 14 specific genes had greater than 1.5-fold (range 1.52–2.57) higher gene expression in high–intermediate risk endometrial cancer patients who recurred: CLCF1, KIT, CDKN1B, FANCE, HIST1H3H, GRIA3, FANCA, DUSP2, CACNA2D3, FGF18, PIM1, FZD7, BMP7, and NR4A1. Four genes had a 1.5-fold (range 1.54–2.7) lower gene expression in high–intermediate risk endometrial cancer patients who recurred: BAIA03, MECOM, MAP3K13, and NOS. Although not statistically significant, pathway analysis showed a downregulated cell cycle apoptosis pathway and upregulated MAPK pathway in the group that recurred.

Conclusion: Our small cohort of patients is unique in that all patients were observed, removing the bias of type of adjuvant treatment given when comparing the risk of recurrence in patients with high–intermediate risk endometrial cancer. We identified 18 genes that had a significant difference in their level of RNA expression in high–intermediate risk endometrial cancer recurrent patients. Further developing a gene signature to help stratify endometrial cancer patients with high–intermediate risk would help identify patients who warrant adjuvant treatment and spare the 75% of patients who have a low risk of recurrence from the toxicity of radiation. These data will need to be validated on a larger cohort of patients.

Prevalence and opinions regarding BRCA genetic testing and counseling in a racially and ethnically diverse population of women with epithelial ovarian cancer

R. Borczuka, M.A. Gardina, O.R. Khouri³, S.M. Dolan³, S.K. Gorobetz³ and N.S. Nevadunsky, aMontefiore Medical Center, New York, NY, USA, bAlbert Einstein College of Medicine/Montefiore Medical Center, New York, NY, USA

Objective: The purpose of this study was to determine potential barriers and facilitators to BRCA genetic counseling and testing among women with epithelial ovarian cancer in a racially and ethnically diverse urban population.

Method: Data were abstracted by retrospective chart review from all patients treated for epithelial ovarian cancer from 2001 to 2016 at Montefiore Medical Center in Bronx, New York. Data collected included patient demographics and the presence or absence of BRCA genetic counseling and genetic testing records. A validated questionnaire examining patient opinions regarding BRCA counseling and testing was performed using both in-person and telephone interviews over a 2-month period from June to August 2019. Qualitative methods were used to summarize the data.

Results: Of 327 evaluable records, 40 (12%) patients had formal genetic counseling and 75 (23%) patients had BRCA genetic testing. Thirteen women within this study population were interviewed. The median age of women interviewed was 64 years (range 45–77 years), and 4 (31%) women identified as Caucasian race, 4 (31%) black race, and 5 (38%) Hispanic origin. Of these women, 10 (77%) had undergone genetic counseling, and 10 (77%) had undergone genetic testing. The highest perceived benefit of genetic counseling, selected by 10 (77%) women, was that it "helped [her] decide whether [she] should undergo genetic testing for breast and ovarian cancer risk," while the highest perceived barrier, selected by 5 (38%) women, was that "[she] was worried that [her] health insurance would not cover the cost of genetic counseling." Ten (77%) women reported that they knew either "almost nothing" or "relatively little" when asked about their general knowledge on BRCA genetic testing. Of the women who had undergone BRCA genetic testing, 10 (100%) would recommend BRCA genetic testing to a patient in a similar situation.

Conclusion: Although our data suggest that women find BRCA genetic counseling and testing to be beneficial, we identified barriers, including lack of patient knowledge and health insurance concerns, that may explain the low prevalence in our study population. As genetic information is becoming more essential for access to targeted therapies, there is an increasing need to focus on thorough patient education for women with ovarian cancer.
Utilization of next generation sequencing in ovarian and endometrial cancers at a single institution

Objective: An increasing number of targeted therapies have been approved by the FDA for gynecologic malignancies. The expanded availability of affordable next-generation sequencing has allowed for widespread tumor testing for pathogenic mutations. We sought to describe the most frequent genetic mutations associated with common histologic subtypes of a selected cohort of ovarian and endometrial cancer patients at a single large academic medical center.

Method: A retrospective chart review of all patients at our institution who had molecular profiling of their ovarian and endometrial cancer tumors was conducted using the Caris Life Sciences© platform. Results of tumor testing were cross-referenced with electronic medical records and pathology reports including immunohistochemistry. Descriptive statistics were performed.

Result: A total of 306 patients had tumor molecular testing sent for gynecologic malignancies; 37 patients with neither ovarian nor endometrial malignancies were excluded. There were 192 patients identified with ovarian, fallopian tube, or primary peritoneal cancer. Of these, 124 patients had high-grade serous ovarian, fallopian tube, or peritoneal cancer (HGSOC); 13 had low-grade serous ovarian cancer (LGSOC); 13 had clear-cell ovarian cancer (CCOC); and the remaining 42 patients with other ovarian histologies were excluded because of low volume and heterogeneity. Seventy-five patients were identified with endometrial cancer. The most common mutations and their associated frequencies were tabulated (Table 1). Of note, 13% of patients with HGSOC had pathogenic BRCA1 or BRCA2 mutations; 23% of patients with LGSOC and 15% of patients with CCOC had a BRCA2 variant of unknown significance. Forty-six percent of CCOC had an ARID1 mutation. Only 25% of patients with endometrial cancer had a PTEN mutation.

Conclusion: In a subselected patient population with gynecologic malignancies at a large academic urban medical center, the frequency of certain mutations is consistent with the literature. BRCA2 VUS was present in 23% of patients with LGSOc and 15% of patients with CCOC. Seven percent of patients with endometrial cancer had a pathogenic BRCA gene mutation. Patients with endometrial cancer, LGSOc, and CCOC may benefit from routine germline genetic testing and may be candidates for targeted therapies.

Table 1. Mutation frequency by histology.

<table>
<thead>
<tr>
<th>Histology</th>
<th>Pathogenic Mutation</th>
<th>Frequency percentage (n/total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HGSOC</td>
<td>TP53</td>
<td>85% (105/124)</td>
</tr>
<tr>
<td></td>
<td>BRCA1 (Pathogenic)</td>
<td>11% (17/124)</td>
</tr>
<tr>
<td></td>
<td>BRCA1 (VUS)</td>
<td>4% (5/124)</td>
</tr>
<tr>
<td></td>
<td>BRCA2 (Pathogenic)</td>
<td>2% (2/124)</td>
</tr>
<tr>
<td></td>
<td>BRCA2 (VUS)</td>
<td>7% (9/124)</td>
</tr>
<tr>
<td></td>
<td>ARID1</td>
<td>4% (5/124)</td>
</tr>
<tr>
<td></td>
<td>ARID2</td>
<td>1% (1/124)</td>
</tr>
<tr>
<td></td>
<td>BRIP</td>
<td>2% (2/124)</td>
</tr>
<tr>
<td>LGSOC</td>
<td>KRAS</td>
<td>38% (5/13)</td>
</tr>
<tr>
<td></td>
<td>BRCA2 (VUS)</td>
<td>23% (3/13)</td>
</tr>
<tr>
<td>Ovarian Clear Cell</td>
<td>ARID1</td>
<td>46% (6/13)</td>
</tr>
<tr>
<td></td>
<td>BRCA 2 (VUS)</td>
<td>15% (2/13)</td>
</tr>
<tr>
<td>Endometrial Carcinoma</td>
<td>TP53</td>
<td>60% (45/75)</td>
</tr>
<tr>
<td></td>
<td>PIK3CA</td>
<td>45% (34/75)</td>
</tr>
<tr>
<td></td>
<td>PTEN</td>
<td>25% (19/75)</td>
</tr>
<tr>
<td></td>
<td>ARID1A</td>
<td>21% (14/75)</td>
</tr>
<tr>
<td></td>
<td>CTNNB1</td>
<td>16% (12/75)</td>
</tr>
<tr>
<td></td>
<td>ERBB2 (mutation/amplification)</td>
<td>15% (11/75)</td>
</tr>
<tr>
<td></td>
<td>FBXW7</td>
<td>12% (9/75)</td>
</tr>
<tr>
<td></td>
<td>BRCA1 (Pathogenic)</td>
<td>3% (2/75)</td>
</tr>
<tr>
<td></td>
<td>BRCA 1 (VUS)</td>
<td>5% (4/75)</td>
</tr>
<tr>
<td></td>
<td>BRCA2 (Pathogenic)</td>
<td>4% (3/75)</td>
</tr>
<tr>
<td></td>
<td>BRCA2 (VUS)</td>
<td>4% (3/75)</td>
</tr>
</tbody>
</table>

HGSOC: High grade serous ovarian, fallopian tube and primary peritoneal cancers
LGSOC: Low grade serous ovarian cancer
568 - Poster Session
**Matched sequential tumor molecular profiling in solid malignancies may impact clinical practice**
*aUniversity of California, Los Angeles, Los Angeles, CA, USA,  
bFoundation Medicine, Cambridge, MA, USA

**Objective:** The purpose of this study was to determine whether performing repeat tumor molecular profiling in solid malignancies over time can identify new findings that have an impact on clinical care.

**Method:** All patients with a solid malignancy and more than 1 tumor molecular analysis were identified at a single institution. Each test report was examined to identify the genomic alterations. Chart review was performed to determine subsequent therapies following each test result and the impact of tumor profiling on clinical practice.

**Results:** At a single institution, 110 patients were identified with having more than 1 tumor molecular analysis, with 100 subjects having test results available for review. Eighty-six patients had differences in reported results at the time of subsequent analysis. Gynecologic malignancies represented 28 cases. In 23 of these cases, differences were found in genomic reports available for clinician's review. These differences may reflect changes in tumor biology, be attributed to intrapatient or intratumor heterogeneity, or be due to technical updates of the next-generation sequencing platforms. Among the 100 patients with solid tumors, the median time between tests was 10 months (range 0.5–66 months), with the majority of tests performed at the time of disease progression or recurrence. In this population, a total of 24 patients received targeted therapies that were associated with actionable findings on any tumor molecular analysis. Of these, 6 patients had new genomic findings identified on sequential testing that affected treatment.

**Conclusion:** The future of cancer care must include precision medicine approaches. Evolution of next-generation sequencing has contributed to this effort. Results of this single institution study summarize the reported findings on tumor molecular testing and suggest that subsequent testing may have an impact on clinical care in a subset of patients. While only 6% of patients in this study received targeted therapies based on new findings on sequential testing reports, this approach may be more clinically relevant in the future with the development of novel targeted therapies. This may be especially significant in a patient population that has progressed on standard therapies and in which treatment options are limited.

569 - Poster Session
**Prevalence of hereditary breast and ovarian cancer predisposition gene mutations among 882 HBOC high-risk Chinese individuals**
*D. Shao, C. Zhu and F. Guo. BGI Genomics, Shenzhen, China

**Objective:** Identification of deleterious variants in HBOC susceptible genes allows for increased clinical surveillance and early detection, and could predict the response to PARP inhibitor in patients with advanced ovarian carcinomas.

**Method:** We used multigene testing to reveal the distribution and prevalence of deleterious germline mutations among 882 patients with a suspected HBOC risk in 21 HBOC heredity susceptible genes.

**Results:** Overall, 176 deleterious mutations were observed in 19.50% (*n* = 172) individuals; 26 of 176 mutations were not previously identified or archived in public databases. Among patients with ovarian cancer, 115 deleterious mutations were identified in 429 patients (48.6%) with significant enrichment for a family history of breast or ovarian cancer syndrome (*P* < 0.05). In the breast cancer subgroup, 31 deleterious mutations were identified in 261 patients. Besides *BRCA1* (8, 25.8%) and *BRCA2* (11, 35.5%), the most occurred genes, an additional 12 deleterious mutations (38.7%) were found in 7 other susceptible genes. Higher mutation incidence (57.9%) was observed in subjects with histories of breast and ovarian cancer. See **Figure 1**.

**Conclusion:** Our results highlighted the genetic heterogeneity of HBOC and the efficiency of multigene panel in performing risk assessment.
Characterization of primary-metastasis pairs in high-grade serous ovarian cancer with short- and long-term survival

**E.N. Kotnik, N. Spies, C.A. Miller, T. Li, M. Inkman, J. Zhang, L. Guo, C. Maher, C.K. McCourt, P.H. Thaker, A.R. Hagemann, D.G. Mutch, M.A. Powell and K.C. Fuh. Washington University School of Medicine in St. Louis, St. Louis, MO, USA**

**Objective:** The aim of this study was to identify genomic and transcriptomic alterations unique to high-grade serous ovarian cancer (HGSC) metastatic tumors with short-term survival.

**Method:** Matched normal tissue, primary, and metastatic tumors from 23 HGSC short-term survivors (OS < 3.5 years) and 14 long-term survivors (OS > 5 years) underwent whole exome and RNA sequencing. We compared somatic mutations, copy number alternations, differential expression, homologous recombination (HR) scores, and gene fusion predictions between the primary and metastatic tumors of the short- and long-term survival groups.

**Results:** We identified 10,124 somatic mutations in the tumors of long-term survivors and 13,599 somatic mutations in short-term survivors. There was a higher percentage of shared variants between the primary and metastatic tumors for short-term survivors than for long-term survivors. We observed little differential expression between primary and metastatic tumors, but we did observe unique clustering between the transcriptomes of long- and short-term survivors’ tumors. There was no significant difference between the number of gene fusions predicted between primary and metastatic tumors, but the total of 1,218 gene fusions predicted in short-term survivors’ tumors was significantly more than the 240 gene fusions predicted in long-term survivors. The short-term primary tumor group had the most predicted gene fusions, and 35 gene fusions were recurrent only in short-term survivors. Interestingly, we observed that patients with HR-positive primary tumors but HR-negative metastatic tumors had significantly shorter overall survival compared to matched tumor pairs with no, or very little, difference in HR scores. This finding suggests that differences in HR scores between primary and metastatic tumors in HGSC patients may correlate with survival.

**Conclusion:** Overall, we observed similar genomic and transcriptomic features in the landscape between primary and metastatic tumors, but identified more genetic characteristics specific to tumors of long- and short-term survival.

Assessment of breast cancer risk in BRCA carriers with ovarian cancer: Evaluation of data from a longitudinal observation study

**T. Safra**a and B. Waissengrinb. aTel Aviv Sourasky Medical Center, Sackler School of Medicine, Tel Aviv, Israel, bTel Aviv Sourasky Medical Center, Tel Aviv, Israel

**Objective:** The aim of this study was to identify genetic markers associated with breast cancer risk in carriers of BRCA1 and BRCA2 mutations, specifically in the context of ovarian cancer.

**Method:** matched normal tissue, primary, and metastatic tumors from 23 HGSC short-term survivors (OS < 3.5 years) and 14 long-term survivors (OS > 5 years) underwent whole exome and RNA sequencing. We compared somatic mutations, copy number alternations, differential expression, homologous recombination (HR) scores, and gene fusion predictions between the primary and metastatic tumors of the short- and long-term survival groups.

**Results:** We identified 10,124 somatic mutations in the tumors of long-term survivors and 13,599 somatic mutations in short-term survivors. There was a higher percentage of shared variants between the primary and metastatic tumors for short-term survivors than for long-term survivors. We observed little differential expression between primary and metastatic tumors, but we did observe unique clustering between the transcriptomes of long- and short-term survivors’ tumors. There was no significant difference between the number of gene fusions predicted between primary and metastatic tumors, but the total of 1,218 gene fusions predicted in short-term survivors’ tumors was significantly more than the 240 gene fusions predicted in long-term survivors. The short-term primary tumor group had the most predicted gene fusions, and 35 gene fusions were recurrent only in short-term survivors. Interestingly, we observed that patients with HR-positive primary tumors but HR-negative metastatic tumors had significantly shorter overall survival compared to matched tumor pairs with no, or very little, difference in HR scores. This finding suggests that differences in HR scores between primary and metastatic tumors in HGSC patients may correlate with survival.

**Conclusion:** Overall, we observed similar genomic and transcriptomic features in the landscape between primary and metastatic tumors, but identified more genetic characteristics specific to tumors of long- and short-term survival.
Objective: The purpose of this study was to evaluate the risk of breast cancer in BRCA-mutated (BRCA+) ovarian cancer patients in order to reevaluate the need for breast cancer surveillance and/or prophylactic mastectomy in ovarian cancer patients.

Method: Data on 495 BRCA+ carriers diagnosed with ovarian cancer between 2000 and 2018 in 8 medical centers (1 in the United States and 7 in Israel) were analyzed. Data included demographics, breast surveillance type, family history, BRCA mutation type, timing of breast cancer diagnosis (before or after ovarian cancer diagnosis), and family history of cancer.

Results: The median age at diagnosis of ovarian cancer was 55.6 years (range 31.3–90 years). A third (32%) had a family history of breast cancer; 18%, ovarian cancer; and 42%, both. Most patients (68%) were Ashkenazi Jews; 74% were BRCA1 carriers; and 31% had the 185delAG mutation. Breast cancer was diagnosed before ovarian cancer in 17% of patients and after ovarian cancer in 6%. Median time to breast cancer diagnosis after ovarian cancer was 54.8 months (range 11–168 months). Of those diagnosed with breast cancer, 7% and 2% were BRCA1 and BRCA2 carriers, respectively. Most (61%) had triple-negative breast cancer; 22% had luminal B breast cancer (ER+, PR-, Her2-negative); 11% had luminal A breast cancer (ER+, PR+, her2-negative); and 11% had Her2-positive breast cancer. No definite deaths from breast cancer were recorded. There was a trend for a statistically significant correlation between breast cancer and ovarian cancer, when breast cancer was diagnosed before ovarian cancer (P = 0.08) but not when breast cancer was diagnosed after ovarian cancer. There was no correlation between breast cancer diagnosis and family history.

Conclusion: The incidence of breast cancer after ovarian cancer diagnosis in the BRCA+ population is consistent with prior series. As ovarian cancer does not seem to increase the risk for breast cancer, prophylactic bilateral surveillance measures should be reevaluated in this population and may only be needed in long-term disease-free survivors and in subpopulations yet to be identified.
Objective: Current guidelines recommend risk-reducing bilateral salpingo-oophorectomy (RRSO) for women with known non-BRCA and Lynch ovarian cancer susceptibility gene mutations. Optimal timing for RRSO remains unclear. We sought to characterize the practice patterns for these women at our 2 institutions.

Method: Women with germline ovarian cancer susceptibility pathogenic gene mutations who had a RRSO from January 2000 to September 2019 were identified in an Institutional Review Board-approved study. All patients were asymptomatic with no suspicion for malignancy at time of RRSO. Clinicopathologic characteristics were extracted from the medical records. Continuous variables were analyzed with a Mann-Whitney U test and categorical variables analyzed with a proportionality Z test.

Results: A total of 25 non-BRCA (9 BRIP1, 9 RAD51C, and 7 RAD51D) and 76 Lynch (36 MLH1, 19 MSH2, 21 MSH6) mutation carriers were identified. The median age of the cohort at the time of RRSO was 47 years. There was no difference between age at testing, age at RRSO, and interval between testing and RRSO between groups. Nearly all patients in both groups had formal genetic counseling. Family history of ovarian cancer was more common in non-BRCA patients than in Lynch patients. Both groups had similarly high rates of family history of breast cancer. Although personal history of breast cancer was higher in non-BRCA patients. Concomitant hysterectomy was performed more frequently in Lynch carriers. Hormone replacement therapy (HRT) was rarely used in the non-BRCA group. There was no occurrence of occult ovarian or fallopian tube cancer or premalignancy in either group. (See Table 1.)

Conclusion: There were no occult cancers observed in either group of patients at the time of RRSO. The minority of patients in this cohort used HRT following RRSO. It appears safe to defer RRSO until natural menopause in women with non-BRCA and Lynch mutations in order to minimize the burden of early surgical menopause.

Table 1. Results.

<table>
<thead>
<tr>
<th></th>
<th>Non-BRCA (BRIP1, RAD51C, RAD51D)</th>
<th>Lynch (MLH1, MSH2, MSH6)</th>
<th>P =</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age at GeneticTesting (Med)</td>
<td>47</td>
<td>45</td>
<td>0.09</td>
</tr>
<tr>
<td>Age at RRSO (Med)</td>
<td>48</td>
<td>47</td>
<td>0.11</td>
</tr>
<tr>
<td>Interval from Test to RRSO</td>
<td>0.89</td>
<td>0.52</td>
<td>0.48</td>
</tr>
<tr>
<td>Documented Genetic Counseling (%)</td>
<td>92</td>
<td>100</td>
<td>0.02</td>
</tr>
<tr>
<td>Fam Hx of Ovarian Cancer (%)</td>
<td>52</td>
<td>20</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Fam Hx of Breast Cancer (%)</td>
<td>56</td>
<td>42</td>
<td>0.24</td>
</tr>
<tr>
<td>Personal Hx of Breast Cancer (%)</td>
<td>40</td>
<td>9</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Prophylactic Mastectomy (%)</td>
<td>4</td>
<td>1</td>
<td>0.41</td>
</tr>
<tr>
<td>HRT post RRSO (%)</td>
<td>12</td>
<td>43</td>
<td>&lt;.01</td>
</tr>
</tbody>
</table>

574 - Poster Session
Assessment of genetic testing rates in ovarian cancer patients
M.C. Alzamora1, T.Y. Sia1, A.I. Tergas2 and J.Y. Hou1. 1Columbia University, New York, NY, USA, 2Columbia University College of Physicians and Surgeons, New York, NY, USA, 3New York-Presbyterian/Columbia University Medical Center, New York, NY, USA

Objective: Despite national recommendations that women with epithelial ovarian cancer undergo genetic testing, studies have shown underuse in testing. We investigated genetic testing referral and completion rates in ovarian cancer patients and the impact of testing results on treatment plan.

Method: A cohort of newly diagnosed ovarian, fallopian tube, or primary peritoneal cancer patients seen in an urban and diverse gynecologic oncology clinic between August 22, 2016, and April 30, 2019, was analyzed. Charts were reviewed and data collected using REDCap. Results were analyzed with descriptive statistics and Fisher exact test.

Results: A total of 90 patients with a mean age of 57 years were included; 12% of cases were borderline tumors, 6.7% were sex-cord, 5.6% were germ-cell tumors, and 74.4% were epithelial. Eleven patients had a previous history of malignancy, most commonly breast, and 40% of patients had a relevant family history of cancer. Table 1 shows there were no major differences between patients who had and did not have genetic testing. Of the patients with epithelial ovarian cancer (n = 67), 71.6% underwent genetic testing with a mean lag time of 73.1 days between surgery and sample collection and 19 days between sample collection and results. The most common primary treatment in these patients was surgery (54.2%) over neoadjuvant (45.8%). Results were available in 89.6% of cases; of these, 12.5% were positive for a pathogenic mutation, including alterations in BRCA1 (50%), MLH1 (16.1%), CHEK2 (16.1%), and RAD51C (16.1%) genes, and 29.1% had a VUS; 62.8% of results were discussed by the physician, with a lag time of 79.6 days after result reports. Only 2 cases were referred for genetic counseling, and 2 cases with positive results prompted changes in treatment plan by establishing new
referrals, both to breast oncology. Of the 19 patients with epithelial ovarian cancer who did not undergo genetic testing, 57.9% were due to clinical team factors, and 31.6% had genetic testing done at an outside institution, but results were not made available.

**Conclusion:** In our cohort, only 71.6% of epithelial ovarian cancer patients underwent genetic testing. The most common reason for noncompletion was clinical team-related factors, which should be the focus of future quality improvement measures, including maintaining physician awareness and improving data-recording techniques.

**Table 1.** Differences between epithelial ovarian cancer patients with and without GT \((n = 67)\).

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Patient Group</th>
<th></th>
<th></th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Genetic Testing ((n=48))</td>
<td>No Genetic Testing ((n=19))</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Demographics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean age</td>
<td>60.2</td>
<td>61.2</td>
<td></td>
<td>0.300</td>
</tr>
<tr>
<td>White</td>
<td>24 (50.0)</td>
<td>11 (57.9)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black/African American</td>
<td>6 (12.5)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td>7 (14.6)</td>
<td>3 (15.8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>3 (6.3)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Native Hawaiian or Other Pacific Islander</td>
<td>2 (4.2)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle Eastern</td>
<td>1 (2.1)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown / Not Reported</td>
<td>5 (10.4)</td>
<td>5 (26.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Insurance Type</strong></td>
<td></td>
<td></td>
<td></td>
<td>0.681</td>
</tr>
<tr>
<td>Medicaid</td>
<td>7 (14.6)</td>
<td>4 (21.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medicare</td>
<td>13 (27.1)</td>
<td>5 (26.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private</td>
<td>20 (41.7)</td>
<td>9 (47.4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-Pay</td>
<td>8 (16.7)</td>
<td>1 (5.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Stage</strong></td>
<td></td>
<td></td>
<td></td>
<td>0.641</td>
</tr>
<tr>
<td>I</td>
<td>5 (10.9)</td>
<td>2 (10.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>10 (21.7)</td>
<td>4 (21.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>23 (50.0)</td>
<td>12 (63.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>8 (17.39)</td>
<td>1 (5.2)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>2 (4.2)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Tumor Histology</strong></td>
<td></td>
<td></td>
<td></td>
<td>0.719</td>
</tr>
<tr>
<td>Serous</td>
<td>35 (72.9)</td>
<td>14 (73.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mucinous</td>
<td>3 (6.3)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clear cell</td>
<td>3 (6.3)</td>
<td>2 (10.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Endometrioid</td>
<td>4 (8.3)</td>
<td>1 (5.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brenner</td>
<td>0</td>
<td>1 (5.3)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mixed epithelial / Stromal</td>
<td>1 (2.1)</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undifferentiated</td>
<td>2 (4.2)</td>
<td>1 (5.3)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**575 - Poster Session**

**Assessment of tumor sequencing rates in ovarian cancer patients**

M.C. Alzamora\(^a\), T.Y. Sia\(^b\), A.I. Tergas\(^b\) and J.Y. Hou\(^b\). \(^a\)Columbia University, New York, NY, USA, \(^b\)Columbia University College of Physicians and Surgeons, New York, NY, USA

**Objective:** Tumor gene sequencing can identify targetable mutations with potential prognostic and predictive therapeutic implications. There are no specific recommendations regarding patient selection for testing. Herein, we investigated tumor sequencing referral patterns and completion rates in ovarian cancer patients as well as the impact of testing on treatment plan.

**Method:** A cohort of newly diagnosed ovarian, fallopian tube, or primary peritoneal cancer patients seen in an urban and diverse gynecologic oncology clinic between August 22, 2016, and April 30, 2019, was analyzed. Charts were reviewed and data collected using REDCap. Results were analyzed with descriptive statistics.
Results: A total of 90 patients with a mean age of 57 years (range 22–94 years) were included. Out of these 90 cases, 40 (44.4%) were submitted for tumor sequencing. Of high-stage tumors, 53.3% were sent for genetic testing, compared 35.7% of low-stage tumors. The main differences between cases in which tumor sequencing was requested and cases in which it was not are illustrated in Table 1. All (100%) tests sent were resulted, of which 90% were positive for a genomic alteration, and 72.5% were found to be MSS (22.5% unable to determine) with an average tumor burden of 3.71 mutations/megabase. The average lag time from specimen collection to specimen reception by testing company was 97 days, with a standard deviation of 137 days. The most common genomic alterations found on positive tumor sequencing results involved the following genes: TP53 (58.3%), KRAS (16.7%), BRCA1 (13.9%), and NF1 (13.9%). In addition, of the cases with positive results, 66.7% were actionable mutations, including ones with approved therapies for both the specific tumor and other tumor types, as well as clinical trials. However, only 12.5% of these resulted in a change in treatment plan.

Conclusion: In our cohort, we found that high-stage tumors were more likely to be sent for tumor gene sequencing. Mutations were most commonly found in TP53, KRAS, and BRCA1. Although actionable mutations were found in 66.7% of cases, making tumor sequencing in ovarian cancer feasible, these have not resulted in a significant change in treatment plan.

Table 1. Differences between ovarian cancer patients with and without tumor.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Patient Group</th>
<th>Tumor Sequencing (n=40)</th>
<th>No Tumor Sequencing (n=50)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographics</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean age</td>
<td></td>
<td>57.8 (45.0)</td>
<td>56.08 (44.0)</td>
<td>0.750</td>
</tr>
<tr>
<td>White</td>
<td></td>
<td>18 (45.0)</td>
<td>22 (44.0)</td>
<td></td>
</tr>
<tr>
<td>Black/African American</td>
<td></td>
<td>5 (12.5)</td>
<td>3 (6.0)</td>
<td></td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td></td>
<td>8 (20.0)</td>
<td>10 (20.0)</td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td></td>
<td>2 (5.0)</td>
<td>1 (2.0)</td>
<td></td>
</tr>
<tr>
<td>Native Hawaiian or Other Pacific Islander</td>
<td></td>
<td>0</td>
<td>2 (4.0)</td>
<td></td>
</tr>
<tr>
<td>Unknown / Not Reported</td>
<td></td>
<td>7 (17.5)</td>
<td>11 (22.0)</td>
<td></td>
</tr>
<tr>
<td>Insurance Type</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medicaid</td>
<td></td>
<td>10 (25.0)</td>
<td>9 (18.0)</td>
<td>0.557</td>
</tr>
<tr>
<td>Medicare</td>
<td></td>
<td>8 (20.0)</td>
<td>13 (26.0)</td>
<td></td>
</tr>
<tr>
<td>Private</td>
<td></td>
<td>16 (40.0)</td>
<td>24 (48.0)</td>
<td></td>
</tr>
<tr>
<td>Self-Pay</td>
<td></td>
<td>6 (15.0)</td>
<td>4 (8.0)</td>
<td></td>
</tr>
<tr>
<td>Stage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td></td>
<td>9 (22.5)</td>
<td>18 (36.0)</td>
<td>0.434</td>
</tr>
<tr>
<td>II</td>
<td></td>
<td>6 (15.0)</td>
<td>9 (18.0)</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td></td>
<td>18 (45.0)</td>
<td>18 (36.0)</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td></td>
<td>6 (15.0)</td>
<td>3 (6.0)</td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td></td>
<td>1 (2.5)</td>
<td>2 (4.0)</td>
<td></td>
</tr>
<tr>
<td>Tumor Histology</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serous</td>
<td></td>
<td>27 (67.5)</td>
<td>28 (56.0)</td>
<td>0.667</td>
</tr>
<tr>
<td>Mucinous</td>
<td></td>
<td>2 (5.0)</td>
<td>5 (10.0)</td>
<td></td>
</tr>
<tr>
<td>Clear cell</td>
<td></td>
<td>2 (5.0)</td>
<td>3 (6.0)</td>
<td></td>
</tr>
<tr>
<td>Endometrioid</td>
<td></td>
<td>1 (2.5)</td>
<td>5 (10.0)</td>
<td></td>
</tr>
<tr>
<td>Brenner</td>
<td></td>
<td>1 (2.5)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Mixed epithelial / Stromal</td>
<td></td>
<td>0</td>
<td>1 (2.0)</td>
<td></td>
</tr>
<tr>
<td>Undifferentiated</td>
<td></td>
<td>2 (5.0)</td>
<td>1 (2.0)</td>
<td></td>
</tr>
<tr>
<td>Sex-cord / Stromal</td>
<td></td>
<td>2 (5.0)</td>
<td>4 (8.0)</td>
<td></td>
</tr>
<tr>
<td>Germ-cell</td>
<td></td>
<td>2 (5.0)</td>
<td>3 (6.0)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td>1 (2.5)</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
**Objective:** Targeted cancer therapies derived from tumor genomic sequencing have been associated with improved outcomes in the treatment of solid cancers. These therapies have lagged in the treatment of gynecologic cancers because of limited information regarding common genetic mutations and the availability of targeted therapies. We aimed to identify common genetic mutations in ovarian, fallopian tube, and primary peritoneal cancer patients and investigate the utilization of these mutations to direct disease treatment.

**Method:** The EMERSE program was utilized to search the medical records and identify all patients diagnosed with ovarian, fallopian tube, and primary peritoneal cancer who underwent tumor genomic profiling within our institution between April 2014 and January 2019. All patients who underwent testing with verifiable results were included in our retrospective data collection. Clinical information on tumor histology, stage, genetic mutations, utilization, and outcomes of treatments in patients with clinically relevant genetic mutations were collected.

**Results:** A total of 223 patients met inclusion criteria. In patients with clinically relevant genetic mutations and patients with non-clinically relevant genetic mutations, the majority had high-grade serous histology (37.2% vs 56.6%) and stage IIIC disease (45.4% vs 56.6%). Ninety-one percent of patients were found to have genetic mutations associated with their solid tumors, with a median of 2 mutations per patient (range 0–12). TP53 mutations were the most frequent genetic mutation (69.6%) with 35.6% of patients demonstrating this as their only mutation. Moreover, in our patients with genetic mutations, 54.2% (n = 110) were found to have at least 1 clinically relevant genetic mutation. BRCA1 and BRCA2 mutations were the most commonly identified clinically relevant genetic mutations (15%, n = 33), followed by KRAS (12.3%, n = 24), PIK3CA (9.0%, n = 20), and MYC (9.0%, n = 20); 10.8% (n = 24) of patients were treated with therapeutic agents or enrolled in clinical trials based on sequencing results. Of those on targeted treatment from sequencing, 16.7% (n = 4) had complete response; 16.7% (n = 4) had partial response; and 8.3% (n = 2) had stable disease for an objective response rate of 41.7%.

**Conclusion:** Genomic sequencing of ovarian tumors was associated with a high rate of detection of clinically relevant genetic mutations. Detection of such mutations enables treatment with existing targeted therapies. Furthermore, it will improve identification of common genetic alterations and fuel research investigating new potential targeted therapies.

---

**Objective:** Our aim was to develop a longitudinal biomarker algorithm combining 2 biomarkers, CA-125 and HE4, in a surveillance pilot study for ovarian cancer in women with BRCA mutations.

**Method:** Women with BRCA mutations and intact ovaries were prospectively identified from a large California health care system. Patients could self-select 1 of 2 surveillance strategies: the experimental Risk of Cancer Algorithm (ROCA) arm in which women had CA-125 and HE4 performed every 4 months, or the National Comprehensive Cancer Network (NCCN) Standard of Care (SOC) surveillance arm consisting of ultrasound and CA-125 performed every 6 months. Abnormal results triggered a second-line ultrasound and clinical evaluation. The combination biomarker strategy was based on the previously validated ROCA score using only CA-125. The HE4 blood tests were integrated into the ROCA methodology to determine whether the expanded screening strategy improved upon the single-biomarker algorithm. The performance of the combined ROCA score was assessed and compared to SOC performance.

**Results:** Over the study period August 2016–June 2018, 159 women enrolled in the ROCA arm and 43 in the SOC arm. There were 565 specimens collected and processed for CA-125 and HE4; 221 were used to compute the combined ROCA score. Menopause was significantly associated with an abnormal HE4 score (P = 0.009 by test and P = 0.027 by woman), but was not associated with the ROCA CA-125 or ROCA combined scores. Abnormal scores were found in 23.8% of the 172 ROCA CA-125 scores computed prior to the availability of the HE4 algorithm. This percentage dropped to 16.3% of the 172 ROCA CA-125 or new ROCA HE4 scores computed prior to the availability of the ROCA combined score. The percentage dropped further to 7.7% of the 221 computed ROCA combined scores. In the SOC arm, there were 14.9% abnormal ultrasounds or CA-125 laboratory tests. The combined ROCA score average specificity was 0.93, and the program average specificity for the ROCA arm was 0.99. See Table 1.

**Conclusion:** A pilot study using a newly developed multiple biomarker ROCA score demonstrated lower callback rates than either ROCA CA-125 used every 4 months or NCCN guideline standard surveillance. This approach warrants confirmation in a larger randomized trial to assess whether sensitivity for early-stage disease is maintained or increased while simultaneously reducing callback rates.
Table 1. Outcomes of ROCA and SOC surveillance tests.

<table>
<thead>
<tr>
<th></th>
<th>n</th>
<th>Intermediate ROCA abnormal (%)</th>
<th>Elevated abnormal ROCA score (%)</th>
<th>Total abnormal (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ROCA arm</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CA125 lab result</td>
<td>565</td>
<td></td>
<td></td>
<td>4.4</td>
</tr>
<tr>
<td>HE4 lab result</td>
<td>565</td>
<td></td>
<td></td>
<td>1.4</td>
</tr>
<tr>
<td>CA125 ROCA score only</td>
<td>172</td>
<td>13.37</td>
<td>10.47</td>
<td>23.8</td>
</tr>
<tr>
<td>Both CA125 &amp; HE4 ROCA scores (no combined)</td>
<td>172</td>
<td>11.63</td>
<td>4.65</td>
<td>16.3</td>
</tr>
<tr>
<td>Combined CA125/HE4 ROCA score</td>
<td>221</td>
<td>3.17</td>
<td>4.52</td>
<td>7.7</td>
</tr>
<tr>
<td><strong>SOC arm</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ultrasounds</td>
<td>121</td>
<td></td>
<td></td>
<td>11.6</td>
</tr>
<tr>
<td>CA 125 lab result</td>
<td>124</td>
<td></td>
<td></td>
<td>4.0</td>
</tr>
<tr>
<td>One or both tests</td>
<td>121</td>
<td></td>
<td></td>
<td>14.9</td>
</tr>
</tbody>
</table>

Quality & Healthcare Systems

578 - Poster Session

Electronic family history screening tool improves detection of inherited cancer risk: A prospective study
A. Le, K. Janes, E. Valice, C. Kobelka, E. Hoodfar and C.B. Powell. 1Kaiser Permanente, San Francisco, CA, USA, 2Kaiser Permanente National Quality, Oakland, CA, USA, 3Kaiser Permanente Northern California Division of Research, Oakland, CA, USA, 4Kaiser Permanente, Sacramento, CA, USA, 5Kaiser Permanente Northern California Gynecologic Oncology Program, San Francisco, CA, USA

Objective: Our aim was to assess the utility of an electronic screening tool to identify women at inherited cancer risk.

Method: Eligible participants included nonpregnant women, ages 35–55 years, seen at routine gynecologic visits without prior referral to the genetics department for cancer risk. The baseline group (August 2017 to December 2017) included women who completed the standard-of-care paper questionnaire (n = 1,037). An electronic screening tool was implemented in two phases. In phase 1 (June 2018 to October 2018), an online link to a questionnaire was completed after the visit (n = 935). In phase 2 (July 2019 to September 2019), an iPad-based questionnaire was completed in the clinic prior to the visit with the provider (n = 289). Both electronic screening tools generated an automated notification with inherited cancer risk and a referral to genetic counselling. Response rates between the online link and the iPad-based questionnaire were compared using $\chi^2$ tests. Referral rates for each electronic screening tool were compared to the baseline group using $\chi^2$ tests. Characteristics of responders and nonresponders to the online link and iPad-based questionnaires were compared with $\chi^2$ and Wilcoxon signed rank tests.

Results: The iPad-based questionnaire yielded a significantly greater response rate than the online link (47% vs 5.7%, $P < 0.0001$). Compared to the baseline genetics referral rate of 0.7%, significantly more women were referred to the genetics department with the online link and iPad-based questionnaires (3.6% and 11.8%, respectively, $P < 0.0001$). Women who completed the online link were more likely to be white compared to nonresponders (72% vs 46%, $P < 0.01$). There were no significant differences between responders and nonresponders on the iPad-based questionnaire.

Conclusion: Both electronic screening tools significantly increased referrals to the genetics department. Implementing innovative self-reporting tools can improve inherited cancer risk detection, resulting in cancer prevention in women and their families.

579 - Poster Session

Cystoscopy at the time of hysterectomy performed by a gynecologic oncologist and delayed lower genitourinary tract injury
R.M. Polan and E.L. Barber. Northwestern University Feinberg School of Medicine, Chicago, IL, USA

Objective: The aim of this study was to compare the rate of delayed 30-day lower genitourinary tract injury in women who underwent cystoscopy at the time of hysterectomy performed by a gynecologic oncologist for malignant or benign indications with those who did not.

Method: This is a retrospective cohort study of patients who underwent hysterectomy for malignant or benign pathology with a gynecologic oncologist recorded in the National Surgical Quality Improvement Program targeted hysterectomy file between 2014 and 2017. The primary outcome was a delayed lower genitourinary tract injury in the 30 days after hysterectomy. Secondary outcomes included urinary tract infection and operative time. The exposure of interest was cystoscopy at the time of hysterectomy. Stratified analysis was performed by route of surgery. Bivariate tests were used to examine associations. Patients who underwent additional procedures for prolapse or incontinence were excluded.
Results: We identified 28,863 women who underwent hysterectomy for benign or malignant indications with a gynecologic oncologist between 2014 and 2017. In these patients, surgical approach was open (29%), laparoscopic or robotic-assisted laparoscopic (63%), and vaginal or vaginally assisted (7%). Overall, 13% of women underwent cystoscopy at the time of surgery; cystoscopy was more commonly performed in laparoscopic or robotic (16%) and vaginal hysterectomy (12%) than in open hysterectomy (7%) ($P < 0.001$). There was no difference in delayed lower genitourinary tract injury between patients who underwent cystoscopy at the time of surgery compared with those who did not (0.38% vs 0.27%, $P = 0.23$). Patients who underwent cystoscopy were more likely to be diagnosed with a urinary tract infection (3% vs 2%, RR 1.3, 95% CI 1.1–1.6). Median operative time was increased by 6 minutes in patients in which hysterectomy and cystoscopy were performed (142 vs 138 minutes, $P = 0.06$) compared with cases of hysterectomy alone. See Table 1.

Conclusion: Cystoscopy at the time of hysterectomy performed by a gynecologic oncologist for benign or malignant indications does not result in a lower rate of 30-day delayed lower genitourinary tract injury compared with no cystoscopy.

<table>
<thead>
<tr>
<th>Question</th>
<th>No cystoscopy (n = 25,202)</th>
<th>Cystoscopy (n = 3,661)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any delayed genitourinary injury</td>
<td>68 (0.27%)</td>
<td>14 (0.38%)</td>
<td>0.23</td>
</tr>
<tr>
<td>Ureteral obstruction</td>
<td>28 (0.11%)</td>
<td>7 (0.19%)</td>
<td>0.19</td>
</tr>
<tr>
<td>Bladder fistula</td>
<td>17 (0.07%)</td>
<td>2 (0.05%)</td>
<td>0.77</td>
</tr>
<tr>
<td>Ureteral fistula</td>
<td>19 (0.08%)</td>
<td>3 (0.08%)</td>
<td>0.89</td>
</tr>
<tr>
<td>Reoperation for a GU injury</td>
<td>60 (0.24%)</td>
<td>12 (0.33%)</td>
<td>0.31</td>
</tr>
</tbody>
</table>

580 - Poster Session
Utilization and knowledge of oncofertility services: A single institution experience
S. Gordhandas, N. Shah and J. Stewart. Weill Cornell Medical College, New York, NY, USA

Objective: The aim of this study was to analyze fertility preservation referral patterns, utilization of fertility preservation services, and provider knowledge of fertility preservation for oncology patients at a large tertiary referral center.

Method: All oncofertility referrals to a single institution from January 2011 to December 2016 were included; the following data were collected: patient age, cancer diagnosis, and fertility preservation type (oocytes, embryos, ovarian tissue, or no services utilized). An anonymous, one-time survey was distributed electronically to providers that participate in the care of cancer patients. The survey included demographic information and assessed awareness of fertility preservation services offered, barriers to referral, and comfort level with counseling.

Results: From November 2011 to December 2016, 553 oncofertility referrals were received with 292 patients (53%) proceeding with fertility preservation. Breast cancer ($n = 129, 44$%) and leukemia/lymphoma ($n = 76, 26$%) were the most prevalent diagnoses; gynecologic cancers accounted for 12% (ovarian $n = 16$, endometrial $n = 10$, cervical $n = 8$). Seven patients were referred due to high-risk mutations, BRCA/Lynch syndrome. The majority of patients undergoing fertility preservation cryopreserved oocytes ($n = 190$), followed by embryos ($n = 83$) and ovarian tissue ($n = 19$). A total of 151 surveys were completed (response rate 20%); 12% of participants identified gynecologic oncology as their specialty. Survey responses of all participants and gynecologic oncology participants are presented in Table 1. Providers indicated lack of knowledge ($n = 89$), financial barriers ($n = 59$), uncertain prognosis of disease ($n = 41$), treatment delay ($n = 28$), and uncertain efficacy of fertility preservation ($n = 25$) as barriers to referral. When counseling patients on fertility preservation, providers indicated that they are most likely to use handouts/brochures ($n = 75$) and an informative website ($n = 68$).

Conclusion: The majority (68%) of providers are aware that fertility preservation services are available. However, provider knowledge of what fertility preservation services include, which patients qualify for fertility preservation, and how to refer patients for fertility preservation, lags behind. When compared to all participants, gynecologic oncology providers were more knowledgeable about fertility preservation (Table 1). The majority (53%) of patients referred for oncofertility preservation consultation completed fertility preservation services. This information will direct quality improvement initiatives to improve services at our medical center.

Table 1. Survey responses, gynecologic oncology providers vs. all participants.

<table>
<thead>
<tr>
<th>Question</th>
<th>Gyn Onc</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are you aware that fertility preservation services are available at Weill Cornell Medical Center?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>18 100.0</td>
<td>103 68.2</td>
</tr>
<tr>
<td>No</td>
<td>0 0.0</td>
<td>48 31.8</td>
</tr>
<tr>
<td>Do you know what services fertility preservation includes?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>16 88.9</td>
<td>56 37.1</td>
</tr>
<tr>
<td>Question</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>-------------------------------------------------------------------------</td>
<td>------</td>
<td>-----</td>
</tr>
<tr>
<td>Do you know which patients qualify for a fertility preservation referral?</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td>Do you know how to refer patients for fertility preservation?</td>
<td>13</td>
<td>5</td>
</tr>
<tr>
<td>How likely are you to discuss fertility preservation with patients recently diagnosed fertility limiting disease (i.e. malignancy)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Very likely</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>Likely</td>
<td>2</td>
<td>11.1</td>
</tr>
<tr>
<td>Neither likely nor unlikely</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Unlikely</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Very unlikely</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>How comfortable are you personally counseling patients on fertility preservation?</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Not at all comfortable</td>
<td>2</td>
<td>11.1</td>
</tr>
<tr>
<td>Slightly comfortable</td>
<td>4</td>
<td>22.2</td>
</tr>
<tr>
<td>Somewhat comfortable</td>
<td>8</td>
<td>44.5</td>
</tr>
<tr>
<td>Moderately comfortable</td>
<td>4</td>
<td>22.2</td>
</tr>
<tr>
<td>Extremely comfortable</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>How important is fertility preservation for your patients?</td>
<td>10</td>
<td>55.6</td>
</tr>
<tr>
<td>Extremely important</td>
<td>7</td>
<td>38.9</td>
</tr>
<tr>
<td>Very important</td>
<td>1</td>
<td>5.5</td>
</tr>
<tr>
<td>Not so important</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Not at all important</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>How often do you include counseling on fertility preservation in discussions with your patients?</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>2</td>
<td>11.1</td>
</tr>
<tr>
<td>Rarely, in less than 10% of the chances when I could have</td>
<td>3</td>
<td>16.7</td>
</tr>
<tr>
<td>Occasionally, in about 30% of the chances when I could have</td>
<td>1</td>
<td>5.5</td>
</tr>
<tr>
<td>Sometimes, in about 50% of the chances when I could have</td>
<td>14</td>
<td>77.8</td>
</tr>
<tr>
<td>Frequently, in about 70% of the chances when I could have</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>How likely are you to refer patients recently diagnosed with fertility limiting disease (i.e. malignancy) for fertility preservation?</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Very likely</td>
<td>16</td>
<td>89.0</td>
</tr>
<tr>
<td>Likely</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Neither likely nor unlikely</td>
<td>1</td>
<td>5.5</td>
</tr>
<tr>
<td>Unlikely</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Very unlikely</td>
<td>1</td>
<td>5.5</td>
</tr>
</tbody>
</table>

581 - Poster Session
Trends in venous thromboembolism prophylaxis in gynecologic surgery for benign and malignant conditions
S.K. Syeda, L. Chen, J.Y. Hou, A.I. Tergas, F. Khoury Collado, A. Melamed, C.M. St. Clair and J.D. Wright. New York-Presbyterian/Columbia University Medical Center, New York, NY, USA

Objective: Venous thromboembolism (VTE) is a leading cause of perioperative morbidity and mortality. We analyzed the trends in use of VTE prophylaxis over time in women undergoing hysterectomy for both benign and malignant indications.

Method: The Premier Database was used to identify women who underwent hysterectomy from 2011 to 2017. Women were stratified by indication for surgery (benign or cancer) and route of hysterectomy. VTE prophylaxis was stratified as none, mechanical, pharmacologic, or combination (mechanical and pharmacologic). Trends in use of prophylaxis over time were analyzed. Multivariate models were developed to examine predictors of use of prophylaxis.

Results: Among 920,477 patients identified, 579,824 (63.0%) received VTE prophylaxis including 15.4% who received pharmacologic, 34.5% who received mechanical, and 13.1% who received combination prophylaxis. Use of overall prophylaxis declined annually from 68.1% in 2011 to 56.7% in 2017 ($P < 0.001$, Figure 1). Among patients with cancer, use of prophylaxis declined from 84.5% in 2011 to 78.6% in 2017 ($P < 0.001$). A similar trend was noted among women with benign conditions, with rates of prophylaxis declining from 66.2% to 53.5% ($P < 0.001$). In addition, use of prophylaxis declined for patients undergoing MIS hysterectomy from 65.4% in 2011 to 53.3% in 2017, and from 73.1% to 66.7% in patients who underwent abdominal hysterectomy. Among patients with cancer, rates of
pharmacologic and combined prophylaxis slightly decreased over time, with 71.0% of women receiving either in 2011 and 69.7% in 2017 \( (P < 0.001) \). However, among women with benign conditions, rates of pharmacologic and combined prophylaxis rose from 19.4% in 2011 to 25.6% in 2017 \( (P < 0.001) \). Despite these changes in prophylaxis rates and methods, there was no significant change in rate of VTE between 2011 and 2017 \( (P = 0.06) \). Similarly, when stratified by route of hysterectomy, there were no statistically significant increases in the rates of thromboembolism for any subgroup.

**Conclusion:** Despite the lack of change in guidelines for VTE prophylaxis in gynecologic surgery, overall rates of prophylaxis have decreased over time independent of indication or route of surgery. Rates of thromboembolic events have not significantly increased in response to decreased use of VTE prophylaxis.

**Fig. 1.** Rates of venous thromboembolism prophylaxis by prophylaxis type.

---

582 - Poster Session
Implementation of a restrictive discharge opioid algorithm after minimally invasive gynecologic surgery: Impact on patient-reported outcomes and refill requests
The University of Texas MD Anderson Cancer Center, Houston, TX, USA

**Objective:** The aim of this study was to evaluate refill requests and longitudinal patient-reported outcomes (PROs) after implementation of a restrictive discharge opioid algorithm in minimally invasive (MIS) gynecologic surgery.

**Method:** We implemented an evidence-based restrictive discharge opioid-prescribing algorithm within our enhanced recovery program in August 2018. Patients undergoing MIS hysterectomy or adnexal surgery (GYN-MIS) were prescribed 5 tablets of 5 mg oxycodone at discharge, along with ibuprofen and acetaminophen. We compared clinical outcomes before (before February 1, 2017, to December 31, 2017, \( n = 213 \)) and after (after August 1, 2018, to June 30, 2019, \( n = 180 \)) implementation with descriptive statistics. PROs were collected daily for 7 days, then weekly x 5 after discharge using the MD Anderson Symptom Inventory for patients consented for PRO collection \( (n = 324) \). Linear mixed-effects modeling was used to examine the longitudinal change of symptom burden from pain, fatigue, sleep, and constipation, as well as functional interference after discharge. Models were adjusted for clinical and demographic characteristics.

**Results:** There was no difference between the cohorts in median age (before, 55 years, IQR 44–64 years, vs after, 54 years, IQR 45–65 years; \( P = 0.6 \)), rate of hysterectomy (before, 65.7%, vs after, 61.1%; \( P = 0.3 \)), or rate of same-day discharge (before, 62.4%, vs after, 66.7%; \( P = 0.4 \)). "After" patients were prescribed a higher median morphine equivalent dose at discharge (225 mg, range 0–520 mg).
than "after" patients (37.5 mg, range 0–225 mg; \( P < 0.001 \)), equivalent to a reduction of approximately 25 tablets of 5 mg oxycodone per patient. Overall, 5.9% of patients requested an opioid refill within 30 days of surgery, and this rate did not differ between the "before" (13/213, 6.1%) and "after" (10/180, 5.6%; \( P = 1 \)) cohorts. There was no difference in patient-reported pain (\( P = 0.8 \)), fatigue (\( P = 0.4 \)), interference with walking (\( P = 0.6 \)) or sleep (\( P = 0.3 \)) between before and after cohorts. There was a trend toward reduced patient-reported constipation in the after cohort (\( P = 0.05 \)) (Figure 1).

**Conclusion:** Restrictive discharge opioid prescribing after GYN-MIS significantly reduced opioid prescribing without increasing patient-reported pain, and was not associated with increased opioid refill requests. These data provide novel longitudinal post-discharge PRO data to support the wide adoption of restrictive opioid prescribing after GYN-MIS.

---

**Fig. 1.** Longitudinal post-discharge patient reported outcomes by opioid prescribing cohort (historical vs. prospective).

---

**583 - Poster Session**

A quality improvement analysis of alvimopan administration among gynecologic oncology patients undergoing bowel surgery

R.A. Guerra\( ^{a,b} \), A. Freeman\( ^{a,b} \), M. Swanson\( ^{a,b} \), J.S. Chapman\( ^{a,b} \), S.M. Ueda\( ^{a,b} \), E.A. Alvarez\( ^{a,b} \) and L.M. Chen\( ^{a,b} \); \( ^{a} \)University of California, San Francisco, San Francisco, CA, USA; \( ^{b} \)UCSF Helen Diller Family Comprehensive Cancer Center, San Francisco, CA, USA

**Objective:** The primary objective of this study is to determine whether proper (FDA-labelled) use of alvimopan for patients with a gynecologic malignancy who undergo bowel surgery affects hospital length of stay. We also sought to understand whether alvimopan use is associated with return to bowel function defined as time to flatus, time to bowel movement, and time to tolerance of regular diet × 24 hours.

**Method:** A retrospective cohort study was performed from July 2018—when our institution made alvimopan available for inpatient use—to June 2019. Participants were women, 18 years and older, with a gynecologic malignancy who underwent bowel surgery at the time of their surgical debulking. Exclusion criteria included women with a diagnosis of nongynecologic malignancy and those who had bowel surgery scheduled as a reoperation if their initial surgery did not involve bowel surgery. FDA-labelled use of alvimopan was defined as the administration of a preoperative dose of 12 mg orally followed by 12 mg twice daily postoperatively for a maximum of 15 doses. Descriptive analysis, \( t \) tests, and logistic regression were performed.

**Results:** A total of 50 bowel surgeries were performed during the study time frame. Seven patients were excluded for nongynecologic malignancy, and 1 patient was excluded because of death related to abdominal sepsis; this patient did not receive alvimopan. Of the 42 patients eligible for this study, 21 patients received alvimopan according to recommended dosage and administration guidelines, and 21 patients did not receive alvimopan as recommended. The average number of alvimopan pills taken postoperatively was 10 (range 3–14 pills). Patients in the FDA-labelled use group of alvimopan had more comorbid conditions than their counterparts (42.8%, 4–6 comorbid conditions, vs 23.81%, \( P = 0.20 \)). The mean length of stay was 9.57 days in the FDA-labelled use group compared to 11.00 days in the other group (\( P = 0.58 \)). No difference was seen between groups in time to return of bowel function.
**Conclusion:** Proper use of alvimopan is not significantly associated with decrease in hospital length of stay or faster return of bowel function in patients undergoing bowel surgery with a diagnosis of gynecologic malignancy. A larger study may detect these differences, supporting observations in other surgical populations that alvimopan is associated with improved surgical outcomes after bowel surgery.

---

**584 - Poster Session**

**Characterizing patient-reported outcomes as standard of care**


**Objective:** The aim of this study was to determine whether patient-reported outcomes (PRO), race, and/or rurality indicate hospitalization rate in breast and gynecologic oncology patients.

**Method:** This was a retrospective chart review of 225 female patients who met the following criteria: (1) diagnosed with primary breast or gynecologic cancer between June 1, 2016, and June 30, 2019, at the University of South Alabama Hospital, (2) older than 18 years at diagnosis, (3) enrolled in Oncology Care Model (OCM), and (4) completed a PRO survey within 15 days of diagnosis. The following data were extracted from patient charts and surveys: pain score, distress score, depression score, performance score (ECOG-based disability score), cancer site, race, rurality, BMI, and hospitalizations 3 months following diagnosis. \( \chi^2 \) analysis and Fisher exact test using SAS 9.4 were used to model data.

**Results:** White patients (170, 75.6%) were significantly more depressed (\( P = 0.002 \)) than non-white patients (55, 24.4%). Breast cancer patients (137, 60.9%) were significantly more distressed than gynecologic cancer patients (88, 39.1%) (\( P = 0.008 \)). No correlation was found between rurality and pain score, depression score, distress score, disability, or hospitalizations. No correlation was found between hospitalizations and race, pain score, distress score, or depression score. Rural patients with medium or severe pain (score >3) (17, 7.6%) were more than 14 times more likely to be hospitalized (OR = 14.63, 95% CI 1.57–136.2, \( P = 0.018 \)) than rural patients with mild pain (pain scores ≤3) (43, 19.1%). More disabled patients (performance score >1) (22, 9.8%) were about 3 times more likely to be hospitalized than patients with performance scores <1 (203, 90.2%) (OR = 2.97, 95% CI 1.28–6.90, \( P = 0.014 \)).

**Conclusion:** PRO survey data were not indicative of hospitalizations, with the exception of disability across all patients and pain in rural patients. We believe this was because patients taking PRO surveys were navigated throughout treatment via the OCM, and thus had clinicians intervene before poor PRO score precipitated hospitalization. Clinicians should pay close attention to PRO of pain score in rural patients and performance score in all patients so intervention may occur and therefore reduce hospitalization rates.

---

**585 - Poster Session**

**Reducing postoperative opioid prescriptions in gynecologic oncology patients: Implementation of a three-tiered evidence-based protocol**

E. Westona, A.L. Beavisb, A. Sannehb, S. Chaudharii, R.L. Stonec, A.N. Faderb and S.L. Wethingtonb. *Johns Hopkins School of Medicine, Baltimore, MD, USA, *Johns Hopkins Hospital, Baltimore, MD, USA, *Johns Hopkins Hospital, The Kelly Gynecologic Oncology Service, Baltimore, MD, USA

**Objective:** The aim of this study was to determine the impact of a postoperative opioid-prescribing protocol on opioid-prescribing practices, refill requests, and pain-related patient phone calls in gynecologic oncology patients.

**Method:** A prospective quality improvement project to reduce postoperative opioid prescriptions was implemented for all patients undergoing minimally invasive or open surgery with an academic inpatient gynecologic oncology service. The clinical team was trained to use a 3-tiered standardized discharge prescription algorithm (see Table 1). Postoperative opioid prescription quantities were based on inpatient opioid use in oral morphine equivalents (OME) in the 24 hours prior to hospital discharge. Education on postoperative pain management and expectations was provided to all patients. Enhanced recovery after surgery (ERAS) pathways were used for the laparotomy patients. We compared OME prescribed, pain-related patient phone calls, and refill requests using Wilcoxon rank sum and Fisher exact tests pre- and post-protocol and measured compliance during the initial implementation period. The study was powered to detect a 25% reduction in OME prescribed.

**Results:** When comparing pre- (n = 42) and post-protocol (n = 45) cohorts during the initial study period, there were no differences in demographics, clinical characteristics, or perioperative complication rates. Patients had a mean age of 57 years and mean BMI of 31, and 63% underwent open surgery; 66% had a diagnosis of cancer (50% ovarian cancer); and 15% had a diagnosis of chronic pain. Post-protocol women were prescribed fewer opioids upon hospital discharge than pre-protocol (median 240 pre-protocol vs 113 OME post-protocol, a 53% decrease, \( P < 0.0001 \)). There was no increase in the proportion of patients calling with pain-related complaints (24 pre-
vs 9% post-protocol, \( P = 0.08 \)) or refill requests (3 pre- vs 7% post-protocol, \( P = 0.62 \)). Compliance with the protocol was 69% during the initial implementation period.

**Conclusion:** During the initial phase of implementation, a 3-tiered opioid-prescribing protocol markedly reduced discharge opioid prescriptions without increasing patient phone calls or prescription refill requests. Using inpatient opioid requirements in the 24 hours prior to hospital discharge is a feasible and effective means to guide evidence-based postsurgical opioid prescribing after gynecologic oncology surgery.

### Table 1. Post-operative opioid prescribing protocol.

<table>
<thead>
<tr>
<th>Inpatient opioid pill use 24 hours prior to discharge</th>
<th>Inpatient MME use 24 hours prior to discharge</th>
<th>Rx recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 pills</td>
<td>0</td>
<td>Rx 5 pills (Consider 0)*</td>
</tr>
<tr>
<td>1 – 4 pills**</td>
<td>&gt; 0 – 32**</td>
<td>Rx 15 pills</td>
</tr>
<tr>
<td>5 or more pills</td>
<td>&gt; 32</td>
<td>Rx 30 pills</td>
</tr>
</tbody>
</table>

*In conversation with patient/attending

**1 pill = 5 mg oxycodone (7.5 MME/pill) ~ or hydromorphone 2 mg (8 MME/pill)

Same Rx recommendations for oxycodone 5 mg or hydromorphone 2 mg tabs

---

**586 - Poster Session**

**Exploring the utility and burden of clinical follow up of threshold alerts generated by patient-reported outcomes in women with recurrent ovarian cancer: A longitudinal study**

*M. Villanueva*\(^a\), C.C. Sun\(^b\), A. Schneider\(^b\), E. Molina\(^b\), X.S. Wang\(^b\) and L. Meyer\(^b\). \(^a\)The University of Texas Health Science Center at Houston, Houston, TX, USA, \(^b\)The University of Texas MD Anderson Cancer Center, Houston, TX, USA

**Objective:** A commonly perceived barrier to implementing the routine collection of patient-reported outcomes (PROs) in clinical practice is concern regarding the additional workload from the follow-up effort required of the medical team. We identified the proportion of patients with recurrent ovarian cancer who triggered predetermined clinical alert levels in an outpatient care setting.

**Method:** As part of an ongoing longitudinal study, patients completed a series of validated PRO instruments from June 2017 to January 2019. Responses exceeding specific threshold scores triggered an email alert to the clinical team. The MD Anderson Symptom Inventory–Ovarian Cancer (MDASI-OC) assesses symptom severity and interference on a scale of 0 to 10. Sadness, shortness of breath, and pain scores ≥7 triggered an alert. This was completed every 2 weeks for 1 year and monthly thereafter. The CESD-20 depression screen and the Generalized Anxiety Disorder-7 (GAD-7) screen triggered alerts for scores ≥16 and ≥15, respectively. These were completed every 3 months. Follow-up data associated with each threshold alert were gathered through the medical record and any clinical email correspondence between the clinical and study teams.

**Results:** A total of 5,225 surveys from 195 patients were collected with 137 (70%) women triggering 746 (14%) alerts (2–30 per patient). Median (range) alert scores for CESD-20, GAD-7, and MDASI-OC were 20.5 (16–49), 15 (15–20), and 8 (7–10), respectively. Follow-up information revealed that 320 (43%) alerts were attributed to disease or treatment; 58 (8%) were unrelated health issues; and 368 (49%) were unclear due to insufficient information. Overall, the most common triggered clinical alert was pain (42%). Additional management was offered through 79 (11%) referrals, 36 (15%) emergency visits, and 26 (11%) hospital admissions. See Table 1.

**Conclusion:** While a large proportion of patients triggered an alert, the overall proportion of alerts was only 14%. Notably, less than 50% of the alerts were easily attributed to disease or treatment. In this patient population of advanced, recurrent ovarian cancer, the median alert scores surpassed predetermined clinical cut points. Future steps aim to explore whether the current recommended thresholds for alerts are appropriate and clinically meaningful in this patient population.

### Table 1. Number of clinical alerts sent, attribution to ovarian cancer and follow-up actions.

---


<table>
<thead>
<tr>
<th>PRO Instrument and symptom</th>
<th>Total number of alerts</th>
<th>Related to disease or treatment</th>
<th>Unrelated to disease or treatment</th>
<th>Unclear if related or not</th>
<th>On active treatment or prior history of depression or anxiety</th>
<th>Referral to another service for further evaluation</th>
<th>Emergency room visit</th>
<th>Hospital admission</th>
</tr>
</thead>
<tbody>
<tr>
<td>CESD (depression screening tool)</td>
<td>184</td>
<td>70 (38.0%)</td>
<td>10 (5.4%)</td>
<td>104 (56.5%)</td>
<td>27 (14.7%)</td>
<td>33 (17.9%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>GAD-7 (anxiety screening tool)</td>
<td>7</td>
<td>2 (28.6%)</td>
<td>1 (14.3%)</td>
<td>4 (57.1%)</td>
<td>1 (14.3%)</td>
<td>0 (9%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>MDASI –OC Sadness</td>
<td>111</td>
<td>42 (37.8%)</td>
<td>5 (4.5%)</td>
<td>64 (57.6%)</td>
<td>7 (6.3%)</td>
<td>17 (15.3%)</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>MDASI OC Shortness of breath</td>
<td>127</td>
<td>59 (46.4%)</td>
<td>10 (7.9%)</td>
<td>58 (45.7%)</td>
<td>NA</td>
<td>11 (8.7%)</td>
<td>11 (8.7%)</td>
<td>11 (8.7%)</td>
</tr>
<tr>
<td>MDASI OC Pain</td>
<td>317</td>
<td>147 (46.4%)</td>
<td>32 (10.1%)</td>
<td>138 (43.5%)</td>
<td>NA</td>
<td>18 (5.7%)</td>
<td>25 (7.9%)</td>
<td>15 (4.7%)</td>
</tr>
</tbody>
</table>

**587 - Poster Session**

**Accuracy of a real-time electronic medical record based score to predict unplanned hospital readmission among gynecologic oncology patients**

J.S. Taylor, C.A. Marten, T.W. Earles, B. Fellman, A. Hoffman, J.A. Dottino, R.F. Harrison, K.H. Lu and K. Schmeler. The University of Texas MD Anderson Cancer Center, Houston, TX, USA

**Objective:** Unplanned hospital readmissions within 30 days of discharge are costly and decrease health care quality. The LACE+ index (LACE+) scoring system predicts 30-day risk of readmission, is available real time in the electronic medical record, and has not been previously applied to gynecologic oncology patients. Our objective was to assess the ability of the LACE+ score to predict unplanned gynecologic oncology readmissions.

**Method:** We assessed gynecologic oncology readmission rates and associated LACE+ scores from January 2017 to December 2018. LACE+ score was derived from patient demographics and recent health care utilization. Logistic regression models assessed LACE+ score as a prognostic factor of readmission. We determined an optimal cut point for predicting readmission using Youden’s index, which maximizes sensitivity plus specificity. These models were conducted overall and within surgical and nonsurgical subsets. All statistical analysis were performed using Stata/MP v15.0.

**Results:** A total of 2,185 unique patients with 2,958 admissions were analyzed. Of the 2,958 admissions, 1,274 (43%) were surgical and 1,684 (57%) nonsurgical. There were 376/2,958 (13%) overall readmissions, 66/1,274 (5%) surgical readmissions, and 310/1,684 (18%) nonsurgical readmissions. LACE+ scores were significantly higher among all patients readmitted versus not (mean 68.7 vs 53.6, \( P < 0.001 \)) and among surgical patients (55.3 vs 44.2, \( P < 0.001 \)) and nonsurgical patients (71.6 vs 61.9, \( P < 0.001 \)). Optimal cut points of LACE+ score were ≥66 for all patients (OR = 4.62, 95% CI 3.65–5.85, \( P < 0.001 \)), ≥53 for surgical patients (OR = 4.12, 95% CI 2.46–6.91, \( P < 0.001 \)), and ≥73 for nonsurgical patients (OR = 3.27, 95% CI 2.52–4.25, \( P < 0.001 \)). We found a differential effect of LACE+ scores between surgical and nonsurgical groups. The probability of readmission increases at a greater rate as LACE+ scores increase in the nonsurgical group versus the surgical group (Figure 1).

![Figure 1](image-url)
Conclusion: The LACE+ score accurately predicts risk of readmission for gynecologic oncology patients. We found optimal cut points of LACE+ scores to identify highest risk patients. These differ between surgical and nonsurgical patients. Increases to LACE+ score among nonsurgical patients raise risk of readmission more than among surgical patients. Our results can be used to target at-risk patients and prevent readmission.

Fig. 1. Interaction effect of LACE and surgery on readmission within 30 days.

588 - Poster Session
The role of ERAS in minimally invasive surgery: Impact on patient satisfaction and opiate use
Magee-Womens Hospital of UPMC, Pittsburgh, PA, USA

Objective: With the widespread implementation of Enhanced Recovery After Surgery (ERAS) protocols in gynecologic oncology, patient outcomes should be evaluated. Our aim was to assess changes in postoperative opiate use and patient satisfaction after implementation of an ERAS protocol for minimally invasive gynecologic oncology surgery.

Method: An ERAS protocol for patients undergoing minimally invasive surgery was initiated on the gynecologic oncology service at the University of Pittsburgh Medical Center. Patients were surveyed pre- and postimplementation of the protocol. The goal of the survey was to assess patient satisfaction, pain on an 11-point scale (0 = "no pain" to 10 = "worst possible pain"), and opiate use. Patient clinical data were collected prospectively in an institutional database and augmented retrospectively to capture additional clinical data of interest. Basic descriptive and comparative statistics were performed.

Results: Nineteen patients were evaluated prior to ERAS implementation and 25 patients after ERAS. There were no significant differences in baseline demographics, with patients having a mean age of 60 years and BMI of 35.1 mg/m², and the majority were white. Total in-hospital oral morphine equivalents (OME) were higher pre-ERAS with 85.5 OME compared to 50.4 OME on ERAS (P < 0.01). There were higher rates of preoperative OME use in the ERAS group at 21 versus 0 OME (P < 0.01). Intraoperative OME was higher pre-ERAS with 61.3 versus 13.0 OME in ERAS (P < 0.01). There was no difference in postoperative day 1 OME usage between groups. Home oral opiate use was similar between groups with 18 (95%) in the pre-ERAS and 20 (80%) in the post-ERAS group using fewer than 20 tablets of opiate pain medication after surgery (P = 0.34). Patient satisfaction was similar between the two groups at 1.3 compared to 1.1, as was average pain and pain at time of postoperative visit; however, worst pain experienced was higher in the ERAS patients at 5.3 compared to the pre-ERAS at 3.7 (P = 0.02). See Figure 1.

Conclusion: An ERAS protocol for minimally invasive gynecologic oncology surgery resulted in a reduction in total hospital OME use without a change in patient satisfaction. After discharge from the hospital, the majority of patients did not use more than 20 opiate tablets, and 40% used none at home regardless of ERAS protocol. We have shown that reducing the number of opiates prescribed did not affect patient satisfaction.
Objective: Minimally invasive surgery (MIS) has been shown to offer improved perioperative outcomes and uptake has increased across different specialties with significant implications for health systems and resource allocation. We sought to assess the uptake of MIS over time in uterine and cervix cancer patients in Ontario and evaluate associations between MIS rates and institutional, patient and provider factors.

Method: A retrospective population-based cohort study of women with surgically managed uterine and cervix cancer in Ontario, Canada from 2000 to 2017 was performed. Clinicopathologic, demographic, institutional, and provider factors were identified through administrative databases and linked through Institute of Clinical and Evaluative Sciences algorithms. Fisher’s exact tests, chi-square tests, Wilcoxon rank sum tests and logistic regression models were used to explore factors associated with the use of MIS.

Results: We identified 24264 and 3388 patients who had a hysterectomy for pre-operative diagnoses of uterine and cervix cancer, respectively. In total, 6199 (26%) uterine and 842 (25%) cervix cancer patients had MIS hysterectomy. The proportion of MIS to open surgeries increased from <1% in 2000 to over 55% in 2017 (OR=1.30, CI 1.29-1.31) (Figure 1). Higher volume institutions had higher rates of MIS (30% vs 14%, p<0.001). On multivariable regression for uterine cases, low income, rurality, higher age and Charlson comorbidity score, low surgical volume, non-teaching hospitals and non-gyn oncology surgeon were associated with reduced odds of MIS (p<0.001). MIS was associated with reduced length of stay (median=1 vs 3 days, p<0.001), fewer ED visits within 30 days (12.6% vs 16.3%, p<0.001) and fewer deaths within 30 days (0.1% vs 0.6%, p<0.001).

Conclusion: Use of MIS to treat women with uterine and cervix cancer in Ontario has steadily increased over time, most pronouncedly in centres with high case volume. Low income patients and those living in rural communities have reduced odds of receiving MIS, raising the concern of health equity in Ontario’s equal access system. Uptake of MIS has significant implications for health systems and resource allocation. Further planned analyses will focus on how MIS rates affect surgical wait times.
Objective: The aim of this study was to evaluate safety of early discharge after robotic radical hysterectomy (RRH) in a tertiary hospital that has the enhanced recovery after surgery (ERAS) protocol.

Method: Among 94 consecutive cervical cancer patients who had undergone RRH, perioperative outcomes, postoperative genitourinary function, and the rate of unexpected visit and readmission were analyzed retrospectively. Patients were categorized as a surgery-to-discharge time of ≤12 hours (early discharge) or >12 hours (late discharge).

Results: About 77% (n = 72) of analyzed patients were discharged within 12 hours after RRH. Of these, 46 patients (65%) underwent nerve-sparing (NS) RRH (vs 18% of late discharge, \( P < 0.001 \)). The early discharge group had significant correlation with shorter duration for urinary catheter required (1 vs 39 days, \( P < 0.001 \)), less operative blood loss (100 vs 125 ml, \( P = 0.004 \)), and less voiding difficulty after long-term follow-up (3 vs 18%, \( P = 0.025 \)) compared to the late discharge group. There was no difference in perioperative complications, unexpected visit, and readmission between the 2 groups. Performing NS-RRH was the only independent predictor for early discharge (\( P = 0.043 \), HR for late discharge = 0.22, CI 0.05–0.95).

Conclusion: Early discharge within 12 hours after RRH was safe in the setting of the ERAS protocol. The NS-RRH could avoid the delay of genitourinary function recovery after surgery that caused late discharge. It can become the reasonable clinical pathway for early discharge of patients who undergo NS-RRH with the ERAS protocol.

591 - Poster Session
Development of a prediction model for postoperative opioid use following gynecologic surgery

LV. Rodriguez\(^b\), J.R. Salinaro\(^b\), O. Kohrm\(^b\), A.S. Habib\(^c\), L.J. Havrilesky\(^b\), J.E. Jelovsek\(^b\) and B.A. Davidson\(^c\). \(^a\)Duke School of Medicine, Durham, NC, USA, \(^b\)Duke University, Durham, NC, USA, \(^c\)Duke University Medical Center, Durham, NC, USA

Objective: The aim of this study was to develop a model that predicts postoperative opioid use after gynecologic surgery.

Method: A prospective cohort study of women undergoing surgery on a gynecologic oncology service was conducted from February 1, 2018, to March 1, 2019. Eligible subjects included English-speaking women 18 years and older. Subjects were excluded if primary vulvar or vaginal surgery was planned. Baseline characteristics were collected. Subjects completed the Pain Catastrophizing Scale and were asked to rate their anxiety regarding surgery, anticipated postoperative pain, and anticipated postoperative pain medication use. Subjects were contacted postoperatively by telephone at 1, 2, 4, and 6 weeks or until no longer requiring opioids. Candidate prediction models were created with the number of opioid pills used following hospital discharge as the response variable. Thirty-nine candidate

![Fig. 1. Uptake of MIS hysterectomy over time for uterine and cervix cancer in Ontario, Canada.](image-url)
predictors were considered. The first full model was fit after case-wise deletion of candidate predictors. Final predictors were selected using backwards stepdown and penalized ordinal regression with regularization. Overall model performance was calculated using the ordinal concordance (\(c\)) statistic.

**Results:** A total of 274 patients enrolled, with 216 completing follow-up. Median (IQR) opioid pills prescribed at hospital discharge was 20 (15–25), and median number of opioid pills used by subjects was 4 (0–14) with 36% (78/216) of participants using zero pills. Age, education, smoking history, anticipated pain medication use, preoperative anxiety, preoperative pregabalin use, and total operating time were final predictors in the models. Three different cumulative probability ordinal models had the best fit with an overall ordinal \(c\) statistic (95% CI) of 0.63 (0.59–0.66), 0.63 (0.59–0.67), and 0.65 (0.61–0.69). General calibration slopes were 0.80, 0.80, and 0.77, demonstrating marginal overfitting of 20%–23%. A clinical decision tool was created using the final predictors (Figure 1).

**Conclusion:** Models generated in the prospective study estimate individual patient probabilities of opioid use following gynecologic surgery, offering the potential to reduce both the number of opioids prescribed and those unused after surgery. External validation is ongoing to select the most clinically relevant model.

![Clinical decision tool using the final predictors.](image)

**Fig. 1.** Clinical decision tool using the final predictors.

---

**592 - Poster Session**

**Rethink of intense surveillance practice adopted for cancer survivors in cervical cancer and endometrial cancer**

K. Nakamura\(^a\), Y. Kitahara\(^b\), K. Kigure\(^a\), S. Yamashita\(^a\) and T. Kanuma\(^a\). \(^a\)Gunma Prefectural Cancer Center, Ota, Japan, \(^b\)Gunma University OB/GYN, Maebashi, Japan

**Objective:** In Japan, 25,000 women are diagnosed annually with uterine cancers. Health care insurance policy in Japan allows patients to have more intense follow-up care and routine surveillance than in the United States. Thus, within the first 2 years, patients receive tumor marker test, Pap test every 1–2 months, and CT imaging every 6–12 months in our hospital. Afterward, patients visit the oncologist for a regular survey every 4 months. However, there is no clear evidence that this surveillance brings better outcomes for and decreases morbidity in patients after recurrence. The aim of this study was to retrospectively analyze data, including surveillance method to detect recurrence, recurrence site, and survival period after recurrence in order to consider surveillance benefits for patients and cost-effective practices.

**Method:** The medical records of patients diagnosed as having recurrent cervical cancer and endometrial cancer in our institution between January 2009 and December 2015 were retrospectively analyzed. Their clinicopathological data (Table 1) were statistically analyzed by using the Kaplan-Meier method, and a log rank test was performed with a statistical significance of \(P < 0.05\). We performed statistical analysis using SAS v9.4.

**Results:** No significant differences in time until recurrence after initial treatment were found between stages for both cervical cancer and endometrial cancer. The three-fourths of patients who were diagnosed as having relapse tumor were asymptomatic and detected by tumor marker test and imaging analysis such as CT, MRI, and PET scan. However, the surveillance methods and the recurrence sites did not demonstrate any difference in survival period after recurrence (Table 1).
Conclusion: In this retrospective study, a dense surveillance protocol adopted in our hospital has not shown better clinical outcomes for patients with recurrence. At this stage, an effective gynecologic surveillance has not been established. In addition, an ideal salvage therapy needs to be developed to benefit patients after recurrence. Prospective randomized trials have to be designed for evaluation of surveillance protocol after primary treatment in order to provide evidence-based surveillance.

Table 1.

<table>
<thead>
<tr>
<th></th>
<th>Cervical Cancer</th>
<th>P value**</th>
<th>Endometrial Cancer</th>
<th>P value**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients with Invasive Carcinoma</td>
<td>360</td>
<td></td>
<td>279</td>
<td></td>
</tr>
<tr>
<td>Patients* with Recurrence</td>
<td>35</td>
<td></td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Age [Median (Range)] (Year)</td>
<td>43 (26-83)</td>
<td>64 (51-73)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>7</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>10</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>5</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>13</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time to Recurrence</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Median (95%CI)] (Day)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stage 1</td>
<td>995 (148-1495)</td>
<td></td>
<td>812 (295-1378)</td>
<td></td>
</tr>
<tr>
<td>Stage 2</td>
<td>397 (182-640)</td>
<td></td>
<td>371 (143-599)</td>
<td></td>
</tr>
<tr>
<td>Stage 3</td>
<td>361 (90-1427)</td>
<td></td>
<td>245 (78-560)</td>
<td></td>
</tr>
<tr>
<td>Stage 4</td>
<td>371 (160-442)</td>
<td></td>
<td>526 (243-1302)</td>
<td></td>
</tr>
<tr>
<td>Diagnosis of Recurrence</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Symptom</td>
<td>3</td>
<td></td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Pap Smear or Biopsy</td>
<td>5</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Tumor Marker</td>
<td>13</td>
<td></td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Imaging Analysis (CT, MRI, PET)</td>
<td>14</td>
<td></td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Time from Recurrence to Death</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>[Median (95%CI)] (Day)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diagnosis  Method</td>
<td></td>
<td>P=0.54</td>
<td>P=0.86</td>
<td></td>
</tr>
<tr>
<td>n=3</td>
<td>247 (175- )</td>
<td>1777 (1- )</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=5</td>
<td>1236 (704-1235)</td>
<td></td>
<td>610 (314-906)</td>
<td></td>
</tr>
<tr>
<td>n=13</td>
<td>565 (401-802)</td>
<td></td>
<td>821 (205- )</td>
<td></td>
</tr>
<tr>
<td>n=14</td>
<td>616 (176-1055)</td>
<td></td>
<td>501 (86- )</td>
<td></td>
</tr>
<tr>
<td>Site of Recurrence</td>
<td></td>
<td>P=0.90</td>
<td>P=0.12</td>
<td></td>
</tr>
<tr>
<td>Local</td>
<td>704 (176-1235)</td>
<td></td>
<td>1481 (906-2056)</td>
<td></td>
</tr>
<tr>
<td>Regional Lymph node</td>
<td>554 (401-554)</td>
<td></td>
<td>501 (314- )</td>
<td></td>
</tr>
<tr>
<td>Distant Lymph node</td>
<td>637 (419-1410)</td>
<td></td>
<td>no estimate</td>
<td></td>
</tr>
<tr>
<td>Intra Abdominal</td>
<td>565</td>
<td></td>
<td>734 (205- )</td>
<td></td>
</tr>
<tr>
<td>Distant Site</td>
<td>736 (175- )</td>
<td></td>
<td>355 (45-1777)</td>
<td></td>
</tr>
</tbody>
</table>

*Patients reached CR after primary treatments
** a log-rank was performed

593 - Poster Session
Characterization of care before endometrial cancer diagnosis at an urban safety net hospital for assessment of potential screening intervention
*Morehouse School of Medicine, Atlanta, GA, USA, †Emory University School of Medicine, Atlanta, GA, USA, ‡BronxCare Health System, Icahn School of Medicine at Mount Sinai, Bronx, NY, USA

Objective: Many communities bear a disproportionate burden from endometrial cancer (EC), suggesting that screening special populations may have an amplified advantage in addressing this excess morbidity and mortality. Safety net hospitals serve these same people and may represent opportunities to intervene before the onset of this disparity. Since part of the worse outcomes for endometrial
cancer is due to histology differences, we compared endometrioid and nonendometrioid cancers for population characteristics related to successful screening, such as access and acceptance.

**Method:** Women with EC were identified by the cancer registry and supplemented by electronic medical records. Analogue cases were classified as appropriate with chart review. Prior registration was used as a surrogate for safety net hospital access and prior Pap smear as indication of women's health care access.

**Results:** From 2012 to 2016, 169 patients were diagnosed with EC; 98 with endometrioid and 71 nonendometrioid; 92.3% (156/169) had bleeding complaints; however, only 24.2% were grade 1 and 97 stage I (53.8%) with only 23.1% being both (39/169). A total of 58 first presented for symptoms of their EC. Among those who were established hospital patients unrelated to their EC (n = 112), the median time between initial visit within the same safety net hospital system to date of EC diagnosis was 31 (IR 26.5–56) months. Among these same patients, advanced-stage (stage ≥II) (n = 39) time to diagnosis was 25 months from unrelated first encounter. Only 9.8% of EC patients had a prior Pap smear >1 year before cancer diagnosis. See Table 1.

**Conclusion:** Nonendometrioid cancers share characteristics with endometrioid cancers (proportion with safety net hospital access), which suggests both populations at risk could participate in screening programs in the safety net hospital destined to treat them. However, there was a low rate of women’s health care based on the Pap smear rate. Although most had bleeding complaints, this did not shield them from more advanced stage or histology. Some important differences also indicate potential difficulty in screening for EC especially nonendometrioid.

<table>
<thead>
<tr>
<th></th>
<th>Endometrioid</th>
<th>Non-endometrioid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average age (range)</td>
<td>58.8 (30-88)</td>
<td>64.9 (45-94)</td>
</tr>
<tr>
<td>African American race</td>
<td>79 (80.6%)</td>
<td>64 (90.1%)</td>
</tr>
<tr>
<td>Average BMI</td>
<td>38.4</td>
<td>34.8</td>
</tr>
<tr>
<td>Stage 1</td>
<td>73 (74.5%)</td>
<td>28 (39.4%)</td>
</tr>
<tr>
<td>Histology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade 1: 41 (41.8%)</td>
<td></td>
<td>Serous/mixed serous: 40 (56.3%)</td>
</tr>
<tr>
<td>Grade 2: 44 (44.9%)</td>
<td></td>
<td>Carcinosarcoma: 25 (35.2%)</td>
</tr>
<tr>
<td>Grade 3: 12 (12.2%)</td>
<td></td>
<td>Undifferentiated/poorly differentiated: 6 (8.5%)</td>
</tr>
<tr>
<td>Mucinous: 1 (0.01%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Previous pap in &gt;1 year prior to diagnosis</td>
<td>14.9% (7/47)</td>
<td>4.4% (2/45)</td>
</tr>
<tr>
<td>Bleeding complaints</td>
<td>93.9%</td>
<td>90.1%</td>
</tr>
<tr>
<td>Established SNH patients prior to EC</td>
<td>68.4% (67/98)</td>
<td>63.4% (45/71)</td>
</tr>
<tr>
<td>Established patients median time between initial SNH visit to date of diagnosis/ Interquartile range (months)</td>
<td>33 / 13.5-58</td>
<td>26 / 18-55</td>
</tr>
</tbody>
</table>

**594 - Poster Session**

**The effect of acquiring a robotic surgical platform on mode of surgery, length of stay and hospital cost among patients undergoing surgery for gynecologic cancer in U.S. hospitals**


**Objective:** The aim of this study was to evaluate the effect of acquisition of a robotic platform on mode of surgery, length of stay, and per-patient hospital cost among patients undergoing hysterectomy for uterine, ovarian, and cervical cancer.
Method: Using data from Premier, a hospital-based administrative database, we identified hospitals in which gynecologic surgeons first began to perform hysterectomies on a robotic surgical platform in 2010 and that contributed to the database for 3 years before and after the initiation of robot-assisted gynecologic surgery (2007–2013). We identified control hospitals with no robotic hysterectomies during the entire period. Within these hospitals, we identified patients who underwent hysterectomy for uterine, ovarian, or cervical cancer using ICD-9 codes. We fit linear and quantile regression models, with cluster robust standard errors, to conduct a controlled, interrupted time series analysis evaluating the effect of acquiring a robotic surgical platform on the mode of hysterectomy, length of stay, and per-patient hospital costs.

Results: We identified 5,433 women treated in 28 hospitals that acquired a robotic platform, and 2,648 women treated in 112 control hospitals. While the proportion of hysterectomies performed by laparotomy was similar in both groups before 2010 (83.5% vs 85.9%), there was a larger decline in the use of laparotomy in hospitals that acquired a robotic system (−38.8 percentage points, 95% CI −26.5 to −51.2) than in controls (−2.3 percentage points, 95% CI −9.9 to 5.4, P < 0.001). The proportion of patients discharged within 1 day of surgery increased more in hospitals that acquired a robotic platform than in controls (+23.9 percentage points, 95% CI 16.7–31.2, vs +1.4, 95% CI −5.7 to 8.6, P < 0.001). Acquisition of a robotic system did not increase per-patient hospital costs compared with controls (median difference +$304 vs +$453, P = 0.75). See Figure 1.

Conclusion: Acquisition of a robotic surgery platform significantly increased the use of minimally invasive hysterectomy for gynecologic cancers and the proportion of patients discharged within a day of surgery, without increasing per-patient hospital costs associated with hysterectomy.

Fig. 1. Interrupted time series analysis evaluating the effect availability of a robotic platform on the frequency of open abdominal hysterectomy (left) and discharge within one day of surgery (right) among patient undergoing hysterectomy for a gynecologic malignancy. Points represent quarterly rates among patients tread in hospitals that acquired a robotic surgical system in 2010 (blue) and control hospitals which did not acquire a robotic system during the study period (red). Solid lines represent linear trends in outcome before (20007-2009) and after (2011-2014) the intervention. Dashed lines are expected outcomes if pre-intervention trends were to prevail.

595 - Poster Session

Perioperative bundle does not decrease the rate of surgical site infection in patients undergoing hysterectomy
S. Tomita, J. Suhner, A. Bucknor, T. Orfanelli, C. Carr, S. Blank and H.C. Loudon. Icahn School of Medicine at Mount Sinai, New York, NY, USA

Objective: The aim of this study was to determine the efficacy of an institutionally enforced perioperative hysterectomy bundle in decreasing the rate of surgical site infection (SSI) in patients undergoing laparoscopic/robotic and open hysterectomy.

Method: Electronic charts were reviewed for patients undergoing robotic, laparoscopic, or abdominal hysterectomy for benign and malignant indications from January 2015 through October 2018 across 5 hospital sites in a large urban health system. Characteristics were compared between groups using t test for continuous measures and χ² or Fisher exact tests as appropriate for categorical measures. We fit a multivariate model of SSI and bundle adjusting for potential confounders. A Breslow-Day test was used to explore whether the impact of the bundle varied by laparotomy versus minimally invasive procedure.

Results: A total of 3,902 patient charts were reviewed across 5 hospital sites in a large urban health care system. The mean patient age was 52.6 ± 11.7 years and mean BMI 28.9 ± 7 kg/m². The percentage of procedures performed via laparotomy was 40.44% (n = 1,578), and 59.56% (n = 2,324) were performed minimally invasively. Of all patients, 90.39% (n = 3,527) received the correct preoperative
98.4% \((n = 3,663)\) of patients received the proper antibiotic dose for their BMI. Of all patients, 1.56% \((n = 61)\) had a documented SSI; of these, 63.3% \((n = 38)\) were superficial infections and 36.7% \((n = 22)\) were deep space infections. Prior to the bundle implementation, 1.7% \((n = 36)\) of patients were documented to have SSI compared to 1.4% \((n = 25)\) post-bundle. \(\chi^2\) tests determined that there was no significant difference in the proportion of patients with SSI after implementation of the hysterectomy bundle. After adjusting for potential confounders including BMI, diabetes status, smoking status, and estimated blood loss, a multivariate model was used to show that the bundle remained unassociated with SSI \((\text{aOR} = 1.06, 95\% \text{CI} 0.62–1.81, \text{P} = 0.84)\). There was no evidence of an interaction between procedure type (laparotomy vs minimally invasive) and the bundle on SSI rates \((\text{P} = 0.41)\). See Table 1.

**Conclusion:** After implementation of perioperative hysterectomy bundle, there was no significant change in the rate of SSI for laparoscopic/robotic and open hysterectomy.

<table>
<thead>
<tr>
<th>Timing</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preoperative</td>
<td>“Preventing surgical site infections” flier for patient education</td>
</tr>
<tr>
<td></td>
<td>4% chlorhexidine gluconate shower night before and morning of surgery</td>
</tr>
<tr>
<td>Intraoperative</td>
<td>Antibiotics: Compliance with institution perioperative and intraoperative antimicrobial guidelines regarding TIMING, CHOICE, DOSSING, and REDOSING</td>
</tr>
<tr>
<td></td>
<td>Recommended: Cefazolin 2g (3g if&gt;120kg, 1kg if &lt;50kg), every 4 hours</td>
</tr>
<tr>
<td></td>
<td>PCN allergic patients: Clindamycin 900mg IV every 6 hours and Gentamicin* 5mg/kg (ideal body weight) IV every 8 hours</td>
</tr>
<tr>
<td></td>
<td><strong>Skin prep:</strong> Complete coverage of incisional area with 2% chlorhexidine gluconate** and 70% isopropyl alcohol solution</td>
</tr>
<tr>
<td></td>
<td><strong>Vaginal prep:</strong> 4% chlorhexidine gluconate** + alcohol</td>
</tr>
<tr>
<td></td>
<td><strong>Sterile closing tray</strong> for fascia and skin closure</td>
</tr>
<tr>
<td></td>
<td><strong>Staff glove change</strong> before fascia closure; gown change if soiled</td>
</tr>
<tr>
<td></td>
<td><strong>Change suction, tubing, bovie, bovie tip, light handles</strong> before fascia closure</td>
</tr>
<tr>
<td>Postoperative</td>
<td>Practice excellent hand hygiene:</td>
</tr>
<tr>
<td></td>
<td>1. Upon room entry</td>
</tr>
<tr>
<td></td>
<td>2. Prior to donning gloves</td>
</tr>
<tr>
<td></td>
<td>3. After glove removal</td>
</tr>
<tr>
<td></td>
<td>4. Upon leaving room</td>
</tr>
<tr>
<td></td>
<td><strong>Dressing removal at 24-48 hours</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Patient education</strong> on wound care and infection symptoms</td>
</tr>
</tbody>
</table>

**For chlorhexidine gluconate allergy, use povidone iodine**

---

**596 - Poster Session**

**Performance on an independent elective rotation in gynecologic oncology is associated with improved gynecologic oncology fellowship match rates**


**Objective:** The aim of this study was to determine the impact of participation in an independent elective rotation in gynecologic oncology on gynecologic oncology fellowship match rates for obstetrics and gynecology residents.

**Method:** We collected lists of elective rotating residents at our institution with their internal performance scores from July 2007 to June 2018 and NRMP lists of applicants to our gynecologic oncology fellowship for appointment years 2008 to 2019. We then collected publicly available data on position placement in gynecologic oncology fellowship and residency institutions.

**Results:** We identified 440 gynecologic oncology residents who participated in the independent elective rotation from July 2007 to June 2018. By reviewing NRMP and our applicant data, we found that 94.4% \((\text{range 87.9\%–100\%})\) of all gynecologic oncology applicants apply to our gynecologic oncology fellowship per year. By assuming that all our elective rotators who applied into gynecologic oncology would have applied to our fellowship, we found 76.5% \((337/440)\) of elective rotators applied to gynecologic oncology fellowship. Of these rotators, 64% \((215/337)\) matched, compared to 65% published by the NRMP over the same period. Of the rotators who applied to gynecologic oncology, we had internal performance scores \((0–9\text{ scale})\) available for 86% \((291/337)\). Median performance scores for those who did not match was 7.67 \((\text{range 4.13–8.67})\) versus 8.06 \((\text{range 5.70–9.00})\) for those who matched \((\text{P} < 0.001)\). Improved performance scores demonstrated improved match rates: >8.5, 85% \((23/27)\); >8–8.5, 82% \((77/94)\); >7.5–8, 58% \((55/95)\); >7–7.5, 45% \((18/40)\); and ≤7, 31% \((11/35)\). Of those who matched, 59% \((127/215)\) came from residency programs with a 64% \((215/337)\) fellowship, 85% \((182/215)\) from an academic residency program, versus 29% \((35/122)\) and 67% \((82/122)\) for those who did not match,
respectively. On logistic regression analysis, having a program with a fellowship ($P=0.013$) and performance score ($P<0.001$) were independent variables for matching into fellowship, while being from an academic residency institution was not ($P=0.100$).

**Conclusion:** Gynecologic oncology fellowship applicants with a higher internal performance score during their independent elective rotation in gynecologic oncology correlated with increased fellowship match rates.

---

**597 - Poster Session**

**Feasibility of assessing wound perfusion at the time of laparotomy closure**


*Memorial Sloan Kettering Cancer Center, New York, NY, USA*

**Objective:** The purpose of this study was to assess the feasibility of measuring vertical midline laparotomy incision perfusion using the Spectrum near-infrared (NIR) imaging system before and after skin closure with either staples or running subcuticular suture.

**Method:** This was a nonrandomized feasibility study of patients undergoing laparotomy via vertical midline incision for any indication on the gynecology service from February 2018 to August 2019. Patients were assigned skin closure with either running subcuticular suture or skin staples in a sequential, nonrandomized fashion before the procedure and underwent fascial and subcutaneous tissue closure according to surgeon preference. Skin perfusion was recorded using NIR imaging after an intravenous injection of 4 mL indocyanine green (ICG) and subsequently measured by video analysis at predefined points along the incision after fascial closure was complete and upon skin closure. Clinicodemographic data, perioperative details, and surgical secondary events were recorded.

**Results:** Twenty patients were enrolled in the study: 10 with staples and 10 with suture skin closure. Table 1 reports perioperative variables. Groups were similar with the exception of higher preoperative albumin in the staple cohort, and a greater proportion of patients in whom the subcutaneous tissue was closed with a continuous running stitch in the suture cohort. Of all patients, 85% (17/20) had successful perfusion recorded pre- and post-closure; 5% (1/20) had successful perfusion recorded post-closure only; and 10% (2/20) did not have successful perfusion recorded. No patients experienced an adverse event with ICG. One patient in the staple cohort had a grade 1 wound separation that healed without additional intervention. This patient did have successful pre- and post-closure perfusion recording.

**Conclusion:** These data indicate that measuring abdominal incision perfusion with NIR imaging is feasible both pre- and post-closure in those with suture and staple closure. These data support the design of a larger randomized study to determine the utility of NIR imaging in measuring wound perfusion.

**Table 1.**

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>ALL, N=20</th>
<th>STAPLES, N=10</th>
<th>SUTURE, N=10</th>
<th>P-VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEDIAN AGE, YEARS (RANGE)</td>
<td>59 (41-78)</td>
<td>60 (42-71)</td>
<td>56.5 (41-78)</td>
<td>p=0.73</td>
</tr>
<tr>
<td>MEDIAN BMI (RANGE)</td>
<td>26 (21.5-36)</td>
<td>27.6 (22-36)</td>
<td>25.8 (21.5-34.2)</td>
<td>p=0.47</td>
</tr>
<tr>
<td>RACE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WHITE</td>
<td>14</td>
<td>7</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>BLACK</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>ASIAN</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>OTHER</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>COMORBIDITIES</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIABETES MELLITUS</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>HYPERLIPIDEMIA</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>HYPERTENSION</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>HISTORY OF SMOKING</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>GYNECOLOGIC MALIGNANCY</td>
<td>14</td>
<td>8</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>UTERINE MALIGNANCY</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>OVARY MALIGNANCY</td>
<td>7</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>OTHER MALIGNANCY</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>HISTORY OF PRIOR ABDOMINAL SURGERY</td>
<td>13</td>
<td>9</td>
<td>4</td>
<td>P=0.53</td>
</tr>
<tr>
<td>LAPAROTOMY</td>
<td>9</td>
<td>7</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>MINIMALLY INVASIVE</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>MEDIAN PREOP ALBUMIN (RANGE)</td>
<td>4.0 (3.1-4.9)</td>
<td>4.4 (3.8-4.9)</td>
<td>4.0 (3.1-4.1)</td>
<td>P=0.03*</td>
</tr>
</tbody>
</table>
598 - Poster Session
Opioid-free gynecologic surgery: A prospective quality improvement initiative
B. Margolis, L. Andriani, K.E. Baumann, A. Hirsch, K. Lutz, J.P. Curtin and B. Pothuri. New York University School of Medicine, New York, NY, USA

Objective: Surplus postoperative opiate pills can lead to misuse and dependence for patients and household contacts. We aimed to omit or reduce opiate prescriptions after gynecologic surgery with a prospective quality improvement initiative.

Method: Patients undergoing scheduled surgery by a gynecologic oncologist at an academic hospital were included. Procedures performed vaginally were excluded. Patients received preoperative counseling, including setting expectations and pain management strategies. Preoperative gabapentin and acetaminophen and postoperative acetaminophen, ibuprofen, and gabapentin were prescribed. Ambulatory patients were not prescribed opiates, and minimally invasive (MIS) 23-hour observation patients were prescribed only 4 pills of oxycodone if they used >5 opiate doses prior to discharge. Laparotomy patients were provided oxycodone opiate prescriptions according to their usage 24 hours prior to discharge: no opiate prescriptions if 0–1 dose used, 4 pills if 2–5 doses used, and 12 pills if >5 doses used. Baseline characteristics, postoperative opiate prescriptions, opiate refills, and pain scores were collected 60 days pre- and post-intervention. Pre- and post-intervention variables were compared using \( t \) tests, Wilcoxon rank sum tests, Pearson \( \chi^2 \), and Fischer exact tests.

Results: A total of 193 procedures (103 pre- and 90 post-intervention) were analyzed. The mean number of opiate pills prescribed decreased from 5.63 to 1.96 \( (P < 0.001) \); mean oral morphine equivalent decreased from 29 to 12 \( (P < 0.001) \), and the percentage of patients sent home with an opiate prescription was reduced from 69% to 23\% \( (P < 0.001) \). MIS hysterectomy patients who received an opiate prescription decreased from 81% to 18\% \( (P < 0.001) \), and laparotomy patients who received an opiate prescription decreased from 64\% to 50\% \( (P = 0.400) \). There was no significant change in postoperative opiate prescription refills (6\% vs 11\%, \( P = 0.184 \)) or postoperative pain calls (9\% to 14\%, \( P = 0.137 \)). Ninety-five percent of patients agreed to the statement “my pain was well controlled after surgery” at their postoperative visit. See Table 1.

Conclusion: Opiate prescriptions were significantly reduced or omitted with excellent patient satisfaction and without increasing refills. More than 80\% of MIS hysterectomy and 50\% of laparotomy patients were discharged without an opiate prescription. Curtailing or omitting opiate prescriptions is a very important step in reducing the opioid epidemic by surgeons.

Table 1. Patient Demographics, Operative Characteristics and Outcome Measure Pre- and Post-Intervention

<table>
<thead>
<tr>
<th>Type of surgery</th>
<th>Patients, No. (%)</th>
<th>Pre-Intervention (n=103)</th>
<th>Post-Intervention (n=90)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>April 2 – June 1 2019</td>
<td>June 17 – Aug. 15 2019</td>
<td></td>
</tr>
<tr>
<td>Laparotomy</td>
<td></td>
<td>14 (13.6)</td>
<td>22 (24.4)</td>
<td>0.027</td>
</tr>
<tr>
<td>Ambulatory</td>
<td></td>
<td>74 (71.8)</td>
<td>48 (53.3)</td>
<td></td>
</tr>
<tr>
<td>MIS</td>
<td></td>
<td>15 (14.6)</td>
<td>20 (22.2)</td>
<td></td>
</tr>
<tr>
<td><strong>Ambulatory/MIS hysterectomy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td></td>
<td>41 (39.8)</td>
<td>38 (42.2)</td>
<td>0.733</td>
</tr>
<tr>
<td>No</td>
<td></td>
<td>62 (60.2)</td>
<td>52 (57.8)</td>
<td></td>
</tr>
<tr>
<td><strong>Age, years</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td></td>
<td>53.38 (15.2)</td>
<td>51.58 (13.9)</td>
<td>0.390</td>
</tr>
<tr>
<td>Median (IQR)</td>
<td></td>
<td>53 (40-66)</td>
<td>52 (42-6)</td>
<td>0.503</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td></td>
<td>78 (75.7)</td>
<td>64 (71.1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Cases</td>
<td>MIS</td>
<td>Ambulatory/MIS Hyst</td>
<td>Ambulatory</td>
</tr>
<tr>
<td>----------------------</td>
<td>-------------</td>
<td>-----</td>
<td>---------------------</td>
<td>------------</td>
</tr>
<tr>
<td></td>
<td>Total Cases</td>
<td>MIS</td>
<td>Ambulatory/MIS Hyst</td>
<td>Ambulatory</td>
</tr>
<tr>
<td></td>
<td>Total Cases</td>
<td>MIS</td>
<td>Ambulatory/MIS Hyst</td>
<td>Ambulatory</td>
</tr>
<tr>
<td></td>
<td>Total Cases</td>
<td>MIS</td>
<td>Ambulatory/MIS Hyst</td>
<td>Ambulatory</td>
</tr>
<tr>
<td></td>
<td>Total Cases</td>
<td>MIS</td>
<td>Ambulatory/MIS Hyst</td>
<td>Ambulatory</td>
</tr>
<tr>
<td></td>
<td>Total Cases</td>
<td>MIS</td>
<td>Ambulatory/MIS Hyst</td>
<td>Ambulatory</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>6 (5.8)</td>
<td>10</td>
<td>10 (11.1)</td>
<td>0.179</td>
</tr>
<tr>
<td>Asian</td>
<td>15 (14.6)</td>
<td>8</td>
<td>8 (8.9)</td>
<td></td>
</tr>
<tr>
<td>Unknown/Other</td>
<td>4 (3.9)</td>
<td>8</td>
<td>8 (8.9)</td>
<td></td>
</tr>
<tr>
<td>BMI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>27.50 (7.3)</td>
<td>27.59 (6.2)</td>
<td>0.925</td>
<td></td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>25.83 (21.7-32.6)</td>
<td>27.15 (22.97-30.7)</td>
<td>0.611</td>
<td></td>
</tr>
<tr>
<td>Smoking status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td>1 (1.0)</td>
<td>5</td>
<td>5 (5.6)</td>
<td>0.218</td>
</tr>
<tr>
<td>Former</td>
<td>32 (31.0)</td>
<td>26</td>
<td>26 (28.9)</td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>70 (68.0)</td>
<td>59</td>
<td>59 (65.6)</td>
<td></td>
</tr>
<tr>
<td>Prior abdominal surgeries</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>1.08 (1.4)</td>
<td>1.10 (1.4)</td>
<td>0.910</td>
<td></td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>1 (0-2)</td>
<td>1</td>
<td>1 (0-2)</td>
<td></td>
</tr>
<tr>
<td>Diagnosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benign or pre-invasive</td>
<td>63 (61.2)</td>
<td>56</td>
<td>56 (62.2)</td>
<td>0.880</td>
</tr>
<tr>
<td>Malignant</td>
<td>40 (38.8)</td>
<td>34</td>
<td>34 (37.8)</td>
<td></td>
</tr>
<tr>
<td>Length of OR case, minutes</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>162 (104.8)</td>
<td>192.47 (105.7)</td>
<td>0.046</td>
<td></td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>140 (90-194)</td>
<td>162 (121-237)</td>
<td>0.008</td>
<td></td>
</tr>
<tr>
<td>Comprehensive staging or debulking performed</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>34 (33.0)</td>
<td>27</td>
<td>27 (30.0)</td>
<td>0.654</td>
</tr>
<tr>
<td>No</td>
<td>69 (67.0)</td>
<td>63</td>
<td>63 (70.0)</td>
<td></td>
</tr>
<tr>
<td>Length of stay, days</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>1.04 (4.5)</td>
<td>0.92 (1.4)</td>
<td>0.802</td>
<td></td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>0 (0-1)</td>
<td>0</td>
<td>0 (0-1)</td>
<td></td>
</tr>
<tr>
<td>Chronic opioid use</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>6 (5.8)</td>
<td>1</td>
<td>1 (1.1)</td>
<td>0.124</td>
</tr>
<tr>
<td>No</td>
<td>97 (94.2)</td>
<td>89</td>
<td>89 (98.9)</td>
<td></td>
</tr>
<tr>
<td>Number of opioid doses in 24 hours prior to discharge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambulatory, Mean (SD)</td>
<td>1.9 (1.89)</td>
<td>2.2</td>
<td>2.2 (2.48)</td>
<td>0.494</td>
</tr>
<tr>
<td>Non-ambulatory, Mean (SD)</td>
<td>1.3 (1.65)</td>
<td>1.9</td>
<td>1.9 (1.8)</td>
<td>0.165</td>
</tr>
<tr>
<td>Intraoperative complications</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>2 (1.9)</td>
<td>4</td>
<td>4 (4.4)</td>
<td>0.420</td>
</tr>
<tr>
<td>No</td>
<td>101 (98.0)</td>
<td>86</td>
<td>86 (95.6)</td>
<td></td>
</tr>
<tr>
<td>Conversion to open (among MIS cases)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>2 (2.2)</td>
<td>3</td>
<td>3 (4.2)</td>
<td>0.655</td>
</tr>
<tr>
<td>No</td>
<td>88 (97.8)</td>
<td>68</td>
<td>68 (95.8)</td>
<td></td>
</tr>
<tr>
<td>Last pain score at time of discharge</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>2.88 (1.7)</td>
<td>2.60 (1.7)</td>
<td>0.241</td>
<td></td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>3 (2-4)</td>
<td>3</td>
<td>3 (1-4)</td>
<td>0.179</td>
</tr>
</tbody>
</table>

**Outcome Measures**

<table>
<thead>
<tr>
<th></th>
<th>Total Cases</th>
<th>MIS</th>
<th>Ambulatory/MIS Hyst</th>
<th>Ambulatory</th>
<th>Laparotomy</th>
<th>Ambulatory/MIS Hyst</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients who called with pain within 30 days</td>
<td>8 (7.8)</td>
<td>13 (14.4)</td>
<td>0.137</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>95 (92.2)</td>
<td>77</td>
<td>85.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patients who received 1 refill</td>
<td>6 (5.8)</td>
<td>10 (11.1)</td>
<td>0.184</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>97 (94.2)</td>
<td>80</td>
<td>88.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patients who received 2 refills</td>
<td>3 (2.9)</td>
<td>2 (2.2)</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>99 (97.1)</td>
<td>88</td>
<td>97.8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Postoperative complications</td>
<td>5 (4.9)</td>
<td>13 (14.4)</td>
<td>0.022</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>98 (95.1)</td>
<td>77</td>
<td>85.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean number of pills prescribed (SD)</td>
<td>5.63 (5.7)</td>
<td>1.96 (4.7)</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Cases</td>
<td>9.00 (8.5)</td>
<td>4.59 (6.9)</td>
<td>0.977</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambulatory</td>
<td>4.91 (5.2)</td>
<td>1.04 (3.6)</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MIS</td>
<td>6.07 (3.6)</td>
<td>1.25 (2.6)</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambulatory/MIS Hyst</td>
<td>6.12 (4.9)</td>
<td>1.29 (3.7)</td>
<td>&lt;0.001</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Mean number of OME prescribed (SD)

<table>
<thead>
<tr>
<th></th>
<th>Total Cases</th>
<th>Laparotomy</th>
<th>Ambulatory</th>
<th>MIS</th>
<th>Ambulatory/MIS Hyst</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>28.88 (30.3)</td>
<td>49.29 (50.7)</td>
<td>24.73 (25.8)</td>
<td>30.33 (18.1)</td>
<td>30.61 (24.7)</td>
</tr>
<tr>
<td></td>
<td>11.60 (30.2)</td>
<td>25.41 (40.8)</td>
<td>5.21 (18.2)</td>
<td>11.75 (35.8)</td>
<td>6.45 (18.6)</td>
</tr>
<tr>
<td></td>
<td>&lt;0.001</td>
<td>0.129</td>
<td>&lt;0.001</td>
<td>0.054</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Number (%) of patients sent home with an opiate prescription

<table>
<thead>
<tr>
<th></th>
<th>Total Cases</th>
<th>Laparotomy</th>
<th>Ambulatory</th>
<th>MIS</th>
<th>Ambulatory/MIS Hyst</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>71 (68.9)</td>
<td>9 (64.3)</td>
<td>49 (66.2)</td>
<td>13</td>
<td>33 (80.5)</td>
</tr>
<tr>
<td></td>
<td>21 (23.3)</td>
<td>11 (50.0)</td>
<td>5 (10.4)</td>
<td>5</td>
<td>7 (18.4)</td>
</tr>
<tr>
<td></td>
<td>&lt;0.001</td>
<td>0.400</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

MIS, minimally invasive surgery; OME, oral morphine equivalent; BMI, body mass index; SD, standard deviation; Hyst, hysterectomy; IQR, inter quartile range
◊Fischer’s Exact Test
All other tests were t-tests for means, Wilcoxon rank sum for medians, Pearson’s chi-square for percentages

599 - Poster Session
The impact of state Medicaid expansion on patients with cervical cancer
C.R. Gamblea,b, L. Chen,c, E. Chapman-Davisb and J.D. Wrightc. aNew York-Presbyterian/Columbia University Medical Center, New York, NY, USA, bWeill Cornell Medical College, New York, NY, USA, cColumbia University College of Physicians and Surgeons, New York, NY, USA

Objective: The Medicaid expansion component of the Patient Protection and Affordable Care Act (ACA) allowed low-income Americans to gain insurance coverage. Little is known about how this policy specifically affects gynecologic cancer outcomes. We sought to determine the impact of state Medicaid expansion status on women with cervical cancer by examining the rates of insurance coverage at time of diagnosis, stage at presentation, as well as delays in and receipt of curative intent treatment.

Method: In this quasi-experimental difference-in-differences (DiD) retrospective cohort study, we compared patient outcomes before (2011–2012) and after (2015–2016) Medicaid expansion. We used the National Cancer Data Base to identify patients diagnosed with cervical cancer between 2011 and 2016. Patients were grouped by those living in states that expanded Medicaid in January 2014 and those living in states that had not expanded Medicaid as of 2016. Outcomes included rate of uninsured, guideline-concordant care, treatment delays (initiation > 60 days after diagnosis), 30-day surgical readmission, and 1-year mortality. We used Cochran-Mantel-Haenszel tests to assess differences in distribution of categorical variables within and between states before and after Medicaid expansion. We used DiD models clustered at the hospital level to estimate absolute changes.

Results: There were 16,536 patients diagnosed with cervical cancer over the study period, with 6,946 (42.0%) in expansion states and 9,590 (58.0%) in nonexpansion states. The proportion of patients with advanced-stage disease was significantly increased in the post-expansion compared to the pre-expansion period study groups (P < 0.001). Medicaid expansion was associated with a greater decrease in proportion of uninsured (8.7% to 2.9% vs 14.2% to 12.0%, P < 0.001). Medicaid expansion did not have an impact on 30-day surgical readmissions; there was a trend that these readmission rates were improved in nonexpansion states (3.9% to 4.0% vs 5.9% to 3.5%, P = 0.06). There was not an association between Medicaid expansion status and guideline concordant care or 1-year mortality. See Table 1.

Conclusions: Medicaid expansion significantly reduced the proportion of uninsured women with cervical cancer living in expansion states. However, the beneficial impact on oncologic outcomes has not yet been demonstrated. More time is needed for the data to mature before long-term impacts can be appreciated.

Table 1.

<table>
<thead>
<tr>
<th>outcomes</th>
<th>Non-expansion Pre ACA</th>
<th>Non-expansion Post ACA</th>
<th>Expansion Pre ACA</th>
<th>Expansion Post ACA</th>
<th>Difference in difference, % (95%CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uninsured</td>
<td>14.2</td>
<td>12.0</td>
<td>8.7</td>
<td>2.9</td>
<td>-3.5% (-5.6, -1.5)</td>
<td>0.001</td>
</tr>
<tr>
<td>Treatment delay &gt; 60 day</td>
<td>19.1</td>
<td>21.8</td>
<td>21.7</td>
<td>22.5</td>
<td>-2.1% (4.9, 0.6)</td>
<td>0.14</td>
</tr>
<tr>
<td>Curative intent treatment</td>
<td>76.3</td>
<td>76.4</td>
<td>77.5</td>
<td>77.6</td>
<td>-0.1% (-3.3, 3.1)</td>
<td>0.94</td>
</tr>
<tr>
<td>1-year mortality</td>
<td>13.9</td>
<td>12.7</td>
<td>12.2</td>
<td>11.5</td>
<td>0.6% (-1.8, 3.0)</td>
<td>0.63</td>
</tr>
<tr>
<td>30-day surgical readmission</td>
<td>5.9</td>
<td>3.5</td>
<td>3.9</td>
<td>4.0</td>
<td>2.5% (-0.1, 5.1)</td>
<td>0.06</td>
</tr>
</tbody>
</table>

* 16,135 patients were included. 401 patients with unknown insurance status were excluded.
* The number of days from diagnosis to initiation of any treatment (surgery, chemoRT, radiation or chemotherapy) was noted. 15,183 patients were included. 1,353 patients with missing data were excluded.
Factors associated with same day discharge (SDD) after laparoscopic surgery in gynecologic oncology

Objective: The aim of this study was to identify factors associated with same-day discharge after laparoscopic surgery in gynecologic oncology.

Method: All consecutive surgeries on the gynecologic oncology service at a tertiary hospital were reviewed over a 20-month period to determine factors associated with successful same-day discharge after laparoscopic surgery.

Results: During the study period, 803 laparoscopic procedures were performed with a 43.0% same-day discharge. Patients more likely to achieve same-day discharge were younger (52.3 vs 58.0 years, \( P < 0.0001 \), \( R^2 = 0.040 \)), had a lower BMI (31.3 vs 33.7, \( P = 0.0002 \), \( R^2 = 0.017 \)), were less likely to have a malignancy (33.6% vs 60.7%, \( P < 0.0001 \), \( R^2 = 0.028 \)), had a lower estimated blood loss (EBL) (36 vs 72 ml, \( P < 0.001 \), \( R^2 = 0.375 \)), and were more likely to have received an enhanced recovery after surgery (ERAS) protocol (31.1% vs 24.7%, \( P = 0.46 \), \( R^2 = 0.0042 \)). Smoking was associated with a higher same-day discharge (\( P = 0.001 \), \( R^2 = 0.004 \), but alcohol use was not. Other factors associated with less likely same-day discharge included hysterectomy (\( P < 0.0001 \), \( R^2 = 0.027 \)), full lymphadenectomy (\( P < 0.001 \), \( R^2 = 0.031 \)), physician (\( P < 0.0001 \), \( R^2 = 0.48 \)), total narcotic dose (\( P < 0.0001 \), \( R^2 = 0.08 \)), robotic or hand port (\( P < 0.0001 \), \( R^2 = 0.08 \)), increased recovery room time (\( P > 0.001 \), \( R^2 = 0.13 \)), time of day of surgery (\( P < 0.0001 \), \( R^2 = 0.06 \)), and increased surgical time (\( P < 0.0001 \), \( R^2 = 0.17 \)). In a multivariate analysis the factors that remained significant included recovery time, surgery length, time of day when surgery finished, physician, EBL, and age.

Conclusion: Multiple factors affect same-day discharge. Modifiable factors include the surgeon setting the expectation of same-day discharge as well time when the case is completed. Given these data, centers should prioritize surgical order by which patients are more likely to go home.

Tertiary closure for high risk-patients undergoing gynecological abdominal surgery

Objective: Wound closure by secondary intention lowers the risk of SSI in high-risk patients undergoing gynecological abdominal surgery. However, this technique is associated with delayed wound closure, long-term disability, poor cosmesis, and significant cost. The purpose of this study is to describe an alternative wound closure technique (tertiary closure) aimed at improving wound morbidity.

Method: Tertiary closure was performed as follows: (1) fascial closure with continuous double-stranded #1 triclosan-impregnated polydioxanone suture; (2) approximation of subcutaneous tissue with interrupted 2-0 triclosan-impregnated polyglycaprone suture; (3) placement of a subcuticular 2-0 triclosan-impregnated polyglycaprone suture in a continuous fashion looping the suture every 8 cm through the skin, securing with medium hemoclips leaving the skin open; (4) placement of a silver-impregnated vacuum-assisted closure device over the incision at continuous 125 mm of subatmospheric pressure; (5) postoperative day 4, removal of vacuum-assisted closure device and approximation of skin edges via traction on the subcuticular suture, securing with hemoclips; and (6) placement of a protective silver dressing over the incision.

Results: Thirteen consecutive patients undergoing gynecological surgery had tertiary closure of their abdominal incisions. The mean patient age and BMI were 55 years and 28, respectively. Nine patients had surgery for malignant conditions, and 4 patients had surgery for infectious reasons. Two wounds were clean contaminated (class II); 8 of the wounds were contaminated (III); and 3 were dirty/infected (IV). The mean operative duration was 6.5 hours, and the median length of stay was 7 days. All patients have been followed for at least 30 days since surgery (median 5 months). All wounds have remained closed since postoperative day 4. No SSI, wound seromas, or incisional hernias have occurred. One patient developed a superficial sinus tract. See Figure 1.

Conclusion: Tertiary closure of high-risk abdominal wounds during gynecological surgery is safe and feasible. Tertiary closure may be associated with lower rates of SSI and readmission, lower cost, and superior cosmesis compared to secondary closure. Based on our preliminary data, we have designed a larger trial comparing outcomes of tertiary closure to other closure methods.
Objective: The primary aim of this study was to determine postoperative satisfaction and potential discharge needs following implementation of an enhanced recovery after surgery (ERAS) program at a single institution. A secondary aim was to identify patient postoperative opioid requirements to identify adaptations needed in prescribing habits.

Method: A voluntary 16-item patient discharge questionnaire, approved by the hospital patient-reported outcomes team, was completed by patients at their 2-week postoperative appointment at the gynecologic oncology clinic from July 2018 through December 2018. For patients who completed the questionnaire, data collected included cancer diagnosis, surgery type, length of hospital stay, distance from hospital, and opioid prescription amount. Data were analyzed by using RedCap and R.

Results: A total of 147 patients completed the discharge questionnaire; 81.4% \( (n = 118) \) felt prepared or very prepared to leave the hospital; 91.4% \( (n = 128) \) felt that information received on discharge on managing problems was good or very good; and 85.7% \( (n = 126) \) felt that information about discharge medications was easy or very easy to understand. The most common complications post-discharge were abdominal pain \( (25.9\%, n = 38) \) and bowel problem \( (23.1\%, n = 34) \). Qualitative analysis suggested patients would benefit from additional information about postoperative timeline and expectations, as well as more precise medication reviews. On discharge, 90.4% \( (n = 133) \) were prescribed opioid pain medications; 76.2% \( (n = 112) \) were prescribed greater than 19 tablets; and 36.7% \( (n = 54) \) of patients reported requiring no opioid pain medications. Of those who used opioid pain medications \( (n = 92) \), 67.3% used them for 1 week or less, and 35.9% \( (n = 33) \) used them for less than 4 days.

Conclusion: Overall, patients were satisfied with the discharge process and felt that information received prepared them to manage any complications. Minor adjustments to preoperative education and to discharge paperwork to include generalized timelines may be effective interventions to address patient expectations. Postoperative prescriptions for opiates exceed patient-reported opioid needs. With further evaluation of specific opioid postoperative needs, reduction in opioid prescribing is feasible.
**603 - Poster Session**  
Enhanced recovery after surgery (ERAS) does not have a significant impact after minimally invasive surgery in gynecologic oncology

A. Lehmana, R.V. Higginsa, E.V. Kempta, J. Browna, E.K. Craneta, D.L. Taita, V.D. Taylora and R.W. Naumannb, "Levine Cancer Institute, Carolinas Medical Center, Charlotte, NC, USA, bLevine Cancer Institute, Charlotte, NC, USA

Objective: The purpose of this study was to review the impact of an enhanced recovery after surgery (ERAS) protocol on recovery after minimally invasive surgery performed by gynecologic oncologists related to intraoperative narcotics, narcotics in phase I recovery, time in phase I recovery, and total hospital time.

Method: Cases were reviewed from January 1, 2018, through July 31, 2019, representing approximately 10-month pre- and 9-month post-implementation of a standard ERAS protocol that incorporated hydration with an electrolyte solution up to 2 hours prior to surgery, oral acetaminophen, gabapentin, and celecoxib prior to surgery.

Results: A total of 801 minimally invasive surgeries were performed during the inclusion period (77% laparoscopy, 18% robotic, and 5% minilaparoscopy). Laparoscopic surgery was performed in 581 patients without and 220 with the ERAS protocol (not all laparoscopic patients were initially included as the implementation was focused on patients undergoing open surgery). There was no significant difference between the 2 groups with respect to surgery type, smoking, EtOH use, surgical indication, blood loss, or diagnosis. Patients on the ERAS protocol had a significantly lower BMI (33.4 vs 29.9, P < 0.001). There was no significant difference in narcotic use between ERAS and non-ERAS patients in milligrams of morphine IV intraoperatively (21.5 vs 22.7, P = 0.16), morphine use in phase I recovery (4.6 vs 4.4 mg, P = 0.65), or time in recovery (129.5 vs 131.9 minutes, P = 0.71). ERAS patients had a higher rate of same-day discharge (40.8% vs 48.7%, P = 0.046) and a trend to shorter discharge times with ERAS (21.3 vs 18.1 hours, P = 0.08) with an HR for discharge of 0.87 (0.74–1.01) for the standard group.

Conclusion: Implementation of an ERAS protocol does not appear to have an impact on recovery room time or intraoperative or immediate postoperative narcotic use. Although there was a trend toward earlier hospital discharge, this was more likely due to awareness of the ERAS protocol and not the protocol itself. While no adverse events were noted with this protocol, it did not appear to decrease narcotic use or have a significant impact on hospital stay over traditional treatment.

---

**604 - Poster Session**  
Comparison of postoperative opioid reduction strategies following gynecologic surgery

T. Castellanoa, T. Colesb, C.R. Washingtonc, M.E. Buechela, S. Chena and J.L. Walkerd, "The University of Oklahoma Health Sciences Center, Oklahoma City, OK, USA, bUniversity of Oklahoma Stephenson Cancer Center, Oklahoma City, OK, USA, cThe University Of Oklahoma Health Sciences Center, Oklahoma City, OK, USA, dThe University of Oklahoma, Oklahoma City, OK, USA

Objective: The purpose of this study was to test the efficacy and acceptability of 2 differing restrictive postoperative opioid-prescribing approaches across a generalizable gynecologic oncology surgery population.

Method: Baseline data from outpatient and inpatient minimally invasive and laparotomy gynecologic oncology surgeries with both benign and malignant diagnoses were collected. Patients discharged to hospice, with incomplete discharge data, or takeback surgeries for complications were excluded. After review of baseline prescribing practices and provider and patient questionnaires, 2 differing opioid-prescribing approaches were developed: approach 1, based upon postoperative morphine milligram equivalent (MME) use stratified by surgery type, and approach 2, based on calculated individual patient median MME use at the time of discharge. Descriptive and comparative statistics were performed.

Results: For the prescribed MME at time of discharge for each cohort, approach 1 and approach 2 were compared to the baseline cohort. All cohorts were well balanced according to age, BMI, distance traveled, surgery type, operating room time, blood loss, cancer diagnosis, and daily inpatient MME use (Table 1). A significant increase in enhanced recovery after surgery (ERAS) implementation was seen in approach 2, compared to baseline (P < 0.01). Baseline median discharge MME was 32.1/day for a 7-day supply (225 MME) versus 16.1 MME/day for a 7-day supply (112.5 MME) for both approach 1 and 2, a significant decrease (P < 0.01). When compared to each other, neither approach 1 nor 2 was superior. Approach 2 had a nonsignificant decrease in mean MME prescribed at discharge, 20.3 vs 24.1 MME/day, respectively (P = 0.24). Despite a significant decrease in prescribed opioids, there was no associated significant increase in opioid refill requests from baseline (n = 19, 8%) versus approach 1 (n = 8, 10%, P = 0.29) and approach 2 (n = 9, 8%, P = 0.83).

Conclusion: Implementation of restrictive postoperative opioid-prescribing protocols based on surgery type alone significantly decreases the amount of prescribed MME without increasing patient refill requests. Further reductions in opioid MME prescribed may...
be made with a patient-individualized approach but at the cost of decreased provider compliance. Within the context of the greater U.S. opioid crisis, prospective testing to determine the best approach to restrictive opioid-prescribing following surgery is well overdue.

Table 1. Summary and comparative statistics for baseline, approach 1, and approach 2 cohorts.

<table>
<thead>
<tr>
<th>Comparison of 3 medians</th>
<th>Baseline (n = 186)</th>
<th>Approach 1 (n = 64)</th>
<th>Approach 2 (n = 100)</th>
<th>Approach 1 vs 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median age (years)</td>
<td>P = 0.90</td>
<td>58</td>
<td>59</td>
<td>59</td>
</tr>
<tr>
<td>Median BMI</td>
<td>P = 0.18</td>
<td>35.1</td>
<td>32.0</td>
<td>32.1</td>
</tr>
<tr>
<td>Median distance traveled (miles)</td>
<td>P = 0.67</td>
<td>26.0</td>
<td>38.9</td>
<td>26.0</td>
</tr>
<tr>
<td>Surgery type (n, %)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laparotomy</td>
<td>77, 38.7%</td>
<td>25, 39.1%</td>
<td>32, 32.0%</td>
<td>P = 0.28</td>
</tr>
<tr>
<td>MIGS</td>
<td>97, 52.2%</td>
<td>33, 51.5%</td>
<td>63, 63.0%</td>
<td></td>
</tr>
<tr>
<td>Vulvar/Vaginal</td>
<td>17, 19.1%</td>
<td>6, 9.4%</td>
<td>5, 5.0%</td>
<td></td>
</tr>
<tr>
<td>Median OR time (min)</td>
<td>P = 0.66</td>
<td>164.0</td>
<td>174.5</td>
<td>177.0</td>
</tr>
<tr>
<td>Median blood loss (ml)</td>
<td>P = 0.37</td>
<td>150</td>
<td>200</td>
<td>150</td>
</tr>
<tr>
<td>Diagnosis (n, %)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benign</td>
<td>66, 35.7%</td>
<td>24, 37.5%</td>
<td>38, 38.0%</td>
<td>P = 0.95</td>
</tr>
<tr>
<td>Malignant</td>
<td>119, 64.3%</td>
<td>40, 60.5%</td>
<td>62, 62.0%</td>
<td></td>
</tr>
<tr>
<td>Median inpatient MME/24h use</td>
<td>P = 0.50</td>
<td>41.5</td>
<td>39.5</td>
<td>30.0</td>
</tr>
<tr>
<td>Use of ERAS bundle (n, %)</td>
<td>129, 69.4%</td>
<td>52, 81.3%</td>
<td>85, 85%</td>
<td>P &lt; 0.01</td>
</tr>
<tr>
<td>Median hospital stay (days)</td>
<td>P = 1.00</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Discharge opioids prescribed (MME/day)</td>
<td>P &lt;0.01</td>
<td>32.1</td>
<td>16.1 24.1 (P &lt;0.01)</td>
<td>16.1 20.3 (P &lt;0.01)</td>
</tr>
<tr>
<td>Mean</td>
<td>35.0</td>
<td>24.1</td>
<td>20.3</td>
<td></td>
</tr>
<tr>
<td>Refill request rate (n, %)</td>
<td>14, 7.5%</td>
<td>8, 12.7%</td>
<td>9, 9.8%</td>
<td></td>
</tr>
</tbody>
</table>

605 - Poster Session
Implementation of a quality improvement (QI) project of universal screening for Lynch syndrome in women with uterine cancer
D. Spinoso, T. Acosta, J. Wong, K. Kurtovic, J. Mewshaw, S. Collins, N.D. Kauff, L.J. Havrilesky, K.C. Strickland and R.A. Previsa. aDuke University Medical Center, Durham, NC, USA, bDuke Cancer Institute, Durham, NC, USA

Objective: The aim of this study was to determine the effectiveness of a quality improvement (QI) initiative to adopt universal screening for Lynch syndrome in women with uterine cancer at our institution.

Method: A QI initiative to improve detection and genetic referral rates of Lynch syndrome carriers was implemented at a single institution during 2018. Prior to the initiative, tumors of endometrial cancer-diagnosed patients aged ≤60 years were screened for mismatch repair deficiency (dMMR) and microsatellite stability (MS). The QI process improvement model included universal testing of all uterine cancer patients undergoing surgery, provider training, enhanced pathology report documentation, and improved electronic medical record (EMR) documentation. Following implementation, we retrospectively reviewed dMMR/MS screening of newly diagnosed endometrial cancers, genetics referrals for abnormal screening results, germline testing of referred patients, and new Lynch syndrome diagnoses. Data were collected for pre- (calendar year 2017) and post-implementation (academic year 2018–2019) periods.

Results: Pre- and post-implementation targeted population screening rates were 45/80 (57.7%) and 172/182 (94.5%), respectively (P ≤ 0.0001). The rate of abnormal screening results increased post-implementation, from 15/190 (7.9%) to 44/182 cases (24.0%). Genetic referral rates among screen positives increased from 3/15 (20.0%) to 16/44 (36.4%), some of which reflect different rates of MLH1 promoter methylation, not simply provider referral patterns. Germline diagnoses increased from 2/190 (1.1%) with 2 Lynch syndrome diagnoses to 4/182 (2.2%) including 3 Lynch syndrome diagnoses and 1 BRCA diagnosis.

Conclusion: A bundled QI intervention that targets provider education, use of the EMR, and enhanced pathology reporting markedly increases rates of Lynch syndrome screening, genetics referrals, and germline diagnoses.
Objective: Given the opiate pain medication crisis, maximizing pain control while minimizing opiate use has become a major priority in the management of patients undergoing surgery. The purpose of this study is to compare compliance with a preoperative and intraoperative medication regimen of a pilot enhanced recovery after surgery (ERAS) program with postoperative pain scores and patterns of narcotic use.

Method: Eligible patients undergoing gynecologic surgery as part of an ERAS program from May 2018 through June 2019 were enrolled prospectively. The study's target medication regimen included preoperative oral acetaminophen (1,000 mg), celecoxib (400 mg), and gabapentin (300 or 600 mg). Intraoperatively, intravenous dexamethasone, liposomal bupivacaine (open patients only) and marcaine were administered. Opiate requirements and pain scores were collected at 4, 24, and 48 hours and 7 days postoperatively.

Results: The data for the first 138 patients enrolled in this study were analyzed; 87 were minimally invasive surgery (MIS) patients and 28 were open patients. Compliance with preoperative pain medications for eligible patients was acetaminophen, 94.8%; gabapentin, 97.9%; and celecoxib, 90.0%. All patients received marcaine intraoperatively; 100% of open patients received liposomal bupivacaine; and 92.0% of patients received intraoperative IV dexamethasone (4, 8, or 10 mg). The mean length of stay (LOS) was 0.33 days (range 0–4 days) for MIS patients and 3.79 days (range 1–12 days) for open patients. For MIS patients, 82.2% were opiate use-free on postoperative day (POD) 7 (n = 45). Pain scores improved from a mean of 2.63 on POD 0 to 1.32 on POD 7 for MIS patients (n = 60). For open patients, 61% were opiate use-free on POD 7 (n = 18), and pain scores decreased from 3.88 to 2.0 from POD 0 to POD 7 (n = 16).

Conclusion: This study demonstrates that high compliance with ERAS protocols comprising multiple nonopioid pain medications is feasible and effective. This regimen resulted in decreased opioid use, with excellent pain scores at POD 7. Further comparison of ERAS patients to those in matched cases prior to this program demonstrates decreased opiate use, LOS, and reportable complication rates but with improved patient satisfaction scores. This portion of our investigation is ongoing. By applying similar protocols, the overall use of narcotic pain medication in gynecologic surgery may be reduced, potentially preventing adverse surgical outcomes related to the overuse of opiates.

607 - Poster Session
Ethical authorship assignment gynecologic oncology: Keeping score and maintaining compliance?
L. Moulton Chambers1, C.H. Watson1, M. Buechel2, K. Levinson1, R.D. Alvarez3, R.N. Eskander4, C.M. Michener1, and A.M. Jernigan1. 1The Cleveland Clinic Foundation, Cleveland, OH, USA, 2Duke University Medical Center, Durham, NC, USA, 3The University of Oklahoma, Norman, OK, USA, 4Johns Hopkins School of Medicine, Baltimore, MD, USA, 5The Vanderbilt-Ingram Cancer Center, Nashville, TN, USA, 6UCSD Rebecca and John Moores Cancer Center, La Jolla, CA, USA, 7Cleveland Clinic, Cleveland, OH, USA, 8Louisiana State University Health Sciences Center, New Orleans, LA, USA

Objective: Adherence to International Committee of Medical Journal Editors (ICMJE) authorship criteria is low among gynecologic oncology fellows. We sought to investigate trends in authorship assignment among gynecologic oncologists and explore perceptions regarding the applicability and generalizability of ICMJE criteria.

Method: An anonymous 17-question online survey was distributed to Society of Gynecologic Oncology (SGO) full and training members in September and October 2018. Descriptive statistics and univariate analysis were performed.

Results: Of 1,111 members, 266 (23.9%) responded; most reported ≥1 publication (90.6%). Approximately one-third (30.6%) had assigned authorship not meeting ICMJE criteria, with an additional 30.6% acknowledging awareness of this practice. Reported reasons for assigning authorship not meeting criteria were inclusion of author’s patients (59.3%), resume building (45.7%), networking (22.2%), other perceived meaningful contributions (40.7%), and mentor acknowledgment (29.6%); only 2.5% of respondents reported lack of knowledge of ICMJE authorship criteria. While “substantial contributions to the conception or design of the work; or the acquisition, analysis, or interpretation of data for the work” was perceived as the most important criterion regardless of study type, it was reported as the most important component for trainees (73.9%) but not for faculty (42.4%). The majority of respondents reported that ICMJE criteria were generalizable (91.3%) and helpful (83.8%), should not be individualized by journal (75.9%), and perceived nonadherence as scientific misconduct (66.0%). Nonadherence to ICMJE criteria was higher among women (P < 0.001) and fellows and gynecologic oncologists practicing <3 years (P < 0.001).

Conclusion: Within this sample of SGO members, reporting noncompliance with ICMJE authorship criteria is prevalent, especially for fellows and early career faculty. Most responding SGO members feel that ICMJE criteria is an ethically sound way to assign authorship. This finding highlights the existence of a culture in which authorship is assigned, based not on lack of knowledge but on factors outside of ICMJE criteria, such as patient care, mentorship, research collaboration, and career advancement.
**Objective:** In the setting of health system consolidation and expansion, we sought to investigate the extent of gynecologic oncologists’ multisite practices and trends over time, as geographically distributed labor may affect physician performance and patient outcomes.

**Method:** This is a retrospective observational study using the Physician Compare National Downloadable File 2014–2019, which contains specialty and practice site information for all clinicians who are eligible to bill Medicare. Gynecologic oncologists were identified by specialty listing, and practice locations were defined as independent Medicare billing facilities. All gynecologic oncologist practice locations with complete addresses were included. The number of sites and states of practice were calculated for each provider per year. Winsorization of the top 1% of the number of practice sites was performed to minimize the influence of outliers. The travel distance between practice sites was calculated for each provider for 2019 based on practice site street addresses. Regression analyses were conducted to evaluate trends with a significance level of α = 0.05.

**Results:** The total number of gynecologic oncologists increased by 11.6% (1,042 to 1,163) from 2014 to 2019. In 2019, 50.8% (n = 591) had multisite practices, compared to 35.2% (n = 367) in 2014 (P < 0.001). The number of practice sites per gynecologic oncologist ranged from 1 to 12 with 8 outliers in the >99th percentile in 2014 and from 1 to 13 in 2019, reflecting a significantly increased trend in practice sites per gynecologic oncologist (Winsorized mean 1.8, 95% CI 1.7–1.9, vs 2.1, 95% CI 2.0–2.3, P < 0.001). In 2019, 10.2% (n = 60) of gynecologic oncologists with multisite practices were located in more than 1 state (range 2–3). From 2014 to 2019, this percentage did not differ (9.3% vs 10.2%, P = 0.66). In 2019, the average median travel distance between sites for gynecologic oncologists in multisite practice was 39.5 miles (IQR 2.9–28.1). See **Figure 1**.

**Conclusion:** From 2014 to 2019, there was a significant increase in multisite practice by gynecologic oncologists, with half in multisite practice in 2019. While this may provide increased patient access to specialty gynecologic oncology care, the effect on physician performance, cost of care, and quality outcomes warrants further investigation.

---

**Fig. 1.** Gynecologic oncologists’ number of sites, states and regions of practice, 2014-2019.
Objective: Superutilizers constitute a small percentage of the population yet consume a disproportionate amount of health care resources. Our objective was to determine the prevalence of and risk factors for health care superutilization among gynecologic oncology patients.

Method: We performed a retrospective cohort study of gynecologic oncology patients age ≥18 years with an index visit between January and December 2018. Superutilizers were defined as patients with 3 or more unplanned hospital encounters at the same hospital during a 12-month period starting at the time of the index visit. Unplanned hospital encounters included unplanned emergency room visits with or without admission, unplanned direct admissions, and transfers from outside hospitals. Scheduled admissions were excluded. Differences between groups were examined using descriptive statistics. Multivariate logistic regression was used to correlate variables with risk of superutilization.

Results: We identified 786 patients with gynecologic cancer. Of those, 38 (5%) met inclusion criteria for superutilizers. Among superutilizers, the median age was 57 years (range 18–86 years). The most common cancer was uterine (n = 14, 37%) followed by ovarian (n = 12, 32%). The majority (n = 20, 53%) had advanced-stage disease. The distribution of phase of oncologic care at index visit was primary diagnosis (n = 23, 61%), recurrence (n = 8, 21%), and surveillance (n = 6, 16%). Eleven (29%) were new diagnoses of cancer with no prior therapy. Nineteen (50%) had received prior chemotherapy, and 19 (50%) had prior surgery. Only 3 patients were in the last year of life. The median number of visits was 4 (range 3–24). The 2 most common reasons for unplanned visits were gastrointestinal (GI) (n = 25, 66%) and pain (n = 21, 55%). The most common GI complaint was nausea and vomiting, and the most common pain was abdominal. A multivariate analysis adjusting for key variables demonstrated the following risk factors associated with superutilization of health care: Medicare insurance (OR = 4.22, 95% CI 1.86–9.55) and African American race (OR = 3.57, 95% CI 1.60–7.93).

Conclusion: The majority of health care utilization occurred during the first year of diagnosis. The results of this exploratory analysis can be used to develop quality improvement initiatives to decrease health care utilization, particularly during upfront treatment.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Medications</th>
<th>Average number of pills prescribed at discharge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor</td>
<td>No opioids prescribed</td>
<td>0.2</td>
</tr>
<tr>
<td>Laparoscopic</td>
<td>Oxycodone 5mg x 5 tabs</td>
<td>5.4</td>
</tr>
<tr>
<td>Major</td>
<td>Oxycodone 5mg x 15 tabs</td>
<td>14.7</td>
</tr>
</tbody>
</table>
611 - Poster Session
The gynecologic oncology patient experience with oral anti-cancer therapy: A quantitative and qualitative analysis of medication adherence
C.H. Watsona, L. Fishb, L.J. Havrileskya, A.A. Secordc,d and B.A. Davidsona. aDuke University Medical Center, Durham, NC, USA, bDuke Cancer Institute, Durham, NC, USA, cDuke Cancer Institute, Duke University Health System, Durham, NC, USA, dDuke University School of Medicine, Durham, NC, USA

Objective: The objective of this study was to gain a better understanding of gynecologic oncology patient adherence to oral anticancer agents through both a cross-sectional survey of adherence and qualitative interviews with patients and clinicians regarding their experience with these medications.

Method: A cross-sectional measurement of adherence was performed via survey. Any woman taking an oral anticancer agent for a gynecologic malignancy at a tertiary academic medical center for ≥30 days was eligible. The survey included an evaluation of adherence, distress, quality of life, and health literacy. Semistructured interviews regarding medication experience were then held with a subset of both adherent and nonadherent subjects. A gynecologic oncology clinician group interview was also conducted. Demographic and clinical data were evaluated using descriptive statistics, and relationships between variables of interest and adherence were assessed. Subject and clinician interviews were analyzed using a 5-stage qualitative thematic analysis.

Results: A total of 86 women taking oral anticancer agents were enrolled, of whom 35 (41%) were on maintenance therapy and 51 (59%) in active treatment. Twenty-four (28%) reported nonadherence to their medication; 19 (22%) reported equivocal adherence (i.e., missed at least 1 dose); and 43 (50%) reported adherence. Nonadherent or equivocal subjects were significantly more likely to be non-white (33% vs 5%, P < 0.05); there was no significant difference between the adherent and nonadherent/equivocal groups for other clinical or demographic variables. The following themes related to adherence were identified from the 14 interviews: the mental burden of self-administration of medication, ease of use compared to traditional therapy; perceived importance of the medication; management of side effects; and the desire for robust provider communication (Table 1). In the clinician interview, providers expressed a belief that adherence was high and that out-of-pocket cost was likely the biggest driver of potential nonadherence.

Conclusion: Oral anticancer agents are frequently used in women with gynecologic cancer. Of all patients 50% self-reported equivocal or nonadherence to these medications, and nonadherence was significantly associated with non-white race. These findings emphasize the need for improved provider communication concerning adherence and further investigation of potential barriers to utilization of these agents.

Table 1. Qualitative interview themes and sample quotations.

<table>
<thead>
<tr>
<th>Theme</th>
<th>Sample Quotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mental burden of self-administration of medication</td>
<td>“It was this thing like, as I took the first dose, there was this thought in my head of, oh my God, I’m gonna be doing this every day for the rest of my life. So, there was a little bit of something of like a sentence being passed, so when I first took it, that was when I was still you know, I hadn’t adjusted my thinking yet, but I was really surprised at how momentous and ominous that felt and it was a little while before it became just sort of oh yeah, I gotta take my pills.”</td>
</tr>
<tr>
<td>Ease of use compared to traditional therapy</td>
<td>“And I think that just the biggest difference between chemo and the oral pill is just knowing that I can take this pill and it’s gonna be a normal day. I’ll be just like everybody else.”</td>
</tr>
<tr>
<td>Perceived importance of medication</td>
<td>“Because if I don’t [take the medication]... If I don’t take that medicine then I might be in trouble.”</td>
</tr>
<tr>
<td>Management of side effects</td>
<td>“It [taking oral medication] is a lot better, but I’m still taking drugs and I’m still in treatment and I still have side effects... That part I still have to deal with.”</td>
</tr>
<tr>
<td>Desire for consistent and increased communication</td>
<td>“There should be a visit just for [name of drug], with any family members that are gonna be surrounding that particular patient, because it needs to not be a part of your regular visit because it’s so important.”</td>
</tr>
</tbody>
</table>
Hospital at home pilot for gynecologic oncology patients
O. Foley, R. Sugrue, K. Safavi and M.G. del Carmen. Massachusetts General Hospital, Boston, MA, USA

Objective: Hospital at Home is a health care delivery model in which patients receive inpatient-level care in the home. Hospital at Home programs for patients with medical illness have been shown to decrease costs and improve patient satisfaction without increasing mortality or adverse effects. Surgical patients are not typically included in Hospital at Home but represent an important target population. We describe the experience of gynecologic oncology patients in the first reported surgical Hospital at Home program in the United States and estimate potential cost saving.

Method: Patients eligible for inclusion were age 18 years or older with stable vital signs, had a safe home environment (questionnaire-based), presented between 8 a.m. and 5 p.m. on a weekday, and lived within an 8-mile radius of the hospital. Patients were deemed appropriate candidates by the evaluating provider and had no need for procedures or invasive studies. Two gynecologic oncology patients were enrolled. Their Hospital at Home treatment course, length of stay, and complications were reviewed in the electronic medical record. Cost of avoided inpatient admission was estimated using an institutional calculator that incorporates backfill opportunity for surgical bed space specific to this hospital.

Results: The first patient was a 49-year-old receiving adjuvant chemotherapy for ovarian cancer who presented with a lower extremity cellulitis requiring IV antibiotics. She was admitted to Hospital at Home for 4 days, during which she had 8 visits, with complete resolution of her cellulitis. The second patient was a 64-year-old with advanced ovarian cancer and multiple previous hospital admissions for hypercalcemia. In her last 2 months of life, she was enrolled in Hospital at Home for 3 days of IV fluids and electrolyte repletion. She did not require inpatient admission in the month following her Hospital at Home experience. To have received similar care as an inpatient would have cost an estimated $8,523 and $6,393, respectively. See Table 1.

Conclusion: Hospital at Home is an established program for medically ill patients that has been previously shown to be desirable for both patients and health care systems. We report the first experience with Hospital at Home for surgical patients in the United States, demonstrating potential for significant patient benefit and cost saving for eligible gynecologic oncology patients.

Table 1. Demographics of and resources utilized by gynecologic oncology patients enrolled in HaH pilot.

<table>
<thead>
<tr>
<th>Demographic Information</th>
<th>Patient SS</th>
<th>Patient MR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>49</td>
<td>64</td>
</tr>
<tr>
<td>Medical Comorbidities</td>
<td>Depression, hypothyroidism, memory loss</td>
<td>Rheumatoid arthritis, hypothyroidism, hypertension, previous stroke</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>Stage IIIa high-grade serous ovarian carcinoma</td>
<td>Recurrent platinum-resistant high-grade serous ovarian carcinoma</td>
</tr>
<tr>
<td>Phase Cancer Treatment</td>
<td>Post TLH/BSO receiving adjuvant chemotherapy (2nd cycle carbo/taxol)</td>
<td>Previous surgical resection currently on 6th line of chemotherapy (taxol) for recurrence</td>
</tr>
<tr>
<td>Home Support</td>
<td>Lived independently</td>
<td>Lived with spouse</td>
</tr>
<tr>
<td>Distance from Hospital</td>
<td>2.3 miles</td>
<td>4.1 miles</td>
</tr>
<tr>
<td>HaH Diagnosis</td>
<td>LE cellulitis</td>
<td>Hypercalcemia</td>
</tr>
<tr>
<td>Treatment Required</td>
<td>IV cefazolin</td>
<td>IV fluids and electrolytes</td>
</tr>
<tr>
<td>HaH Services Utilized</td>
<td>Length of HaH Admission</td>
<td>4 days</td>
</tr>
<tr>
<td></td>
<td>RN Visits</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>MD/PA/NP Visits</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Lab Draws</td>
<td>None</td>
</tr>
</tbody>
</table>
involving the liver, spleen, or diaphragm), residual disease (<1 cm or ≥1 cm), operative time, blood transfusions, length of stay, and serious postoperative complications. Univariate and bivariate statistics analyses were performed.

**Results:** Of women who underwent surgical intervention for stage III and IV ovarian cancer between 2014 and 2017, 35.9% (881/2,457) had upper abdominal disease. The total cohort had a median age of 62.0 years (IQR 54.0–70.0) and median BMI of 26.9 kg/m² (IQR 23.2–32.0), and the majority were Caucasian (71.5%, n = 1,756). Compared to women without upper abdominal disease, those with upper abdominal disease were more likely to have worse intraoperative outcomes, including gross residual disease ≥1 cm (10.4% vs 3.2%, P < 0.01), longer operative times (median 215 vs 174 minutes, P < 0.01), and blood transfusions (40.1% vs 29.8%, P < 0.01). Women with upper abdominal disease were also more likely to have postoperative complications, including longer length of stay (5 vs 4 days, P < 0.01), thromboembolism (5.5% vs 2.0%, P < 0.01), and readmission (11.9% vs 8.7%, P = 0.01) compared to those without upper abdominal disease. There were no differences in postoperative deaths, unplanned intubation, and need for reoperation between those with and without upper abdominal disease.

**Conclusion:** Women with upper abdominal disease who underwent surgical intervention for stage III and IV ovarian cancer were more likely to have worse intraoperative and postoperative outcomes. This should be considered when deciding primary treatment strategies. Further studies are warranted to determine whether these outcomes result in a delay to adjuvant therapy and differential survival outcomes.

---

**614 - Poster Session**

**Implementation of an enhanced recovery protocol in gynecologic oncology: A retrospective cohort study**

T.V. Joshi, S.F. Bruce, S. Chatterjee, E.R. Burton, J.J. Sorosky, M.S. Shahin and M.I. Edelson. Abington Memorial Hospital, Abington, PA, USA; Hanjani Institute for Gynecologic Oncology, Abington Memorial Hospital, Abington, PA, USA

**Objective:** Traditional perioperative care is currently being challenged by a multidisciplinary approach to care of the surgical patient. Enhanced Recovery after Surgery (ERAS) is an evidence-based approach that incorporates pre-, intra-, and postoperative tools thought to reduce narcotic use and maintain anabolic balance to enable full functional recovery. The effects of ERAS remain underdeveloped in gynecologic oncology. This study aims to determine the effect of ERAS implementation on narcotic usage at a community-based hospital in patients who underwent surgery in the gynecologic oncology department. We also characterize its effect on length of stay, return of bowel function, 30-day readmissions, and postoperative complications.

**Method:** A retrospective cohort study was performed at Abington Memorial Hospital in gynecologic oncology, where ERAS was established in 2014. Women who underwent an exploratory laparotomy for both benign and malignant etiologies were included. The non-ERAS cohort included patients from 2011 to 2013 and the ERAS cohort included patients from 2014 to 2016. Patients who had a bowel resection did not receive the ERAS protocol and thereby were excluded from both cohorts. The Mann-Whitney U test was used to investigate the effect of ERAS implementation on postoperative narcotic usage. A χ² analysis was used to study differences of categorical measures between the 2 cohorts.

**Results:** Ninety-eight patients in the non-ERAS cohort and 89 patients in the ERAS cohort were included. A reduction in narcotic usage, measured as PO morphine milliequivalents (MMEs), was seen in the ERAS relative to the non-ERAS group, albeit this difference was not statistically significant (median MME, 16 vs 19.2, P = 0.143). Length of stay was significantly less in the ERAS cohort with 66.3% patients discharged on postoperative day 3 or earlier relative to only 21.4% in the non-ERAS group (P = 0.00). Earlier return of bowel function was also observed in the ERAS group (P = 0.016). No significant differences in the rate of 30-day readmission (P = 0.621) or postoperative complications (P = 0.889) were seen between the 2 groups.

**Conclusion:** This study reveals that there are benefits to implementation of ERAS for perioperative care in gynecologic oncology. While no significant reduction in narcotic usage was observed, earlier return of bowel function and a shorter postoperative hospital stay was seen in the ERAS cohort compared to traditional perioperative care.

---

**615 - Poster Session**

**The modified early warning score in gynecologic oncology inpatients: A quality improvement project**

K.V. Grette, C. Hude, R. Paladin, G.L. Mantell, N.L. Jones, M.A. Finan, R.P. Rocconi, J.Y. Pierce and J.M. Scalici. Mitchell Cancer Institute, University of South Alabama, Mobile, AL, USA; University of South Alabama, Mobile, AL, USA

**Objectives** The modified early warning score (MEWS) was developed to predict future deterioration by subtle changes in vital signs. We implemented MEWS to empower the care team, improve communication, and reduce acute events requiring emergent intervention. Herein we report the impact of MEWS 6 months after implementation.
**Method:** The MEWS matrix and action plan development have been previously described and were implemented on the gynecologic oncology service at a single institution in July 2018. Over the course of the year, MEWS scores were recorded with each vital sign set and analyzed at 6 months, with the primary outcome of acute events or the need for transfer to a higher level of care. Secondary outcomes still under review include rates of death within 30 days and hospital readmission.

**Results:** During the 6 months after implementation, 183 patients were admitted to the gynecologic oncology service at our institution. No acute events or ICU transfers occurred among patients with NEWS scores below 3 (n = 126, NPV = 100%). Of the 57 patients with a score of 3 or greater, 12 (21%) had an acute event or required transfer (RR = 54.7, P = 0.0052). Of 20 patients with a score of 5 or greater, 4 (20%) had an acute event or required transfer, but this threshold failed to detect the majority of patients who were at risk (33%, RR = 4.08, P = 0.0129). In addition, there was a lower rate of transfer and acute events in the last 3 months compared to the first 3 months, although this difference was not statistically significant.

**Conclusion:** MEWS scoring accurately stratifies gynecologic oncology patients at risk for acute events with an NPV of 100%. Although statistical significance is still achieved with a cutoff score of 5, more than half of patients at risk will not meet this trigger and clinical significance suffers. Because of the success of MEWS with gynecologic oncology patients, the hospital system is currently planning expansion to the postpartum, antepartum, and benign gynecology services.

---

**617 - Poster Session**

**Reducing opioid prescriptions in a gynecologic oncology practice: A quality improvement project**

B.Q. Smitha and R. Salanib. aThe Ohio State University, James Cancer Hospital, Columbus, OH, USA, bOhio State University, Columbus, OH, USA

**Objective:** The United States has a well-established opioid crisis. Evidence shows that abused opioids are obtained from friends or family members who initially received an opioids prescription. Gynecologic oncologists rely partially on opioids for the management of postoperative pain. This places us on the front line of this crisis. The objective of this quality improvement project is to implement a restrictive opioid prescription protocol for patients following gynecologic oncology surgery.

**Method:** We determined a reasonable amount of narcotics that would be required for postoperative recovery after discharge. We then developed a protocol for patients undergoing gynecologic oncology procedures regarding the number of opioids each patient would receive at hospital discharge. The opioid quantity was dependent upon whether the patient underwent a minimally invasive procedure or laparotomy as well as the narcotic requirement in the immediate 24 hours prior to hospital discharge. Each patient was also to receive a standard prescription of ibuprofen and acetaminophen as well as a laxative and stool softener. The protocol was drafted and then agreed upon by the gynecologic faculty at our institution. This protocol was then distributed to the faculty and trainees in the gynecologic oncology division as well as all the trainees in the obstetrics and gynecology department who took part in the postoperative management and discharge of gynecologic oncology patients.

**Results:** Prior to initiation of our restrictive opioid prescription protocol, a 1-month sampling showed an average opioid discharge prescription of 146 morphine milligram equivalents (MME) for minimally invasive procedures and 265 MME for laparotomies. After initiation of our restrictive opioid protocol, we saw a decrease in the opioid administration to an average of 94 MME for minimally invasive procedures and 191 MME for laparotomies. Both of these changes are statistically significant (P < 0.05). There were no differences in the number of patients requiring a refill for their opioid prescription.

**Conclusion:** A restrictive opioid prescription protocol is successful in reducing the number of opioids prescribed at discharge. Along with non-narcotic medications, a restrictive opioid prescription protocol does not appear to compromise pain control in the postoperative period. Further analysis is needed to evaluate the impact of a restrictive protocol on the ongoing opioid crisis.

---

**616 - Poster Session**

**The impact of code status simplification on end-of-life health care choices in gynecologic oncology**


**Objective:** The aim of this study was to evaluate outcomes of code status simplification from 6 to 2 distinct options and the effect on end-of-life quality markers in gynecologic cancer care.

**Method:** On December 3, 2018, our institution implemented a change in code status, simplifying 6 options—full code, full support do not resuscitate (FS-DNR), FS do not intubate, FS no chest compressions, comfort care (CC) DNR, and CC-withdraw—to full code or DNR only. A retrospective review of all gynecologic oncology patients admitted 1 year prior to the intervention through 6 months following implementation (December 1, 2017, to June 30, 2018) was performed with identification of patients who died during the interval. Details regarding demographic information, code status prior to death, oncologic treatment in the last 2 weeks of life, location of death, and health care service utilization were abstracted.
**Results:** Death was observed in 157 patients pre-intervention and 57 postintervention. Demographic information including age and cancer type (with recurrent ovarian cancer being most common) was similar in both groups. Of all patients, 120 (76.4%) were full code pre-intervention compared to 31 (54.4%) postintervention ($P < 0.01$). Similarly, fewer patients with recurrent cancer were full code postintervention (70.2% vs 43.8%, $P < 0.01$). There were no differences in location of death (intensive care unit, hospital, home, hospice) or utilization of chemotherapy or radiation in the last 2 weeks of life. Black patients had similar utilization rates of home health (65.0% vs 73.1%, $P = 0.22$) and hospice services (36.3% vs 43.3%, $P = 0.32$). Prior to intervention, black patients were more likely to die in the hospital than white patients (31.6% vs 16.5%, $P = 0.04$), and this remained significant following intervention (43.5% vs 17.6%, $P = 0.04$).

**Conclusion:** Code status simplification to dichotomous choices led to a significant decrease in women electing to remain full code near the end of life. Compared to white patients, black women had similar end-of-life resuscitation goals but were 3 times more likely to die in a hospital bed despite similar utilization of home health and hospice services. Further insight is needed to improve health care delivery for minority patients.

---

**618 - Poster Session**

**A clinical classification system for platinum hypersensitivity reactions**

*M.H. Vetter*, A.V. Castaneda, A. Khan and D.M. O’Malley. *The Ohio State University, James Cancer Hospital, Columbus, OH, USA, *The Ohio State University, Columbus, OH, USA, *The Ohio State University Comprehensive Cancer Center, Columbus, OH, USA, *The Ohio State University College of Medicine, Arthur G. James Cancer Hospital and Solove Research Institute, Columbus, OH, USA

**Objective:** Multiple systems for grading the severity of platinum hypersensitivities exist. These systems use subjective features rather than clearly defined clinical signs, leading to inconsistencies in grading. To overcome these issues, a clinical system for grading platinum hypersensitivities was developed at our institution to standardize the classification of platinum hypersensitivities. We sought to validate our classification and determine the relationship between our system and currently used grading systems.

**Method:** This was a retrospective review of patients with platinum hypersensitivities from 2011 to 2017. Demographics, chemotherapy histories, and details of their initial hypersensitivities were collected. Mild reactions were defined as local skin manifestations only. Moderate–low reactions included widespread skin, respiratory, or gastrointestinal findings. Moderate–standard reactions were defined as transient cardiovascular compromise (CVC), hypoxia, or neurologic changes, while sustained changes (>10 minutes) were used to define severe reaction. Fischer exact tests ($P < 0.05$) were used to identify clinical features associated with CVC or hypoxia, and binary logistic regression analyses were performed. Spearman correlation was used to assess relationships between our grading system and the National Comprehensive Cancer Network (NCCN) and Common Technology Criteria for Adverse Events (CTCAE) v4.0 criteria.

**Results:** Of the 87 patients identified, most were being treated for ovarian cancer ($n = 55, 63.2%$), receiving carboplatin ($n = 62, 71.3%$), and on second-line CT ($P = 34, 42.5%$). The mean prior platinum doses of the cohort were 10.8 (0–57). The rate of individual reaction features and their relationship with CVC or hypoxia are presented in Table 1. Chest pain was associated with transient CVC ($OR = 10.0, 95\% CI 1.148–87.133$) on multivariate analysis, while nausea/vomiting ($OR = 8.420, 95\% CI 1.263–55.275$) was associated with transient hypoxia, albeit less closely than transient hypotension ($OR = 17.010, 95\% CI 2.026–142.825$). Only presyncope/syncope were identified as transient hypoxia ($OR = 1.00$).

**Conclusion:** This 4-tier classification of platinum hypersensitivities offers an objective means of grading hypersensitivity severity and correlates with currently used grading systems.

---

### Table 1. Incidence of individual clinical reaction features and their associated with documented cardiopulmonary changes.

<table>
<thead>
<tr>
<th>Clinical features</th>
<th>$n$</th>
<th>%</th>
<th>Transient cardiovascular compromise</th>
<th>$P$</th>
<th>Transient hypoxia</th>
<th>$P$</th>
<th>Sustained cardiovascular compromise</th>
<th>$P$</th>
<th>Sustained hypoxia</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Back pain</td>
<td>4</td>
<td>4.6</td>
<td>1</td>
<td>0.642</td>
<td>1</td>
<td>0.267</td>
<td>1</td>
<td>0.388</td>
<td>1</td>
<td>0.173</td>
</tr>
<tr>
<td>Anaphylaxis</td>
<td>0</td>
<td>0</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td><strong>Cutaneous</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local flushing</td>
<td>43</td>
<td>49.4</td>
<td>17</td>
<td>0.831</td>
<td>3</td>
<td>1.00</td>
<td>7</td>
<td>0.191</td>
<td>3</td>
<td>0.355</td>
</tr>
<tr>
<td>Local pruritus</td>
<td>37</td>
<td>42.5</td>
<td>13</td>
<td>0.386</td>
<td>1</td>
<td>0.0249</td>
<td>2</td>
<td>0.0182</td>
<td>0</td>
<td>0.135</td>
</tr>
<tr>
<td>Local rash</td>
<td>6</td>
<td>6.9</td>
<td>3</td>
<td>0.685</td>
<td>0</td>
<td>1.00</td>
<td>0</td>
<td>1.00</td>
<td>0</td>
<td>1.00</td>
</tr>
<tr>
<td>General urticaria</td>
<td>10</td>
<td>11.5</td>
<td>4</td>
<td>1.00</td>
<td>1</td>
<td>0.504</td>
<td>2</td>
<td>0.317</td>
<td>0</td>
<td>1.00</td>
</tr>
<tr>
<td>Diffuse rash</td>
<td>20</td>
<td>23.0</td>
<td>7</td>
<td>0.612</td>
<td>1</td>
<td>1.00</td>
<td>1</td>
<td>0.444</td>
<td>0</td>
<td>0.570</td>
</tr>
<tr>
<td>Angioedema</td>
<td>4</td>
<td>4.6</td>
<td>1</td>
<td>0.642</td>
<td>1</td>
<td>0.287</td>
<td>0</td>
<td>1.00</td>
<td>0</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Gastrointestinal</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nausea/vomiting</td>
<td>22</td>
<td>25.3</td>
<td>10</td>
<td>0.626</td>
<td>5</td>
<td>0.010</td>
<td>*2</td>
<td>1.00</td>
<td>1</td>
<td>1.00</td>
</tr>
<tr>
<td>Abdominal pain/discomfort</td>
<td>11</td>
<td>12.6</td>
<td>4</td>
<td>1.00</td>
<td>0</td>
<td>0.589</td>
<td>3</td>
<td>0.010</td>
<td>0</td>
<td>1.00</td>
</tr>
<tr>
<td>Other GI symptoms</td>
<td>5</td>
<td>5.7</td>
<td>1</td>
<td>0.642</td>
<td>0</td>
<td>1.00</td>
<td>0</td>
<td>1.00</td>
<td>0</td>
<td>1.00</td>
</tr>
<tr>
<td><strong>Respiratory</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sneezing or nasal congestion</td>
<td>2</td>
<td>2.3</td>
<td>0</td>
<td>0.511</td>
<td>0</td>
<td>1.00</td>
<td>0</td>
<td>1.00</td>
<td>0</td>
<td>1.00</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>8</td>
<td>9.2</td>
<td>5</td>
<td>0.264</td>
<td>1</td>
<td>0.500</td>
<td>0</td>
<td>0.589</td>
<td>0</td>
<td>1.00</td>
</tr>
<tr>
<td>Throat tightness</td>
<td>8</td>
<td>9.2</td>
<td>2</td>
<td>0.463</td>
<td>1</td>
<td>0.500</td>
<td>0</td>
<td>0.589</td>
<td>0</td>
<td>1.00</td>
</tr>
</tbody>
</table>
Video-assisted counseling for human papillomavirus vaccination: A quality improvement study


Objective: The purpose of this study was to assess the feasibility and preliminary effectiveness of video-assisted human papillomavirus (HPV) education and counseling on vaccination in outpatient pediatric clinics.

Method: Adolescents age 9–18 years (n = 20) and their parents who had not previously completed the HPV vaccination series were enrolled during outpatient care visits at an academic pediatric clinic. Eligible participants were shown a standardized counseling video reviewing HPV transmission, relation to cancer, role of immunization, myths, side effects, series timing, and need for completion. A modified Carolina HPV Immunization Attitudes and Beliefs Scale was administered to parents both before and after video-assisted counseling. Parents were then given the option to proceed with HPV vaccination, decline, or discuss further with their provider. Electronic medical record (EMR) review was performed for pertinent medical and demographic data.

Results: Twenty patients and their corresponding parents were enrolled. At the time of intervention, 85% of patients were eligible for vaccination the same day. The majority of eligible patients (70.6%) elected for the HPV vaccination immediately following video-assisted counseling of those who did not receive the vaccination, 4/5 were not offered the HPV vaccination by their provider post-intervention. The most significant barrier to vaccination was provider recommendation following video-assisted counseling. Parents felt that video-assisted counseling provided adequate information to inform a vaccination choice for their child.

Conclusion: Video-assisted counseling is feasible and effective, particularly when combined with provider recommendation immediately after counseling. Data from this study will be used to inform a randomized trial on HPV counseling in outpatient pediatric clinics.

---

Implementation of a care bundle for inpatient management of acute kidney injury among gynecologic oncology patients: Lessons learned from a quality improvement project


Objective: The aims of this study were to identify etiologies of acute kidney injury (AKI) occurring in gynecologic oncology patients admitted to the hospital and to determine factors associated with AKI recovery, including adherence to an inpatient AKI care bundle.

Method: We implemented a quality improvement initiative at a large academic hospital from June 2017 to August 2018. We adapted a 1-page AKI care bundle worksheet from the Royal Berkshire NHS Foundation Trust. AKI care bundle compliance was defined as initiating the protocol within 48 hours of AKI diagnosis. Bivariate analyses were used to determine factors associated with AKI recovery. AKI recovery according to AKI severity was analyzed using the Kaplan-Meier method and log rank test.

Results: Ninety-right gynecologic oncology inpatients with confirmed cancer met criteria for AKI according to AKI Network criteria, including 66 (67%) due to an increased SCr ≥0.3 mg/dl within 48 hours. Prerenal (62%) etiology was most common followed by
intrinsic (26%) and postrenal (11%). Median age was 68 years; patients were predominantly stage III–IV (71%) and had ovarian
carcinoma (44%); and 14% had pre-existing chronic kidney disease. Over half (66, 67%) recovered from AKI, including 57 (58%) prior
to hospital discharge, and 12 (12%) developed chronic kidney disease. Factors related to AKI recovery included admission type
(medical, 56%, vs surgical, 44%, P = 0.01), lower median SCr level triggering AKI care bundle (1.4 vs 1.75, P = 0.049), lower peak SCr
(median 1.42 vs 2, P = 0.03), last chemotherapy >6 weeks (56% vs 29%, P = 0.01), and severity of AKI stage (I, 83%, vs II, 9%, vs III, 8%;
P = 0.001). Median time to resolution of AKI was 1 versus 12 versus 8.3 days for AKI stages I, II, and III, respectively (log rank P = 0.01)
(Figure 1). AKI care bundle compliance was 71% and significantly improved discontinuation of nephrotoxic medications (28/70, 40%,
vs 5/28, 18%, P = 0.04). A 10% random convenience sample (n = 400/3996) of gynecologic oncology patients admitted during the
quality improvement period revealed a “missed” care bundle activation rate of 8%.

**Conclusion:** Nearly a third of gynecologic oncology patients who receive inpatient care for AKI do not recover function. Future efforts to
improve provider compliance with an AKI care bundle may improve its effectiveness beyond discontinuation of nephrotoxic drugs.

---

**Fig. 1.** Kaplan-Meier survival curve of time to AKI resolution based on AKI severity.

---

**621 - Poster Session**

**Prevalence of perinatal mortality due to neoplasia in the United States (2015-2017): An epidemiologic study**

H. Erfani, A. Rezaei and A.A. Shamshirsaz. Baylor College of Medicine, Houston, TX, USA

**Objective:** Neoplasia has been barely addressed in the scientific literature as a cause of perinatal/infant mortality. In this epidemiologic
investigation we sought to report the prevalence of death due to various neoplasms in the first year following delivery in the United
States between 2015 and 2017.

**Method:** We undertook a population-based retrospective analysis of perinatal/infant mortality in the United States (2015–2017). We
utilized Period Linked Birth–Infant Death data files from the National Center for Health Statistics (NCHS) for years 2015–2017. This
data set includes all U.S. infant deaths linked to their corresponding birth certificates per year, referred to as the numerator file. The
second file is the yearly natality file for the United States, which is used to provide denominators for rate computations. NCHS makes the
selection of the underlying cause of death using the International Classification of Disease-10 (ICD-10). ICD codes for neoplasms,
malignant neoplasms, Hodgkin’s disease and non-Hodgkin’s lymphomas, leukemia, other and unspecified malignant neoplasms, in situ
neoplasms, benign neoplasms, and neoplasms of uncertain or unknown behavior were used to capture the outcome variable. Data
 cleaning and statistical analysis were performed using R Statistical Package v3.5.3, The R Foundation.

**Results:** Of the total of 11,779,972 live births in the United States in 2015–2017, 68,956 deaths in the first year of life were reported;
infant mortality rate = 0.58%. Of those, 37,480 (54.6%) and 8,367 (12.2%) infant deaths happened in day of life 0–7 (early neonatal
death) and day of life 8–28 (late neonatal death), respectively. A total of 271 (0.40%) of all infant deaths were due to neoplasms; 41
(15.1%) in day of life 0–7, 31 (11.4%) in day of life 8–28, and 199 (73.4%) in day of life 29–365. Out of the total of infant deaths due to
neoplasms, 173 (63.8%) were attributed to malignant neoplasms, and 98 (36.2%) were attributed to in situ, benign, or neoplasms of
uncertain or unknown behavior. Table 1 shows some basic characteristics of these deaths.
Conclusion: Perinatal and infant mortality due to neoplasms in early days of life is a public health issue. Additional attention by policymakers to developing screening protocols in pregnancy or early neonatal life is needed.

Table 1. Characteristics of infant deaths due to neoplasia in the United States (2015 - 2017).

<table>
<thead>
<tr>
<th></th>
<th>Malignant Neoplasms (N = 173)</th>
<th>Non-malignant Neoplasms (N = 98)</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maternal Age, year</td>
<td>28 (24, 33)</td>
<td>29 (23, 32)</td>
<td>0.65</td>
</tr>
<tr>
<td>Race/Ethnicity</td>
<td></td>
<td></td>
<td>0.59</td>
</tr>
<tr>
<td>Non-Hispanic White</td>
<td>85 (49.1 %)</td>
<td>48 (49.0 %)</td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic Black</td>
<td>27 (15.6 %)</td>
<td>10 (10.2 %)</td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>40 (23.1 %)</td>
<td>27 (27.5 %)</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>21 (12.1 %)</td>
<td>13 (13.3 %)</td>
<td></td>
</tr>
<tr>
<td>BMI Category, Kg/m²</td>
<td></td>
<td></td>
<td>0.33</td>
</tr>
<tr>
<td>&lt; 18.5</td>
<td>5 (2.9 %)</td>
<td>4 (4.1 %)</td>
<td></td>
</tr>
<tr>
<td>18.5 – 24.9</td>
<td>66 (38.1 %)</td>
<td>44 (44.9 %)</td>
<td></td>
</tr>
<tr>
<td>25 – 29.9</td>
<td>48 (27.7 %)</td>
<td>18 (18.4 %)</td>
<td></td>
</tr>
<tr>
<td>&gt;30</td>
<td>54 (31.2 %)</td>
<td>32 (32.6 %)</td>
<td></td>
</tr>
<tr>
<td>EGA at Delivery, weeks</td>
<td>38 (37, 39)</td>
<td>37 (32, 39)</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Gravidity</td>
<td>2 (2, 4)</td>
<td>2 (1, 3)</td>
<td>0.04</td>
</tr>
<tr>
<td>Prior Terminations/Fetal Death</td>
<td>0 (0, 1)</td>
<td>0 (0, 0)</td>
<td>0.21</td>
</tr>
<tr>
<td>Prior Death of a Living Child</td>
<td>0 (0, 0)</td>
<td>0 (0, 0)</td>
<td>0.11</td>
</tr>
<tr>
<td>Age at Death, days</td>
<td>156 (63, 281)</td>
<td>35 (4, 168)</td>
<td>&lt; 0.01</td>
</tr>
</tbody>
</table>


Non-malignant Neoplasms: ICD codes for ‘in situ neoplasms’, ‘benign neoplasms’, and ‘neoplasms of uncertain or unknown behavior’

Continuous variables are reported as median and interquartile range (Mann-Whitney U-Test)
Categorical variables are reported as n (%) (Chi-Square Test)

622 - Poster Session
Impact of geography and travel distance on outcomes in epithelial ovarian cancer: A National Cancer Database (NCDB) analysis
A. Daruvala\textsuperscript{a}, C.J. Darus\textsuperscript{b} and L. Bradford\textsuperscript{b}. \textsuperscript{a}Tufts School of Medicine, Boston, MA, USA, \textsuperscript{b}Maine Medical Center, Portland, ME, USA

Objective: Despite national guidelines emphasizing the importance of evaluation by a gynecologic oncologist prior to initiation of therapy, access to guideline-adherent care remains an obstacle for many women. The aim of this investigation is to test the null hypothesis that there is no association between proximity of residential zip code to a high-volume Commission on Cancer (COC) cancer center with gynecologic oncologists and mortality and survival.

Method: The National Cancer Data Base was queried for cases of newly diagnosed ovarian cancer between 2004 and 2015. Our final cohort for analysis was 115,540 patients. Our predictor of interest was distance traveled for treatment. Travel distance was classified as <25 miles, 25–50 miles, 50–100 miles, and >100 miles. Our primary outcomes were 30-day mortality, 90-day mortality, and overall survival.

Results: Of the final cohort, 67% of patients lived less than 25 miles from the treatment facility, whereas 6% of patients lived >100 miles. The percentage of patients treated with open surgery increased with travel distance, as did the percentage of patients treated with neoadjuvant chemotherapy. Patients who traveled least were more likely to attend low-volume hospitals and less likely to attend academic medical centers. There was no statistically significant difference in 30- or 90-day mortality among any of the travel distance categories. There was a statistically significant decrease in 30-day readmission among patients who lived further away from the treatment facility. A total of 105,529 patients were available for Kaplan-Meier survival analysis. Survival curves differed between distance strata (P < 0.0001). The adjusted Cox regression models demonstrated increase in long-term mortality as patients live farther away from the treatment facility compared to those who lived within 25 miles: for patients who lived 25–50 miles away, HR = 0.98, 95% CI 0.94–1.03; for patients who lived 50–100 miles away, HR = 1.07, 95% CI 1.01–1.13; and for patients who lived more than 100 miles away, HR = 1.09, 95% CI 1.02–1.16).

Conclusion: While 30- and 90-day mortality do not differ by travel distance, worse survival is observed among women living 50–100 miles and >100 miles from a COC facility. With a national policy shift toward centralization of complex care, a better understanding of the impact of distance on mortality in ovarian cancer patients is crucial. Our findings may help to better inform practices of health care delivery, especially in rural settings.
Objective: The aim of this study was to assess actionability of next-generation sequencing (NGS) in tumors of gynecologic oncology patients and describe clinical utilization of these results.

Method: Patients with NGS results are reviewed at a weekly molecular tumor board at our institution. We performed a retrospective chart review to obtain demographic and clinical information for all gynecologic oncology patients whose tumors were submitted for NGS. Alterations identified on NGS for these patients were stratified according to the OncoKB database actionability algorithm. Descriptive statistics were used to analyze the data.

Results: A total of 196 women with gynecologic cancer between 2014 and 2019 had tumor samples submitted for NGS (92 ovarian, 97 uterine, 2 cervix, 2 vulvar, 1 vaginal, and 2 unknown). Forty-three (21.9%) were ordered in the primary setting; the majority were ordered after a diagnosis of recurrence, 151 (77.0%). Of these, 74 (37.8%) identified no actionable mutation. Only 12 (6.1%) identified an alteration that directed to an FDA-approved or standard-of-care therapy in that tumor type. One hundred ten (56.1%) had alterations that directed to investigational or hypothetical implications. For those patients with an actionable finding, 22 had treatment initiated based on these results. Common reasons for a targeted therapy not being initiated included provider or patient choice of alternative therapy, patient refusal of further therapy, NED status, or death or hospice initiation before results could be discussed. Ninety-eight patients in this cohort have died of disease. Median time between NGS testing and death was 7.3 months (range 0.3–38.7 months). In patients who received at least 1 cycle of a targeted agent initiated based on NGS results, the average time on therapy was 5.5 months (range 0.6–14 months). See Table 1.

Conclusion: The majority (93.9%) of gynecologic tumors did not have mutations associated with FDA-approved or standard-of-care treatments; even in patients with a potential actionable alteration, providers were more likely to choose an alternative therapy. Of note, a significant proportion of NGS was performed when patients were at the end of life. Further investigation is warranted to determine the patient population most likely to benefit from NGS and the timing of testing given the cost and current limited clinical applicability of their results.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Study Population (N=196)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (median (range))</td>
<td>61.0 (19.0–81.6 years)</td>
</tr>
<tr>
<td>Race</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>141 (71.9)</td>
</tr>
<tr>
<td>Black</td>
<td>43 (21.9)</td>
</tr>
<tr>
<td>Asian</td>
<td>2 (1.0)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>2 (1.0)</td>
</tr>
<tr>
<td>Unknown</td>
<td>8 (4.2)</td>
</tr>
<tr>
<td>Diagnosis</td>
<td></td>
</tr>
<tr>
<td>Ovarian</td>
<td>92 (46.9)</td>
</tr>
<tr>
<td>Uterine</td>
<td>97 (49.4)</td>
</tr>
<tr>
<td>Other</td>
<td>7 (3.6)</td>
</tr>
<tr>
<td>Time of testing</td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>43 (21.9)</td>
</tr>
<tr>
<td>Recurrence</td>
<td>151 (77.0)</td>
</tr>
<tr>
<td>Unknown</td>
<td>2 (1.0)</td>
</tr>
<tr>
<td>Prior lines of therapy</td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>46 (23.5)</td>
</tr>
<tr>
<td>1</td>
<td>53 (27.0)</td>
</tr>
<tr>
<td>2</td>
<td>46 (23.5)</td>
</tr>
<tr>
<td>3</td>
<td>25 (12.8)</td>
</tr>
<tr>
<td>4 or more</td>
<td>26 (13.2)</td>
</tr>
<tr>
<td>Mutation Actionability*</td>
<td></td>
</tr>
<tr>
<td>No actionable alteration identified</td>
<td>74 (37.8)</td>
</tr>
<tr>
<td>Class I</td>
<td>10 (5.1)</td>
</tr>
<tr>
<td>Class II</td>
<td>2 (1.0)</td>
</tr>
<tr>
<td>Class</td>
<td>Count (Percentage)</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>Class IIB</td>
<td>60 (30.6)</td>
</tr>
<tr>
<td>Class III</td>
<td>3 (1.5)</td>
</tr>
<tr>
<td>Class IIIB</td>
<td>7 (3.6)</td>
</tr>
<tr>
<td>Class IV</td>
<td>40 (20.4)</td>
</tr>
</tbody>
</table>

Therapy initiated based on results

<table>
<thead>
<tr>
<th>Therapy Initiated Based on Results</th>
<th>Count (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>22 (11.2)</td>
</tr>
<tr>
<td>No</td>
<td>174 (88.8)</td>
</tr>
</tbody>
</table>

*OncoKB classification: I = Directs to FDA-approved therapy; II = Directs to standard of care therapy; IIB = directs to FDA-approved or standard of care in other tumor type; III = Clinical evidence to support biomarker being predictive of response to a drug in this tumor type; IIIB = Clinical evidence to support biomarker being predictive of response to a drug in another tumor type; IV = Biological evidence to support the biomarker as being predictive of response to a drug (Patients may have an alteration that fits into more than one category but were assigned to the highest category).
**Results:** A total of 17 clinical trials were open to enrollment during at least a portion of the retrospective study period. Prior to SWOT analysis, 97 of 2,003 patients seen in clinic during the 3-month period were identified as potentially being eligible for an open trial. Of these 97 (37%) eligible patients, 36 were identified in the medical record as being approached or prescreened for a trial, and 13/97 (13.4%) enrolled. In post-SWOT analysis, 89 patients were identified. Potential eligibility was referenced in the medical record of 42/89 (47%) of these patients, and 14/89 (15.7%) enrolled in a trial. Based on these data, a prospective clinical trial screening workflow was created, and preliminarily, 100% of 24 potentially eligible patients were prescreened. Although actual enrollment numbers remain low, reasons why patients do not enroll on a clinical trial are still being captured.

**Conclusion:** Our SWOT analysis led to increased identification of patients eligible for clinical trials, but did not significantly change the enrollment rate. Preliminary data show that a single dedicated research team member assigned to prescreen patients prior to clinic increases eligibility identification, and should lead to increased enrollment. Further interventions are needed to break down the barriers inhibiting patient enrollment.

---

**626 - Poster Session**

**Enhanced recovery protocols decrease complication rates in all patients with a greater impact on the morbidly obese population**


**Objective:** The objective of this study was to evaluate the impact of an enhanced recovery program (ERP) on complication rates in morbidly obese gynecologic oncology patients undergoing surgery.

**Method:** This retrospective cohort study included gynecology oncology patients undergoing elective laparotomy from October 2016 to December 2018 managed on an ERP. A control group of patients was evaluated from October 2015 to October 2016. The ERP was adapted from the guidelines written by G. Nelson et al. The primary outcome was complication rates in morbidly obese patients (BMI >40) compared to the rest of the population pre- and post-ERP. Complications were defined as pulmonary complications, acute kidney injury, sepsis, myocardial infarction, cerebrovascular accident, thromboembolic morbidity, poorly controlled blood sugars, perioperative blood transfusion, postoperative ileus, and surgical site infection (SSI). Statistical analysis was performed using SPSS Statistics v.24.

**Results:** A total of 739 patients met inclusion criteria, 193 in the control group and 546 in the ERP group. Patient demographics including age, BMI, primary diagnosis, and Charlson comorbidity index were similar between groups. Patients in the ERP group had a shorter length of stay (LOS) than patients in the control group (3.1 vs 3.8 days, \(P < 0.01\)), including the morbidly obese patients; however, there was no difference in 30-day readmission rates (\(P = 0.3\)). Overall, complication rates in the nonmorbidly obese patients decreased from 31.6% to 16.7% (\(P < 0.01\)) after initiation of the ERP, while complications in the morbidly obese patients decreased from 63.0% to 27.8% (\(P < 0.01\)). The most common complications in morbidly obese patients pre-ERP were poor glucose control and SSI (28.0% and 20.0%) compared to blood transfusion and ileus in the ERP group (7.7% and 6.7%).

**Conclusion:** Implementation of an ERP reduces LOS and decreases complication rates in gynecologic oncology patients. This impact is especially pronounced in the morbidly obese population, with a decrease in complication rates by 35% compared to 15% in nonmorbidly obese patients.

---

**627 - Poster Session**

**Fragmentation of surgical care and chemotherapy and its effect on overall survival in ovarian cancer**

S. Chama, Y. Huangb, J.Y. Houc, A. Melamedc, A.L. Tergasb, F. Khoury Colladoc, C.M. St. Clairc and J.D. Wrightb. aBrigham and Women’s Hospital and Harvard Medical School, Boston, MA, USA, bColumbia University College of Physicians and Surgeons, New York, NY, USA, cNew York-Presbyterian/Columbia University Medical Center, New York, NY, USA

**Objective:** Regionalization of surgical cancer care is associated with improved postoperative outcomes. Fragmentation of care in the postoperative setting is associated with increased short-term mortality; however, little is known about its long-term effects. The objective of our study was to examine whether fragmentation of primary debulking surgery (PDS) and adjuvant chemotherapy is associated with overall survival (OS) in ovarian cancer.

**Method:** The National Cancer Data Base was used to identify stage II–IV epithelial ovarian cancer patients between 2004 and 2015 who underwent PDS followed by adjuvant chemotherapy. Fragmentation was defined as receipt of adjuvant chemotherapy at a different institution than where a patient’s PDS was performed. After propensity score weighting, mortality rates stratified by fragmentation were examined. Proportional hazard models were developed to estimate the association between fragmented care and OS.
Results: A total of 36,300 patients were identified. Overall, 13,347 (36.8%) had fragmented care and received adjuvant chemotherapy at a different facility. Patient factors associated with fragmentation included older age, higher income, and longer travel distance for PDS (all, $P < 0.05$). Hospital factors included performance of PDS at a community cancer center or at a facility with lower annual surgical volume (both, $P < 0.05$). Fragmented care was associated with a 15% risk of delay to initiation of adjuvant chemotherapy by 30 days or more (aRR = 1.15, 95% CI 1.09–1.22). In a PS weighted analysis, mortality was reduced when adjuvant chemotherapy was fragmented (HR = 0.95, 95% CI 0.92–0.97). A stratified analysis indicated patients who traveled more than 50 miles and underwent PDS and adjuvant chemotherapy at the same institution had the worst OS (Figure 1).

Conclusion: Receipt of adjuvant chemotherapy after PDS at a different institution may have no adverse effects on long-term OS. Survival outcomes were worst for those who attempted to receive care at the same institution 50 miles or more away. Long travel distance may imply that the time and resources patients expend to travel for centralized care may have an impact on OS.

Fig. 1.

628 - Poster Session
Fellow-run clinic achieves survival outcomes equivalent to faculty clinics
Washington University School of Medicine in St. Louis, St. Louis, MO, USA

Objective: Fellow involvement in patient care improves outcomes in other subspecialties, but whether this holds true for gynecologic oncology care is unclear. Our aim was to compare practice patterns and patient outcomes in faculty clinics versus a fellow training clinic at a large academic medical center.

Method: We performed a retrospective chart review of a convenience sample of consecutive gynecologic oncology patients from 8 faculty clinics and 1 faculty-supervised fellow clinic from May 2010 to May 2012. Allocation to the fellow clinic was based on having no insurance or Medicaid, whereas faculty clinic patients had Medicare or private insurance. Bivariate analyses assessed differences based on patient demographics, cancer characteristics, and practice patterns. Primary outcome was overall survival (OS); secondary outcomes included progression-free survival (PFS), postoperative complications, and chemotherapy within the last 30 days of life. Survival analyses were performed using Kaplan-Meier curves with log rank tests.

Results: Of 101 patients, 54 received care in the fellow clinic. Patients in the fellow clinic were younger ($P < 0.01$) and less likely to be Caucasian ($P < 0.01$) and had no differences from faculty clinic patients in Charlson Comorbidity Index score or cancer primary site and stage. Compared to faculty, fellows more often chose nonsurgical management strategies for upfront treatment (13% vs 46%, $P = 0.0002$). Patients had similar rates of postoperative complications when initial treatment was operative (25.6% vs 26.5%, $P = 0.93$), grade 3–4 chemotherapy complications (4.3% vs 5.4%, $P = 0.80$), and grade 3–4 radiation complications (17.0% vs 7.1%, $P = 0.12$), but were less often prescribed chemotherapy within the last 30 days of life (60% vs 7.1%, $P = 0.04$). There were no differences in median PFS (11 months, IQR 9–26, vs 15 months, IQR 9–34, $P = 0.8$) and OS (32 months, IQR 12–38, vs 19 months, IQR 23–57, $P = 0.1$) between faculty and fellow clinics, respectively. See Figure 1.
Conclusion: Despite treating a more under-resourced patient population, our study shows that a fellow-led clinic designed to provide learning opportunities does not compromise OS and PFS and may improve end-of-life care.

629 - Poster Session
If you prescribe it, will they fill it? Options to optimize postoperative opiate prescribing.
K.M. Croft, B.M. Sarosiek and S.C. Modesitt. aUniversity of Virginia, Charlottesville, VA, USA, bUniversity of Virginia Health System, Charlottesville, VA, USA

Objective: Stemming the flood of unnecessary narcotics into the community will take a multipronged attack. The objective of this study was to identify areas for improved postoperative prescribing practice.

Method: Patients who underwent gynecologic surgery from December 2018 to May 2019 at a tertiary academic institution were reviewed (excluding those with postoperative complications, chronic pain, or opiate abuse). Demographic information and morphine milligram equivalents (MME) used while admitted and prescribed on discharge were obtained. Patients either filled narcotics at their preferred pharmacy (“self fill”) or by bedside medicine delivery prior to discharge (“meds to beds”). Patient opiate prescriptions were compared to their inpatient narcotic use to assess for overprescribing practices and to estimate opiate waste generated.

Results: A total of 305 patients were evaluated with a median age of 55.6 years and median BMI of 29.8 kg/m² and who lived a mean 52.2 miles from the hospital. The majority of cases were performed by gynecologic oncology (58.3%) and were major laparoscopic procedures (51.1%). There were 176 patients who utilized self fill and 129 who utilized meds to beds. Compared to the self fill group, meds to beds patients were younger, lived a greater distance from the hospital, and were more likely to have a laparotomy. Mean MME 24 hours prior to discharge was lower in the self fill group at 16.1 versus 24.7 MME in the meds to beds group (P = 0.001). In both groups, nearly all patients received a prescription for narcotic on discharge (97.2% in self fill group, 100% in meds to beds group). Refill rate was low in both groups at 2.8% and 3.1%, respectively (P = 1). MME prior to discharge was higher for those requiring a refill (65.1 vs 19.3, P < 0.001). MME written was lower in the self fill group (190.2 vs 213.3, P < 0.001); however for both groups, regardless of inpatient opiate use, there was no statistical difference in mean number of tablets written on discharge. In the meds to beds group,
22.5% used no narcotic 24 hours prior to discharge, yet received a mean 26.6 tablets of opiate provided discharge. In the meds to beds group, based on a 7-day supply estimate, there were 1,330 tablets of opiate written that were likely unused.

**Conclusion:** These data suggest a patient’s postoperative opiate use prior to discharge could inform better prescribing practices and limit our contribution to the pool of opiate waste.

---

630 - Poster Session

**Patient perception of gynecologic cancer clinical trial participation in the Deep South**

N.L. Rezvani, O.E. Gilbert, C. Smith, A.G. Chapple, N. Nair and A.M. Jernigan. *Louisiana State University Health Sciences Center, New Orleans, LA, USA*

**Objective:** The purpose of this study was to assess the attitudes toward as well as the barriers and incentives to clinical trial participation (CTP) among women with gynecologic cancer in New Orleans, Louisiana.

**Method:** After Institutional Review Board approval, from May to July 2019, a voluntary 25-item paper survey assessing beliefs regarding CTP was administered to women with gynecologic cancer at 2 outpatient gynecological oncology clinics at a single academic institution. Demographics were recorded from the medical record. Survey responses were tabulated to evaluate the patients’ overall composite attitudes toward CTP (5–7, positive, or 0–4, negative], and responses to individual questions (disagree, 0–2; neutral, 3–4; agree, 5–7). The Fisher exact test was applied.

**Results:** Of the 51 participants, 51.0% were black women, 64.7% were >50 years, 43.1% were college-educated, 62.5% were obese, 45.1% were in a committed relationship, and 43.1% were independently mobile. The overall median composite score toward CTP was 3.8 (95% CI 3.7–4.1); this was not significantly different between groups. More black women disagreed that clinical trials were unnecessary than white women (26.9% vs 4.2%, \( P = 0.025 \)), but more likely to disagree that women who participate in trials benefited (40.7% vs 12.5%, \( P = 0.002 \)). Black women were less likely than white women to agree that the risks of clinical trials were shared equally between races (62.5% vs 95.8%, \( P = 0.010 \)). Women without college education more often than college-educated women disagreed that CTP provided the best cancer treatments (65.5% vs 28.6%, \( P = 0.014 \)) or that CTP will help others in the future (96.6% vs 72.7%, \( P = 0.016 \)). Women reported the following incentives for CTP as “quite” or “extremely” important: future benefit for others (88.2%), personal benefit (64.7%), nonmonetary incentives (28.6%), money for time (19.1%), and identifying cancer team members of the same race (4.1%). See **Figure 1**.

**Conclusion:** In this diverse Deep South gynecologic cancer population, perception of CTP is poor. Black women expressed concerns regarding benefit for trial participants and equal risk-sharing between races. Women with less formal education were less likely to see CTP as an opportunity to receive the best cancer care or to help others in the future. We must make efforts to communicate the power of CTP to improve cancer outcomes and narrow health disparities to our underserved patients and communities.
Objective: The purpose of this study was to evaluate the effects of implementation of a multiarm venous thromboembolism (VTE) prophylaxis quality improvement initiative on the rate of administration of preoperative heparin and the overall VTE rate on the gynecologic oncology service at a single institution.

Method: Prior to 2018, no consensus VTE prophylaxis protocol existed on the gynecologic oncology service at the authors’ academic institution. ACOG and Chest guidelines for VTE prophylaxis were reviewed to create a standardized VTE risk stratification algorithm. A real-time electronic dashboard was created to track various VTE quality measures (e.g., preoperative heparin ordered or given, postoperative heparin ordered, days of outpatient postoperative heparin prescribed). Interventions to improve preoperative heparin administration were introduced in 2 phases. During phase 1, the algorithm for perioperative VTE prophylaxis was rolled out in various forms including identification badge attachments, placards in operating rooms, and integration into a standard H&P template within the electronic medical record (EMR) system. In addition, order sets within the EMR were modified to include a prechecked preoperative heparin order. During phase 2, operating room staff including members of the surgical, anesthesia, and nursing teams were emailed weekly to investigate cases in which preoperative heparin should have been administered but was not. Preoperative heparin administration and postoperative VTE rates were evaluated before and after implementation of the quality improvement initiative for all inpatient gynecologic oncology cases.

Results: In the year prior to the implementation of the quality improvement initiative (January 2017–December 2017), preoperative heparin was administered in 38.4% of inpatient gynecologic oncology cases. During phase 1 of the initiative (January 2018–August 2018), administration rates increased to 61.5%, and during phase 2 (September 2018–July 2019), rates increased further to 77.9%. The VTE rate prior to the quality improvement initiative (January 2017–December 2017) was 5.7% and has decreased to 3.0% following implementation of the quality improvement initiative. See Figure 1.

Conclusion: Implementation of a VTE prophylaxis quality improvement initiative has resulted in improved rates of preoperative heparin administration and has been associated with a decline in VTE rates at our institution.
Objective: The aim of this study was to determine the bibliometric factors that make research receive more frequent citations in the obstetrics and gynecology literature.

Methods: We identified all primary research articles published in the American Journal of Obstetrics & Gynecology, Obstetrics & Gynecology, Gynecologic Oncology, and Journal of Minimally Invasive Gynecology between 1998 and 2008. After a 10-year period, only 45 articles had accrued 0 or 1 citation. This cohort was compared to a cohort of the 45 most highly cited articles from the same journals and time period. Student t tests, Wilcoxon rank sum tests, X² tests, and Fisher exact tests were used to analyze the data. Differences were considered significant by $P < 0.05$.

Results: Compared to articles with 0 or 1 citation, highly cited articles were more likely to be multiinstitutional ($P = 0.0003$) and clinical ($P = 0.0002$) studies. The highly cited cohort was more likely to report statistically significant results in the manuscript ($P < 0.0001$), include a nonobstetrics/gynecology author ($P = 0.0098$), and have longer abstract and manuscript word counts ($P = 0.0011$ and $P < 0.0001$, respectively). The highly cited cohort also had a higher number of authors ($P = 0.0014$), tables ($P = 0.0004$), and manuscript pages ($P < 0.0001$).

Conclusion: Very few articles published in the major obstetrics and gynecology journals have accrued 0 or 1 citation 10 years after publication. This suggests that the articles being chosen for publication in these journals are contributing to further research in the field. However, there were specific and significant differences between the 2 cohorts of articles, showing that certain factors are often associated with more frequent citation in the subsequent literature.
633 - Poster Session
Implementation of a postoperative electronic discharge checklist is associated with lower rate of early health care access
L.K. Berry and M.G. Kelly. Wake Forest University School of Medicine, Winston-Salem, NC, USA

Objective: An electronic discharge checklist (EDC) was created to enhance physician–nursing communication and to minimize perioperative morbidity. The purpose of this study was to assess the feasibility and potential benefits of an EDC.

Method: Patients’ postoperative pain, temperature, heart rate, systolic blood pressure, respiratory rate, urine output, WBC count, hemoglobin level, and early warning score (EWS) were used to create an EDC. Physicians and nurses completed a preimplementation and postimplementation survey and were educated on the EDC. Patients discharged 6 weeks prior to the EDC implementation served as the control group. Early postoperative health care access was defined as emergency room visit <30 days of surgery, urgent office visit <14 days of surgery, or hospital readmission <30 days of surgery.

Results: Fifty-eight percent of health care providers indicated that they had either discharged a patient with abnormal clinical findings or had a concern about a discharged patient on the preimplementation survey. Eighty-nine percent thought an EDC would improve safe discharge for surgical patients. No providers indicated the EDC required too much work on the postimplementation survey. There were 62 and 60 surgical discharges in the control and EDC groups, respectively. The most common abnormality identified during completion of the EDC was tachycardia (23%). Other clinical abnormalities noted on the EDC were low urine output (17%), systolic blood pressure <90 mm Hg (6%), and hemoglobin <8 dL/ml (6%). In the control group, 5 patients had an emergency room visit <30 days of surgery; 15 had an urgent office visit within 14 days of surgery; and 3 had a hospital admission <30 days of surgery. In the EDC group, 1 patient had an emergency room visit; 6 patients had an urgent office visit; and no patients were readmitted after surgery. Patients in the EDC group had a significantly lower rate of early postoperative health care access (10%) compared to patients in the control group (27%, P = 0.01).

Conclusion: An EDC is a feasible mechanism for improving communication during patient discharge. In this pilot study, the EDC decreased patient need for early postoperative health care access. Widespread implementation of an EDC may improve hospital-wide perioperative morbidity rates.

634 - Poster Session
Risk factors for surgical management of bowel obstruction in patients with gynecological malignancy

Objective: Small bowel obstruction (SBO) is common in women with gynecologic cancers. Early identification of patients needing surgical intervention could improve quality of life and reduce health care costs. The objective of this study is to identify risk factors associated with surgical intervention in patients with gynecological malignancies hospitalized for an SBO.

Method: A retrospective analysis was conducted of patients with gynecological malignancies who were hospitalized for an SBO at a single institution between 2006 and 2016. Clinical data were obtained from the day of admission for identification of risk factors; outcome data were also collected. Clinical factors associated with the need for surgical management of SBO were identified using the t test, Mann-Whitney U test, and X² test.

Results: A total of 235 patients were identified. The majority of the cohort included patients with a history of ovarian cancer (61.2%) with serous histology (58.4%) and a median age of 62 years. Most patients had a history of upfront cancer surgery (81.8%), had optimal cytoreductive surgery (57.7%), and received adjuvant chemotherapy (79.7%). At the time of SBO diagnosis, 82% had active cancer, and 63.9% were receiving cancer-directed treatment. The rate of surgical intervention for SBO was 41.3% with most patients undergoing gastrostomy tube placement (52.6%) or bowel resection (28.9%). Median time to the return of bowel function was 3 days (range 1–19 days), and the return to oral intake was 4 days (range 1–25 days). Median duration of hospitalization was 7 days (range 1–41 days). Risk factors associated with surgical intervention for SBO were younger age (P = 0.017), prior suboptimal cytoreductive surgery (P = 0.008), greater number of prior lines of chemotherapy (P = 0.005), active cancer (P = 0.003), platinum resistance (P = 0.009), chronic opioid use (P = 0.047), complete obstruction (P < 0.001), and low albumin level (P = 0.009).

Conclusion: A large number of patients with gynecological malignancies admitted with an SBO require surgical intervention for management of obstruction. The risk factors for surgical intervention identified in this study can aid in appropriate patient counseling and medical optimization in patients with high risk for failure of conservative management.
**635 - Poster Session**

Implementation and safety of intravenous lidocaine as part of enhanced recovery after surgery pathway in patients undergoing elective laparotomy on a gynecologic oncology service

A.L. Alexander, A.M. Saiz, M.F. McGee, A.E. Strohl and S. Ahmad. Northwestern University Feinberg School of Medicine, Chicago, IL, USA

**Objective:** The purpose of this study was to assess the compliance and safety of implementing intravenous (IV) lidocaine infusion as the opioid-sparing component of an Enhanced Recovery After Surgery (ERAS) pathway.

**Method:** An ERAS pathway, including intraoperative and postoperative IV lidocaine, was implemented at a major academic center in October 2017. Surgeons, anesthesia providers, and nursing staff were educated on the protocol and received specific training regarding the safety of IV lidocaine. Prospective data were recorded and collected in the electronic medical record regarding compliance, safety, and patient-reported outcomes. The feasibility and safety of the protocol was then reported for all patients who underwent elective laparotomy on a gynecologic oncology service.

**Results:** Data were collected for 99 patients who underwent elective laparotomy during the study period (October 2017 to August 2019). The ERAS anesthesia bundle, defined as receiving both intraoperative IV ketamine and IV lidocaine, was administered to 74 of the 99 patients (74.7%), and 67 of the 99 (67.7%) patients received a postoperative lidocaine infusion. Patients who received IV lidocaine reported minor side effects during their hospital stay (27.0%), and patients who reported side effects were likely to report more than 1 symptom (14.5%). The most commonly reported side effect was a metallic taste (11.5%) followed by dizziness (10.4%) and perioral tingling (6.3%). One serious event (1.0%) of muscle twitching in the sternocleidomastoid was observed in the setting of a supratherapeutic lidocaine serum value of 5.5 mcg/mL and was self-resolved after cessation of the lidocaine infusion. No seizure-like activity or dysarthria was observed. Serum lidocaine values were verified for patients who reported side effects (maximum patient value range 1–5.8, median 1.6 mcg/mL).

**Conclusion:** Implementation of an ERAS pathway that includes intraoperative and postoperative IV lidocaine is both safe and feasible, although patients may report minor side effects, when prompted, while receiving a postoperative lidocaine infusion. ERAS pathways have typically been implemented in bundles, and protocols are heterogeneous between institutions. Additional research regarding ERAS components, including IV lidocaine, is needed to optimize postoperative patient outcomes.

---

**636 - Poster Session**

Improving the surgical experience in gynecologic oncology patients with use of patient engagement technology: A prospective cohort study


**Objective:** The aim of this study was to evaluate outcomes of patient engagement technology (PET) in gynecologic oncology patients undergoing surgery on an enhanced recovery protocol (ERP).

**Method:** This prospective cohort study included patients undergoing laparotomy on an ERP. All patients were offered enrollment in SeamlessMD, a PET that provides personalized education and remote patient monitoring via smart phone, tablet, or computer. In addition to pre- and postoperative educational content, the PET includes daily health checks that survey patients about common postoperative issues, such as constipation, pain control, and wound care. Based on response, patients receive individualized responses to the health checks, providing home-care instructions for mild problems and prompting calls to the surgical team for more severe symptoms. Patients are also asked to complete surveys to evaluate preparation for surgery, compliance with ERP protocol, and satisfaction. Total duration of enrollment is 30 days postoperatively. Patient uptake, usage, and response to surveys were monitored through the PET platform.

**Results:** A total of 49 patients were offered enrollment from May 2019 to July 2019. Uptake was high with 47 (94.9%) patients enrolled. Mean age was 56 years (range 30–83 years); 55.3% were white, while 42.5% were black. Patients accessed the platform a mean number of 12.2 times (range 1–57). Of the 24 (51.1%) patients who used the platform after hospital discharge, 95.8% completed at least 1 health check during postoperative week 1, 66.7% during week 2, and 58.3% during week 3. Of patients responding to the following survey questions: 22/23 (95.6%) would recommend the PET to another patient; 18/18 (100%) reported the PET made them feel more confident before surgery and in the hospital; and 23/23 (100%) reported feeling more confident after discharge. In addition, 11/21 (52.4%) reported the PET prevented 1 or more calls to the hospital, while 5/21 (23.8%) reported it prevented 1 or more visits to the emergency department.

**Conclusion:** With ongoing enrollment, PET has demonstrated high rates of uptake and satisfaction in gynecologic oncology patients undergoing surgery on an ERP. This platform resulted in high rates of patient engagement and may reduce unnecessary use of health care resources.
**637 - Poster Session**

**Efficacy of preoperative pharmacologic prophylaxis on occurrence of venous thromboembolism following gynecologic oncology surgery: A systematic review and meta-analysis**

C. Incea, M. Nardell and S.P. Bisch. "Tom Baker Cancer Centre, Calgary, AB, Canada, bBrigham and Women’s Hospital, Boston, MA, USA

**Objective:** Venous thromboembolism (VTE) remains a significant complication following gynecologic oncology surgery; however, evidence is lacking on whether it is beneficial to give chemoprophylaxis preoperatively. The aim of this systematic review and meta-analysis was to assess the role of preoperative chemoprophylaxis in preventing postoperative VTE.

**Method:** We designed search strategies for PubMed and EMBASE to find randomized controlled, cohort, and case control trials that compared preoperative VTE chemoprophylaxis to no prophylaxis, mechanical prophylaxis, or only postoperative chemoprophylaxis. Abstracts, full text articles, and methodological quality were independently assessed by 2 authors with discrepancies resolved through consensus or a third author. Data were extracted and pooled using odds ratios (OR) for random effects meta-analysis. Heterogeneity was explored using forest plots as well as Q and I² statistics. Subgroup analysis of use of sequential compression devices (SCDs), equivalent versus nonequivalent postoperative prophylaxis, and methodological quality were performed.

**Results:** We found a total of 503 unique studies on Pubmed and EMBASE. Ultimately, 13 studies were included in the systematic review and 11 in the meta-analysis. We found an OR for incidence of postoperative VTE of 0.49 (95% CI 0.35–0.70), favoring the use of preoperative pharmacological VTE prophylaxis compared to no preoperative pharmacologic prophylaxis (Q = 7.38, I² = 0). In those studies in which postoperative care was equivalent between groups, the OR for VTE was 0.60 (95% CI 0.34–1.06). Preoperative pharmacologic prophylaxis demonstrated benefit when utilized with SCDs (OR = 0.428, 95% CI 0.298–0.645) compared to when no SCDs were utilized (OR = 1.31, 95% CI 0.39–4.34). The benefit of pharmacologic prophylaxis remained only for those studies with high quality (OR = 0.436, 95% CI 0.22–0.88).

**Conclusion:** Preoperative chemoprophylaxis decreases the odds of VTE in the perioperative period for gynecological malignancies by more than half. However, it remains unclear whether the preoperative dose independent of postoperative chemoprophylaxis significantly reduces the risk of VTE. Adequately powered studies controlling for postoperative VTE prophylaxis are needed.

---

**638 - Poster Session**

**Decrease in time to treatment in gynecologic cancers through quality improvement**

M.M. AlHilli, A. Maggiotto, K. Tullio, S. Ricci, H. Mahdi, J. Knight, R. DeBernardo, C.M. Michener and P.G. Rose. "Cleveland Clinic, Cleveland, OH, USA, bThe Cleveland Clinic Foundation, Cleveland, OH, USA

**Objective:** Delays in time to treatment initiation commonly inflict anxiety and distress on patients and their families, and are potentially associated with worsened survival. We report our experience in tracking and decreasing time to treatment initiation at a large comprehensive cancer center.

**Method:** An institution-wide quality improvement process aimed at reducing time to treatment initiation was initiated in January 2015. Time to treatment initiation was measured, monitored, and analyzed each quarter, and data-sharing was implemented to allow for transparent reporting and continuous improvement. Patient flow mapping identified sources of delays in time to treatment initiation across patient access points into the health care system. Patient navigators were hired with the primary role of working to reduce time to treatment initiation. Weekly face-to-face huddles took place, and electronic tools were created to track patients in real time prior to treatment. Time to treatment initiation was defined as the median number of days from initial pathologic diagnosis to patients' first intervention regardless of treatment modality. Patients diagnosed and treated on the same day (time to treatment initiation = 0) were excluded. Outliers were defined as patients experiencing delays >45 days in time to treatment initiation.

**Results:** From January 2015 to December 2018, 981 gynecologic cancers were diagnosed and treated at our institution's main campus including 222 ovarian cancers, 552 uterine cancers, 130 cervical cancers, 56 vulvar cancers, and 21 vaginal cancers. For 810 (83%) patients, surgery was the first treatment. Median time to treatment initiation per year for all gynecologic cancers decreased from 34 (n = 188) days in 2015 to 27 (n = 177) days in 2018. Median time to treatment initiation for internally diagnosed patients decreased from 29 (n = 113) days to 24 (n = 106) days between 2015 and 2018. Time to treatment initiation for externally diagnosed patients decreased from 40 (n = 75) to 30 (n = 71) days from 2015 to 2018. The percentage of internal outliers decreased from 21% to 11%. See Figure 1.

**Conclusion:** Following the initiation of a multidisciplinary data-driven quality improvement program, time to treatment initiation in newly diagnosed gynecologic cancers has been steadily declining.
**Objective:** We sought to characterize the risk factors for 30-day readmission in gynecologic oncology patients who were managed with an enhanced recovery after surgery (ERAS) protocol.

**Method:** We performed a retrospective chart review and identified patients who underwent exploratory laparotomy and were managed with an ERAS protocol. These patients were referred to our gynecologic oncology division because of concern for malignancy and/or surgical complexity. We evaluated their postoperative course and complications historically associated with readmission including pulmonary complications, AKI, sepsis, CVA, MI, PTE/DVT, hyperglycemia, perioperative blood transfusion, postoperative ileus, and surgical site infection. Using the Aletti surgical complexity score (SCS), we characterized their surgical procedures, specifically noting those who underwent bowel surgery or enterotomy repair. Statistical analysis was performed using SPSS Statistics v.24.

**Results:** We identified 562 ERAS patient encounters; 48 patients (9%) were readmitted within 30 days. The most common reasons for readmission were infection (38%) and gastrointestinal complications (33%). Age, BMI, Charlson Comorbidity Index (CCI) scores, surgery times, and SCSs were similar among groups. Among the 514 encounters without readmission, 117 (23%) had experienced 1 or more postoperative complications compared to 25 (52%) of the readmitted patients ($P = 0.001$). Postoperative ileus was more common in the patients who were readmitted (15% vs 7%, $P = 0.05$). Bowel surgery was also more common in patients who were readmitted (33% vs 18%, $P = 0.01$). Blood loss was similar between the groups (405 cc vs 496 cc, $P = 0.18$).

**Conclusion:** Patients who undergo an exploratory laparotomy and experience a postoperative complication are more likely to be readmitted within 30 days. Certain postoperative complications including ileus and bowel surgery are risk factors for readmission. Surgical complexity does not appear to have an impact on readmission rates. Surgeons should identify patients with these risk factors to maximize postoperative optimization and discharge planning in order to decrease hospital readmissions.
**Method:** We performed a retrospective cohort study of women who underwent laparotomy by the division of gynecologic oncology between February 2018 and May 2019. Patients were categorized into 2 groups: those who received a thoracic epidural versus TAP block. Primary outcome was postoperative day 1 pain scores. Secondary outcomes were postoperative day 2 and 3 pain scores, postoperative complications, and length of stay (LOS). Descriptive statistics were utilized. Continuous variables were analyzed using the Wilcoxon rank sum test.

**Results:** We identified 96 women who met inclusion criteria for the study, 49 in the epidural group and 47 in the TAP group; 67% underwent surgery for gynecologic malignancy. Patients in the TAP group had higher rates of chronic kidney disease and history of venous thromboembolism (VTE). There was no difference in age, BMI, other medical comorbid conditions, estimated blood loss, surgical or anesthesia time, malignancy type, surgical complexity or preoperative narcotic use between the 2 groups. Median pain scores were significantly lower in the epidural group on postoperative day 1 (3 vs 5, \( P < 0.01 \)) and postoperative day 2 (2 vs 4, \( P = 0.01 \)). There was no difference by postoperative day 3 (4 vs 3, \( P = 0.77 \)). The TAP group was more likely to have a postoperative lidocaine drip (\( n = 12, 25\% \), vs \( n = 23, 49\% \), \( P = 0.01 \)) There were no differences in intraoperative complications. Median LOS (4, IQR 2–8, vs 3, IQR 2–12, \( P = 0.03 \)) and postoperative complications (\( n = 34, 69\% \), vs \( n = 20, 43\% \), \( P = 0.01 \)) were significantly higher in the epidural group. There were 9 (18\%) anesthesia-associated complications in the epidural group that resolved with a lower dose or discontinuation. These included hypotension, nausea/vomiting, and urinary retention. There were no anesthesia complications related to the TAP block. There was no difference in postoperative ileus, VTE, or surgical site infection between the 2 groups.

**Conclusion:** Our data suggest that epidural anesthesia is more effective in managing immediate postoperative pain but is associated with longer LOS and more postoperative complications.

---

**641 - Poster Session**

**Human papillomavirus vaccination in heterosexual and sexual minority individuals in the United States**

**Objective:** The aim of this study was to determine the trends and prevalence of human papillomavirus (HPV) in both heterosexual and sexual minority populations in the United States.

**Method:** Data were obtained from the NHANES (National Health and Nutritional Examination Survey) from 2007 to 2016. X² and logistic regression analysis were used for statistical methods.

**Results:** Of 4,115 participants, 60.3% were female and 39.7% were male; 92% identified as heterosexual and 8% as sexual minority. The overall vaccination rate was 18.1%, with 17% in the heterosexual group versus 29.8% in sexual minorities. More specifically, heterosexual females initiated vaccination at a rate of 23.5% compared to 34.6% in women who have sex with women (\( P < 0.001 \)). Although men who have sex with men initiated their vaccination at a rate of 15.5% vs 7.7% (\( P < 0.001 \)), their completion rate was lower (17% vs 38%, \( P = 0.14 \)) compared to heterosexual men. Over the 10-year study period (2007–2008, 2009–2010, 2011–2012, 2013–2014, 2015–2016), there was a significant increase in vaccination rates in the overall study group (11%, 15%, 15%, 19%, 23%; \( P = 0.001 \)). There was a gradual increase in the sexual minorities (6%, 14%, 32%, 33%, 39%; \( P = 0.02 \)) but a plateau from 11% to 16% to 14% to 18% to 21% in heterosexuals, particularly in recent years (\( P = 0.01 \)). Factors that independently predicted initiation of vaccination included sexual minority status (OR = 1.72, 95% CI 1.20–2.46, \( P = 0.004 \)), female gender (OR = 3.31, 95% CI 2.38–4.62, \( P < 0.001 \)), older age (OR = 2.84, 95% CI 2.27–3.55, \( P < 0.001 \)), marital status (OR = 1.45, 95% CI 1.18–1.79, \( P = 0.001 \)), and routine access to health care (OR = 1.39, 95% CI 1.09–1.78, \( P = 0.01 \)).

**Conclusion:** Overall, individuals who identify as a sexual minority have higher rates of HPV vaccination than heterosexual individuals. However, vaccination completion rates are lower in the men who have sex with men population.

---

**642 - Poster Session**

**HPV vaccination based on gender, race, and socioeconomic status in United States: Who is getting left behind?**

**Objective:** To identify trends and differences in HPV vaccination rates among heterosexual and sexual minority populations in the United States.

**Method:** hpv vaccination included sexual minority status (OR = 1.72, 95% CI 1.20–2.46, \( P = 0.004 \)), female gender (OR = 3.31, 95% CI 2.38–4.62, \( P < 0.001 \)), older age (OR = 2.84, 95% CI 2.27–3.55, \( P < 0.001 \)), marital status (OR = 1.45, 95% CI 1.18–1.79, \( P = 0.001 \)), and routine access to health care (OR = 1.39, 95% CI 1.09–1.78, \( P = 0.01 \)).

**Results:** Of 4,115 participants, 60.3% were female and 39.7% were male; 92% identified as heterosexual and 8% as sexual minority. The overall vaccination rate was 18.1%, with 17% in the heterosexual group versus 29.8% in sexual minorities. More specifically, heterosexual females initiated vaccination at a rate of 23.5% compared to 34.6% in women who have sex with women (\( P < 0.001 \)). Although men who have sex with men initiated their vaccination at a rate of 15.5% vs 7.7% (\( P < 0.001 \)), their completion rate was lower (17% vs 38%, \( P = 0.14 \)) compared to heterosexual men. Over the 10-year study period (2007–2008, 2009–2010, 2011–2012, 2013–2014, 2015–2016), there was a significant increase in vaccination rates in the overall study group (11%, 15%, 15%, 19%, 23%; \( P = 0.001 \)). There was a gradual increase in the sexual minorities (6%, 14%, 32%, 33%, 39%; \( P = 0.02 \)) but a plateau from 11% to 16% to 14% to 18% to 21% in heterosexuals, particularly in recent years (\( P = 0.01 \)). Factors that independently predicted initiation of vaccination included sexual minority status (OR = 1.72, 95% CI 1.20–2.46, \( P = 0.004 \)), female gender (OR = 3.31, 95% CI 2.38–4.62, \( P < 0.001 \)), older age (OR = 2.84, 95% CI 2.27–3.55, \( P < 0.001 \)), marital status (OR = 1.45, 95% CI 1.18–1.79, \( P = 0.001 \)), and routine access to health care (OR = 1.39, 95% CI 1.09–1.78, \( P = 0.01 \)).

**Conclusion:** Overall, individuals who identify as a sexual minority have higher rates of HPV vaccination than heterosexual individuals. However, vaccination completion rates are lower in the men who have sex with men population.
**Objective**: The aim of this study was to analyze the trends and disparities in HPV vaccination rates in the United States.

**Methods**: Data were obtained from the National Health and Nutrition Examination Survey (NHANES) between 2007 and 2016. $X^2$ analyses were utilized for statistical methods.

**Results**: Of 5,070 participants, the median age was 26 (range 18–36) years. The overall vaccination rate was 17.8%. The rates of HPV vaccination were higher in females (24%) than in males (8.1%, $P < 0.001$). Vaccination rates in whites were 20.1%, blacks 17.8%, and Hispanics 12.6% ($P < 0.001$). Education lower than high school, high school, associates degree/some college, and beyond college had vaccination rates of 15.9%, 19.1%, and 18.8% ($P = 0.10$). Those without insurance, private insurance, and Medicaid had vaccination rates of 10.2%, 20.5%, and 20.3%, respectively ($P < 0.001$). Over the 10-year study period (2007–2008, 2009–2010, 2011–2012, 2013–2014, and 2015–2016), the rates of vaccination increased from 9.6% to 15.9% to 15.1% to 18.3% to 22.3%, respectively ($P < 0.001$). Although there was a 6.3% (9.6% to 15.9%) rise in vaccination rates in the earlier periods 2007–2010, there was only a 4% increase (22.3% to 18.3%) during the more recent years from 2013 to 2016. From 2007 to 2016, the rates of vaccination among females increased 22.7% (9.6% to 32.3%, $P < 0.001$) but among males increased only 5.9% (5.2% to 11.1%, $P = 0.02$).

**Conclusion**: Although there is an increase in HPV vaccination in the United States, overall vaccination rates are still low, particularly in males, Hispanics, and those with lower socioeconomic status.

---

**643 - Poster Session**

**Clinical impact of major discrepancies in pathology reports of gynecologic malignancies**


*Memorial Sloan Kettering Cancer Center, New York, NY, USA, New York University School of Medicine, New York, NY, USA*

**Objective**: The aim of this study was to describe the clinical impact of major diagnostic discrepancies in pathology reports of gynecologic malignancies for patients presenting for second opinion to a comprehensive cancer center.

**Method**: All cases of gynecologic malignancy submitted for second opinion review by gynecologic pathologists between 2010 and 2016 were evaluated. Cases with major discrepancies (deemed to have potential clinical impact) with outside diagnoses were self-identified by the specialized gynecologic pathologists. Cases were grouped according to pathologic disagreement with no impact on care and pathologic disagreement with clinical impact. Clinical impact was based on National Comprehensive Cancer Network (NCCN) guidelines and gynecologic oncologist expert opinion.

**Results**: Of the 8,475 gynecologic cases reviewed, 1,265 (15%) discrepancies with outside hospital diagnoses were identified. Of these, 198 (16%) were deemed to be major discrepancies. There were 77 (39%) endometrial cancers, 42 (21%) ovarian cancers, 32 (16%) sarcomas, 30 (15%) cervical cancers, and 18 (9%) other malignancies. Most cases ($n = 78, 39%$) resulted in change in histology, while 32 (16%) cases noted a different site of origin of disease compared to original diagnosis. Forty-three (22%) cases were downgraded from malignant to benign, and 33 (17%) upgraded from benign to malignant. There were 123 (62%) cases that were deemed to have a pathologic disagreement that had clinical sequelae (change in treatment). Of these, 53 (43%) were surgical (recommend for or against), and 70 (57%) were nonsurgical. Review of uterine sarcoma cases, although considered major discrepancies by expert pathology, had no clinical impact in 60% ($n = 18$) of cases.

**Conclusion**: Pathologic review of outside cases by specialized gynecologic pathologists identified a group of cases across all gynecologic tumor types that led to changes in clinical management. The impact on patient outcomes should be further explored.

---

**644 - Poster Session**

**Gabapentin in multi-modal pain management to decrease postoperative narcotics with minimal use of neuraxial analgesia**


*University of California, Los Angeles, Los Angeles, CA, USA, Olive View-UCLA Medical Center, Los Angeles, CA, USA, David Geffen School of Medicine at UCLA, Los Angeles, CA, USA*

**Objective**: The aim of this study was to evaluate the impact of pre- and postoperative gabapentin on opioid use within a non-narcotic multimodal pain management protocol.

**Methods**: Retrospective analysis of patients admitted following open or minimally invasive (MIS) gynecologic surgery for benign or malignant conditions at a safety net hospital between August 2017 and July 2018. As part of our standardized pain protocol, patients received gabapentin 600 mg POx1 preoperatively and scheduled gabapentin, acetaminophen, and NSAIDs postoperatively. Gabapentin dosing was stratified into <300 mg TID, 300 mg TID, or >300 mg TID. Postoperative morphine equivalence dose (MED) scores (mg/day)
were calculated and normalized to length of stay (LOS). MED scores were stratified into minimal (0–9), occasional (10–20), and frequent use (>20).

**Results:** Of 165 eligible patients, 102 patients had open and 59 had MIS. Median age was 48 (18–69) years and 72% were Latina. Average LOS stay was 2.8 days for open and 1.4 day for MIS. Nineteen patients (13%) used outpatient preoperative gabapentin. Only 21 patients received neuraxial analgesia (13%). Postoperatively, 98% received acetaminophen and 94% NSAIDs. Using this multimodal non-narcotic pain regimen, 59 patients (36%) required zero to minimal, 40 patients (24%) required occasional, and 66 patients (40%) required frequent narcotics postoperatively. A total of 78 patients received gabapentin 300 mg TID and had significantly lower MED/LOS (16, \( P = 0.0084 \)) than the 63 patients who received <300 mg TID or the 24 patients who had >300 mg TID dosing (19 and 26, respectively). Average LOS was shorter for patients who received 300 mg TID gabapentin than for those who got <300 mg TID or >300 mg TID dosing (1.9 vs. 2.7 vs. 2.4, \( P = 0.018 \)). Neuraxial analgesia, number of refills, average postoperative day 1 pain scores, benign versus malignant pathology, and operating room time were all similar between the three groups of gabapentin users.

**Conclusion:** Multimodal non-narcotic perioperative pain management including gabapentin allows for near complete avoidance of postoperative narcotic pain medications in more than half of all gynecologic surgical patients. Scheduled gabapentin 300 mg TID was associated with significantly less opioid use than with lower doses and should be considered as initial dosing in multimodal postoperative pain management.

---

**645 - Poster Session**

**National coverage of biological materials for translational research in the Danish cancerbiobank (RBGB) and of corresponding clinical data in the Danish Gynecological Cancer Database (DGCD)**

E. Høgdall¹, T. Schnack², K.D. Steffensen³, K. Jochumsen⁴, H.S. Kahr⁵, K. Ingerslev⁶, S.L. Antonsen⁷, I.J. Christensen⁸ and C. Hogdall⁹. ¹Herlev University Hospital, Herlev, Denmark, ²Rigshospitalet, Copenhagen, Denmark, ³Lillebaelt University Hospital of Southern Denmark, Vejle, Denmark, ⁴Odense University Hospital, Odense, Denmark, ⁵Aalborg University Hospital, Aalborg, Denmark, ⁶Herlev University Hospital, Copenhagen, Denmark

**Objective:** Optimal personalized medicine may be based on specific predictive/prognostic biomarkers in order to discern between responders and nonresponders. Knowledge of markers is based on biomarker studies analyzing clinical data and their associated biological materials stored in high-quality biobanks. There is no precise knowledge of the extent of nationwide clinical data and corresponding biological specimens available for translational research in gynecologic cancer diseases in Denmark. The aim was to investigate the coverage of biological materials in the Bio- and GenomeBank, Denmark (RBGB), for patients with primary ovarian cancer (tubal, peritoneal, and ovarian) registered in the nationwide compulsory Danish Gynecological Cancer Database (DGCD) for the period 2015–2018.

**Method:** The study is based on data from DGCD and RBGB. Descriptive statistics are used (SAS v9.4).

**Results:** A total of 2,182 women with a primary ovarian cancer diagnosis during the period are registered in DGCD. RBGB contains biological material from 322 (70%, 2018), 399 (70%, 2017), 403 (70%, 2016), and 323 (56%, 2015) of the patients. Blood samples are available for 1,069 patients (49%), and tissue samples are available for 821 patients (38%). Overall, corresponding blood and tissue exist for 443 patients (20%). The coverage ratio on biological material was 66%. Detailed analyses show promising possibilities to combine and correlate DGCD data with more detailed biobank specimens including corresponding data about the material.

**Conclusion:** Biological materials stored in RBGB are clinically useable for both the patient's current and future established treatments. The link between RBGB and DGCD establishes a very promising basis for future translational research in newer individualized treatments. With the strategy for personalized medicine, it is important to continuously ensure optimal biological materials, thereby forming the basis for both the patient's personalized treatment and future research.

---

**646 - Poster Session**

**Readmissions among non-surgical gynecologic oncology patients: An important metric of quality cancer care, or an unavoidable occurrence?**

C.H. Watson¹, R. Gonzalez², K. Kurtovic³, L.J. Havrilkesy⁴ and H.A. Moss⁵. ¹Duke University Medical Center, Durham, NC, USA, ²Duke University, Durham, NC, USA

**Objective:** The aim of this study was to describe the incidence and avoidability of readmissions after nonsurgical index admissions to a gynecologic oncology service, and to identify factors that characterize readmitted compared to nonreadmitted populations.
Method: A retrospective study of nonsurgical hospital admissions to a gynecologic oncology service at a tertiary care center from 2015 to 2017 was performed. Characteristics of initial “index” admissions were obtained from chart review. Readmissions within 30 days were identified and their characteristics collected. Readmissions were then categorized as avoidable, potentially avoidable, or nonavoidable via consensus-driven review performed by 3 gynecologic oncologists. Characteristics of readmitted and nonreadmitted subjects were compared.

Results: A total of 336 nonsurgical index admissions were identified. Of these, 91 (27%) were followed by a 30-day readmission. Median length of stay (LOS) during readmission was 4 days (range 1–34 days). Primary indications for readmission were identical to the primary or secondary diagnoses of the index admission in 62 patients (68%). Forty-seven (52%) readmissions were followed by yet another 30-day readmission. When comparing readmitted to nonreadmitted patients, non-white patients were significantly more likely to be readmitted than white (P < 0.05). There were no significant differences between readmitted and nonreadmitted cohorts regarding LOS, age, insurance status, cancer site, or index hospitalization diagnosis. Forty-four (48%) of readmissions were categorized as nonavoidable, and 47 (52%) were categorized as potentially avoidable or avoidable. Of those identified as avoidable or potentially avoidable, the vast majority were designated as such because either goals-of-care conversations, utilization of outpatient palliative care, or outpatient management resources were deemed potentially inadequate. See Table 1.

Conclusion: The readmission rate among nonsurgical gynecologic oncology inpatients is high, and the majority of patients are readmitted with the same indication. While implementing robust palliative care interventions and appropriately utilizing outpatient resources may contribute to reducing unnecessary readmissions and improve the quality of cancer care, a significant number of readmissions may be unavoidable.

Table 1. Subject demographics and characteristics.

<table>
<thead>
<tr>
<th></th>
<th>Readmitted (N=91)</th>
<th>Not Readmitted (N=245)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td>NS</td>
</tr>
<tr>
<td>Median (range)</td>
<td>61 (26-91)</td>
<td>64 (20-93)</td>
<td></td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Non-white race</td>
<td>51 (54.9%)</td>
<td>105 (42.9%)</td>
<td></td>
</tr>
<tr>
<td>White or Caucasian</td>
<td>40 (44.0%)</td>
<td>140 (57.1%)</td>
<td></td>
</tr>
<tr>
<td><strong>Insurance</strong></td>
<td></td>
<td></td>
<td>NS</td>
</tr>
<tr>
<td>Medicare/Medicaid</td>
<td>50 (54.9%)</td>
<td>147 (49%)</td>
<td></td>
</tr>
<tr>
<td>Private</td>
<td>39 (42.9%)</td>
<td>91 (37.1%)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>2 (2.2%)</td>
<td>7 (2.8%)</td>
<td></td>
</tr>
<tr>
<td><strong>Cancer Site</strong></td>
<td></td>
<td></td>
<td>NS</td>
</tr>
<tr>
<td>Ovarian/peritoneal</td>
<td>44 (48.4%)</td>
<td>107 (43.6%)</td>
<td></td>
</tr>
<tr>
<td>Uterine</td>
<td>22 (24.2%)</td>
<td>73 (29.8%)</td>
<td></td>
</tr>
<tr>
<td>Cervical</td>
<td>12 (4.7%)</td>
<td>36 (14.7%)</td>
<td></td>
</tr>
<tr>
<td>Vulvar/Vaginal</td>
<td>5 (5.5%)</td>
<td>16 (6.5%)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>8 (8.8%)</td>
<td>7 (2.9%)</td>
<td></td>
</tr>
<tr>
<td><strong>Length of Stay</strong></td>
<td></td>
<td></td>
<td>NS</td>
</tr>
<tr>
<td>Median (Range)</td>
<td>3.0 (1.0-66.0)</td>
<td>4.0 (1.0-41.0)</td>
<td></td>
</tr>
<tr>
<td><strong>Index Reason for Admission</strong></td>
<td></td>
<td></td>
<td>NS</td>
</tr>
<tr>
<td>Ascites</td>
<td>2 (2.1%)</td>
<td>11 (4.4%)</td>
<td></td>
</tr>
<tr>
<td>Bleeding</td>
<td>9 (9.8%)</td>
<td>14 (5.7%)</td>
<td></td>
</tr>
<tr>
<td>Dyspnea</td>
<td>12 (13.2%)</td>
<td>30 (12.2%)</td>
<td></td>
</tr>
<tr>
<td>Failure to thrive</td>
<td>9 (9.8%)</td>
<td>16 (6.5%)</td>
<td></td>
</tr>
<tr>
<td>Fever/infection</td>
<td>10 (11.0%)</td>
<td>27 (11.0%)</td>
<td></td>
</tr>
<tr>
<td>GI tract obstruction</td>
<td>14 (15.4%)</td>
<td>26 (10.6%)</td>
<td></td>
</tr>
<tr>
<td>Nausea/vomiting</td>
<td>10 (11.0%)</td>
<td>26 (10.6%)</td>
<td></td>
</tr>
<tr>
<td>Pain</td>
<td>6 (6.6%)</td>
<td>45 (18.4%)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>19 (20.9%)</td>
<td>50 (20.4%)</td>
<td></td>
</tr>
</tbody>
</table>

NS= Not significant

647 - Poster Session
Describing the learning curve for laparoscopic sentinel lymph node mapping for endometrial cancer
M.N. Towner, K.A. Underkofler, P.J. Meacham, C. Angel, B. DuBeshter, S.G. Thomas and R.G. Moore. University of Rochester Medical Center, Rochester, NY, USA
Objective: Sentinel lymph node (SLN) mapping is an acceptable method of lymph node evaluation in clinically early-stage endometrial cancer. A still relatively new technique, sentinel lymph node (SLN) mapping for endometrial cancer, has no defined learning curve. As such, current recommendations to perform the first 20 procedures with concomitant lymphadenectomy and maintain a detection rate >90% are based on breast cancer data. We sought to determine how many cases of SLN mapping for endometrial cancer are needed before the success rate reaches the literature-comparable value of 86%, as well as the gold standard rate of >90%, among a cohort of surgeons adopting the technique.

Method: A retrospective chart review was performed of endometrial cancer patients at 2 academic institutions who underwent SLN mapping by 7 gynecologic oncology surgeons. Data from the first 3 years after implementation were analyzed. Institutional Review Board approval was obtained. Statistical analyses were performed using Χ², Fisher exact, or Kruskall-Wallis tests as appropriate. Learning curves for each surgeon were generated by plotting the cumulative success rate over time.

Results: A total of 573 charts were reviewed. Overall, the detection rate for SLN was 92.7% (25% unilateral and 75% bilateral). Increasing patient age was weakly associated with a decreased success rate ($P = 0.04$), as was higher BMI ($P = 0.03$). Other factors, such as race, histologic subtype, depth of invasion, grade, and stage were not associated with success rate. The institution at which the surgery was performed had the strongest effect, with 1 institution accounting for 76% of unsuccessful cases ($P = 0.004$). Individual surgeon success rates ranged from 82% to 100%. The median number of cases required to reach the literature-comparable detection rate was 4.5 (range 1–8), and to reach the gold standard rate, the median was 5.5 (range 1–10). With 4 of the 7 surgeons, the most dramatic increase in success rate was seen between the first 10 and subsequent attempts. As shown in Figure 1, a plateau in success rate improvement is seen around the 30th case.

Conclusion: The learning curve for SLN biopsy defined in breast cancer literature may not apply to the surgical treatment of endometrial cancer. Fewer cases may be needed in order to achieve acceptable competence, although additional practice does improve success rates.

Fig. 1. Learning curves for seven surgeons adopting the sentinel lymph node technique.
**Objective:** Preoperative identification of patients who are at risk for increased postoperative opioid requirements may allow for implementation of nonopioid pain management strategies for this high-risk cohort. The objective of our study was to understand how patient perceptions of pain preoperatively affect pain medication requirements prior to hospital discharge.

**Method:** A prospective cohort study of women undergoing surgery within a gynecologic oncology division was conducted from February 1, 2018, to March 1, 2019. Eligible subjects included English-speaking women ≥18 years undergoing minimally invasive (MIS) or open abdominal surgery. Subjects were excluded if primary vulvar or vaginal surgery was performed. Baseline patient characteristics were collected. Subjects completed the Pain Catastrophizing Scale (PCS) and were asked to rate their anxiety regarding surgery, anticipated postoperative pain, and anticipated postoperative pain medication use. Inpatient opioid use was abstracted in oral morphine equivalents (OME).

**Results:** Two hundred and seventy-four subjects enrolled, with 211 completed datasets. Median length of stay was 1.0 days (range 0–17 days). Mid-thoracic epidurals and transversus abdominis blocks were used in 6.2% and 10.5% of patients, respectively. Patients' preoperative expectation of postoperative pain medication requirement was positively associated with inpatient opioid requirement (below average, 19.9 OME; average, 42.2 OME; above average, 54.9 OME; $P = 0.01$). In the MIS cohort, total PCS score, rumination subgroup, and helplessness subgroup were each associated with inpatient opioid use ($P = 0.01$, $P = 0.001$, and $P = 0.03$, respectively). Neither PCS total nor subgroups were associated with inpatient opioid use in the planned open cohort. Preoperative anxiety and anticipated pain levels were not associated with inpatient opioid use in either cohort.

**Conclusion:** Patients' preoperative perceptions may be a helpful tool for identifying patients who are at risk for increased opioid requirements during their hospital stay. Early identification of these individuals may facilitate initiation of non-narcotic modalities of pain management and warrants further investigation.

---

**649 - Poster Session**

**Video-based counseling and point-of-contact testing improves genetic screening completion in an ovarian cancer patient population**

S. Lynam, J. Dowling, M. Hutton, H. Wypij, K. Odunsi, S.B. Lele, E. Zsiros, S.N. Akers and P.J. Frederick. Roswell Park Comprehensive Cancer Center, Buffalo, NY, USA

**Objective:** Effective strategies for genetic screening are critical to improved survival in women diagnosed with epithelial ovarian cancer (EOC). In an effort to optimize genetic counseling practices, provider-based point of contact (POC) genetic screening was implemented for individuals with nonmucinous EOC at our institution. Our objective was to compare completion of referral-based screening to POC screening and determine the effect on completion of genetic screening.

**Method:** A retrospective analysis was conducted at a National Comprehensive Cancer Network (NCCN)-designated center between December 2017 and August 2019 among new patients presenting with EOC. Women were referred for genetic counseling via institution-based certified genetic counselors in accordance with NCCN guidelines until December 2018, and thereafter underwent provider-directed POC testing. Individuals undergoing POC screening were directed to watch a brief video discussing the impact of genetic screening in ovarian cancer prior to informed consent with a medical provider. Women with a positive screen or variant of uncertain significance were referred for consultation with a certified genetic counselor. Demographics, testing and counseling status, and treatment data were abstracted via electronic medical record.

**Results:** A total of 181 patients with newly diagnosed or recurrent epithelial ovarian, fallopian, or primary peritoneal cancer were referred for treatment at our institution. Patients with previous germline testing or inadequate follow-up data were excluded from analysis. Prior to implementation of POC testing, 39 of 100 (39%) patients underwent genetic counseling and testing, compared to 39 of 58 (67.2%) women postimplementation ($P < 0.0001$). A majority of patients were Caucasian (91.1%) with advanced-stage disease (77.2%) and high-grade histology (75.3%). Screening status was not affected by age (screened, 63.0 ± 11.2, vs unscreened, 62.2 ± 14.8, $P$ NSS) or insurance status in this population.

**Conclusion:** POC genetic screening for patients with EOC utilizing instructional video content in conjunction with informed consent by gynecologic oncologists is feasible and dramatically improved screening rates at our institution. Future studies should continue to investigate techniques to streamline utilization of certified genetic counselors and optimize patient screening.

---

**650 - Poster Session**

**Impact of parenthood on burnout in members of the Society of Gynecologic Oncology**

M.H. Vetter, M.K. Vetter and J.M. Fowler. aThe Ohio State University, James Cancer Hospital, Columbus, OH, USA, bDenison University, Granville, OH, USA, cThe Ohio State University, Columbus, OH, USA
**Objective:** There are few data on the impact of parenting on burnout in physicians, although several studies demonstrate increased rates of work-family conflict and work-life imbalance among female physicians, presumably because of increased household and child-rearing responsibilities. In this study, we sought to explore the impact of parenthood on burnout and determine whether gender plays a role in differences among parents.

**Method:** This was a cross-sectional study of all SGO members as of March 2017 using an 82-question instrument that included an abbreviated Maslach Burnout inventory, DAST-10, PHQ-6, and CAGE inventory. Burnout was defined as high emotional exhaustion or depersonalization scores. Data were analyzed using Χ² test, independent t test, and Mann-Whitney U test.

**Results:** A total of 373 members responded (response rate of 21.4%). Most respondents were female (58.6%), married (83.0%), parents (66.6%), and age 35–44 years (36.3%). Overall, there was no difference in burnout between parent and nonparent respondents (22.6% vs 23.5%, P = 0.277), although nonparents had significantly higher emotional exhaustion scores than parents (9.8 vs 8.1, P = 0.021). There was also a trend toward higher depersonalization among nonparents (4.9 vs 4.1, P = 0.054). Nonparents had higher rates of positive substance and alcohol abuse (21.1% vs 7.2%, P < 0.001) and depression (10.2% vs 3.2%, P = 0.010) screens than parents. Female parents were more likely to have an employed spouse compared to male parents (76.8% vs 49.6%, P < 0.001). There was no difference in rate of burnout between male and female patients (21.4% vs 24.2%, P = 0.749). However, when stratified by age group, female parents age 35–44 years had a higher rate of burnout than their male colleagues (27.6% vs 0%, P = 0.034). There was no difference in job satisfaction, intent to leave medicine, or regret between male and female parents even when stratified by age. Family size did not have an impact on rates of burnout among parents.

**Conclusion:** While there were no differences in burnout based on parental status, nonparents had significantly higher rates of positive substance abuse and depression screening, suggesting a protective effect of parenting. However, we did identify a higher rate of burnout in female parents compared to male parents in the 35–44 year age group. Early-career female gynecologic oncologists, especially those who are parents, may benefit from additional outreach and intervention.

---

**Objective:** The aim of this study was to compare postoperative mortality and cost of ovarian cancer surgery between high-volume hospitals and low-volume hospitals.

**Method:** We queried Vizient®, an administrative claims database for >400 hospitals in the United States, for all patients with ovarian cancer who had surgery from January 2016 to March 2019. We stratified hospitals by average annual case volume (high volume ≥ 20 vs low-volume < 20 cases). Risk-adjusted indices of mortality and direct cost were compared by case volume cohorts.

**Results:** A total of 19,394 ovarian cancer operations were performed at 321 hospitals, with 15,553 (80%) cases performed at 101 (32%) high-volume hospitals. The mortality index at low-volume hospitals was 0.96 and at high-volume hospitals, 0.87. The direct cost index was 1.08 versus 1.12 at low-volume hospitals and high-volume hospitals, respectively. Stratifying by age, among patients <65 years, the mortality index was 0.85 at low-volume hospitals and 0.64 at high-volume hospitals, while among patients ≥65 years, 1.07 at low-volume hospitals and 1.10 at high-volume hospitals. Stratifying by race, in white patients, the mortality index was 0.93 at low-volume hospitals and 0.91 at high-volume hospitals, and in black patients, 1.54 (54% higher than expected) at low-volume hospitals and 0.44 (56% lower than expected) at high-volume hospitals. Stratifying by insurance, in the privately insured, the mortality index was 0.74 at low-volume hospitals and 0.54 at high-volume hospitals, and in those without private insurance, 1.08 at low-volume hospitals and 1.05 at high-volume hospitals. Surgery at low-volume hospitals was significantly more frequent among patients who were black (RR = 1.7, 95% CI 1.5–1.8), publicly insured (RR = 1.17, 95% CI 1.10–1.24), and younger (RR = 1.12, 95% CI 1.06–1.20).

**Conclusion:** Black, younger, and publicly insured patients disproportionately have surgery at low-volume hospitals. Several studies have shown that ovarian cancer operations performed at low-volume hospitals are associated with guideline nonadherence and decreased overall survival; however, less is known about perioperative outcomes. We found that risk-adjusted mortality in the immediate postoperative period is nearly twice as high at low-volume hospitals. Among black patients, the mortality risk more than triples when ovarian cancer surgery is done at low-volume hospitals. Our findings support concentrating ovarian cancer surgery at high-volume Centers of Excellence and suggest that black, older, and privately insured patients may benefit most.
Objective: The aim of this study was to characterize authorship roles among gynecologic oncology fellowship program directors in the United States. Program directors provide mentorship in clinical skills, intellectual development, research guidance, and overall trainee goals. In medical literature, first author often performs the primary assay, data collection, analyses, and initial writing—critical skills to develop early. Senior author tends to be associated with guidance, conceptualization, and editing. We focused on the time course of transition from first author to senior author to develop a profile as gynecologic oncology mentors develop.

Method: The study population comprises all ACGME-accredited gynecologic oncologist fellowship program directors as of July 1, 2019. A Pubmed search identified publications. Number of publications and order of authorship were counted by year. Year of ABOG gynecologic oncology certification was regarded as to. We selected 3 transitions to characterize assumption of the research mentor role: (1) initial year a senior author paper was published, (2) initial year in which senior author papers exceeded first author papers, and (3) initial year that the career total number of senior author papers equaled the career total number of first author papers. We used the Kaplan-Meier method for time to event calculations, since all data are right censored. Potentially influential institutional and demographic cofactors were evaluated.

Results: The study population comprised 58 gynecologic oncologist program directors. Median number of papers published per year is 3.2. Of these, 0.4 (13%) were first author, and 0.7 (22%) were senior author. Fifty-four (93%) of the program directors have a written a first author paper, and 54 (93%) have written a senior author paper. To date, 41 (71%) program directors have written at least as many senior as first author papers. Fifty (86%) program directors published before certification. Prior to certification, 49 (84%) program directors published a first author paper, and 15 (26%) published a senior author paper. Median time to publication of the initial senior author paper is 3 years; median time to number of senior author papers exceeding first author papers is 4 years; and the median time to the cumulative (career total) number of senior author papers exceeding the cumulative number of first author papers is 10 years. Kaplan-Meier analyses did not find association of times to transition with cofactors.

Conclusion: The majority of gynecologic oncologist program directors are academically productive and have transitioned to the research mentor role, as judged by several parameters. We hope our findings can provide general milestones to help with career management for current mentors and aspiring mentors.

Reduced opioid prescribing protocol for postoperative pain management of gynecologic oncology surgery patients

Objective: Gynecologic oncology patients have higher rates of opioid use than other oncology patients. Our goal was to standardize and reduce the total amount of opioids prescribed at postoperative discharge for opioid-naive gynecologic oncology patients at the University of Minnesota.

Method: Progressively restrictive discharge opioid-prescribing protocols were implemented as part of an institutional quality improvement initiative for all opioid-naive gynecologic oncology surgical patients (n = 121) undergoing laparotomy or minimally invasive (MIS) surgery. Baseline data for each group were established including morphine milligram equivalents (MMEs), refill requests, and satisfaction. Outcomes measures included patient-reported pain control and opioid refill requests within 2 weeks of postoperative discharge. Protocol 1 prescribed 135 MMEs and 90 MMEs for laparotomy and MIS, respectively. Protocol 2 prescribed 120 MMEs and 75 MMEs for laparotomy and MIS, respectively. Each new protocol was implemented when no change in patient satisfaction and refill requests was observed.

Results: For laparotomy, the mean MME was reduced from 167.4 (SD 37.8) to 120.7 (SD 30.4) (P < 0.001, P = 0.513) for protocol 1, and 118 (SD 12.5) (P < 0.001, P = 0.070) for protocol 2. Neither refill requests (baseline 8.3% vs 3.7%, P = 0.435) and 8.6% (P = 0.961) with protocols 1 and 2, respectively) nor rate of postoperative discharge pain-related phone calls (baseline 11.1% vs 7.1%, P = 0.589, and 0%, P = 0.098, for protocols 1 and 2, respectively) changed significantly from baseline. For MIS, the mean MME was reduced from 102.2 (SD 37.8) to 89.1 (SD 4.2) (P = 0.057, P < 0.001) with protocol 1 and 77.8 (SD 15.2) (P < 0.001, P = 0.002) for protocol 2. Neither refill requests (baseline 2.9% vs 3.7%, P = 0.856, and 2.4%, P = 0.912, with protocols 1 and 2, respectively) nor rate of postoperative discharge pain-related phone calls (baseline 5.6% vs 7.4%, P = 0.765, and 4.6%, P = 0.855, with protocols 1 and 2, respectively) changed significantly from baseline.

Conclusion: Use of a restrictive prescribing protocol did not have a negative impact on postoperative pain management or increase refill requests, and the majority of patients used fewer opioids than prescribed. Current practices may overprescribe opioids, and protocols even more restrictive than this study may effectively control postoperative pain while decreasing dependency, tolerance, improper opioid discarding, opioid distribution, and overdose.
Physician strategies to prevent oncology treatment interruption during and after hurricanes Irma and Maria in Puerto Rico
S. Umpierre-Catinchi\textsuperscript{a}, S. Garcia-Camacho\textsuperscript{b}, M. Rivera\textsuperscript{c}, W.A. Calo\textsuperscript{d}, P. Mendez-Lazarro\textsuperscript{e}, G. Tortolero-Luna\textsuperscript{b}, Y. Bernhardt\textsuperscript{b}, A. Diaz-Quiones\textsuperscript{b}, V. Gomez-Vargas\textsuperscript{b}, I. DaLuz-Santana\textsuperscript{a} and A.P. Ortiz\textsuperscript{b,c}. \textsuperscript{a}School of Medicine, University of Puerto Rico Medical Sciences Campus, San Juan, Puerto Rico, \textsuperscript{b}University of Puerto Rico Comprehensive Cancer Center, San Juan, Puerto Rico, \textsuperscript{c}Graduate School of Public Health, University of Puerto Rico Medical Sciences Campus, San Juan, Puerto Rico, \textsuperscript{d}Pennsylvania State University Hershey College of Medicine, San Juan, PA, USA

**Objective:** Interruption of cancer treatment has been shown to worsen patient survival. Uninterrupted quality treatment must be a medical priority after a natural disaster. Hurricanes Irma and Maria hit Puerto Rico in September 2017, causing disruption in essential services including medical care. Using a qualitative assessment, this study describes the stressors experienced and the strategies employed to deliver gynecologic oncology treatment in Puerto Rico after Hurricanes Irma and Maria.

**Method:** We conducted 13 key informant interviews among physicians, including gynecologic oncologists, hematologist oncologists, and radiation oncologists. The interviews addressed problems encountered in their clinics in the aftermath of the hurricanes, perceived stressors and risks of patients, response strategies, and recommendations for future preparedness efforts.

**Results:** All the physicians interviewed experienced disruptions in essential services: potable water, electric power, and communications. Physicians prepared based on previous experiences: physical protection of clinic structures and patient rescheduling of surgeries and clinical visits. Immediately after the hurricanes, physicians created protocols with available clinic personnel for reestablishment of patient services. AM radio stations remaining in operation were the main communication outlet to inform patients of service resumption. A collaborative network of physicians for sharing medical supplies and patient treatment coverage was successfully established. The greatest obstacle to providing oncologic treatment was the lack of communication between agencies, providers, patients, and the general population.

**Conclusion:** Despite the collapse of essential services, oncologic physicians collaborated to minimize the effect of treatment interruption on patient outcomes. These results established the topics to be assessed in the subsequent quantitative phase of this NCI-sponsored project, and the development of a disaster management plan for cancer patients in Puerto Rico.

---

Improving discharge practices for gynecologic oncology surgical patients with acute or chronic renal disease
O. Fukui\textsuperscript{a}, A.W. Gannon\textsuperscript{b} and D.I. Shalowitz\textsuperscript{a}. \textsuperscript{a}Wake Forest School of Medicine, Winston-Salem, NC, USA, \textsuperscript{b}Baylor College of Medicine, Houston, TX, USA

**Objective:** Acute kidney injury (AKI) occurs in up to 18\% of patients undergoing gynecologic cancer surgery. These patients, as well as those with chronic kidney disease (CKD), are at high risk for worsening renal function if discharged with nephrotoxic medications. We assessed standard discharge practices for patients with AKI/CKD and created and tested an intervention to decrease the incidence of patients discharged with high-risk medications.

**Method:** The records of patients undergoing open gynecologic cancer surgery at a large tertiary health system from January to September 2018 were reviewed. Age, BMI, prior CKD diagnosis, serum creatinine, clinical course of AKI, and potentially nephrotoxic medications (e.g., NSAIDs) prescribed on discharge were documented. Clinicians were surveyed to determine baseline discharge practices for patients with AKI or CKD. Subsequently, a quality improvement intervention was implemented, consisting of standardized discharge instructions and education material for patients, as well as checklists (Figure 1) and poster reminders for clinicians. Patient charts were again reviewed from December 2018 to April 2019 to determine post-intervention practices.

**Results:** Pre-intervention, 21/157 (13\%) patients had AKI/CKD, and 9/21 (43\%) were discharged with high-risk medications. Post-intervention, 12/80 (15\%) patients had AKI/CKD and 6/12 (50\%) were discharged with high-risk medications. Post-intervention, the protocol was followed for 4/12 patients (33\%). Of patients for whom the protocol was followed, only 1 received a high-risk medication (25\%); however, clinical justification for this decision was documented.

**Conclusion:** A standardized education and counseling intervention may decrease the proportion of patients with AKI/CKD discharged with potentially nephrotoxic medications after surgery. Unfortunately, it may be challenging to ensure use of the intervention. Future studies should focus on the dissemination and implementation of similar interventions and assessment of their impact on clinical outcomes.

**Figure 1.** Discharge checklist for residents.
The patient has been educated on AKI and has been provided this handout.

Discharge med rec has been modified to reflect stopping any nephrotoxic medication.

- Common medications that may worsen kidney injury include: Ibuprofen, Naproxen, PPIs, metformin, furosemide, Lithium, Cisplatin, aminoglycosides, B-lactam antibiotics.

- All doses of medications being prescribed or resumed on discharge have been dose-adjusted for renal function, if appropriate.
  - E.g. gabapentin needs to be dose-reduced for GFR <30mL/min/1.73m².

- If you decide to continue a medication that may be nephrotoxic, you MUST include a rationale for doing so in the discharge summary.

- Order a BMP for approximately 1 week postop to follow up on serum creatinine.

- Call patient approximately 1 week postop to ask if they remember being told about their diagnosis/if they have avoided medications as a result of the diagnosis.

---

656 - Poster Session

Evaluation of a systematic gynecologic oncology fellowship education curriculum

T. Zigras, S. Nagarajah, S. Laframboise, J. Alfieri and T. May. - University of Western Ontario, London, ON, Canada, University of Toronto - Faculty of Medicine, Toronto, ON, Canada, Princess Margaret Cancer Centre, University of Toronto, Toronto, ON, Canada, McGill University Health Centre, Montreal, QC, Canada

Objective: The objective of this study was to understand the effectiveness of a structured, systematic gynecologic oncology fellowship curriculum from the learners’ perspective.

Method: A module-based educational curriculum was implemented at the University of Toronto gynecologic oncology fellowship program from September 2016 to June 2018. Fellows participated in weekly sessions delivered by subject experts and participated in 3 hands-on surgical laboratories on an annual basis, including cytoreductive cadaver laboratory, laparoscopic skills laboratory, and robotic skills laboratory. Using a mixed-methods approach, we conducted an assessment of the learners’ experience. Fellows completed online evaluations at the conclusion of each weekly session. Responses from each teaching session were pooled (mean response with 95% CI are presented). In addition, semistructured qualitative interviews were performed with gynecologic oncology fellows who completed at least 1 year of the program. Interviews were recorded and transcribed to written text. Transcriptions were analyzed and coded using a thematic analysis approach.

Results: Eight gynecologic oncology fellows completed survey monkey questionnaires over the study period. Goals and objectives were met in 95% of the sessions (95% CI 92.1%–98%), and respondents would recommend the sessions again 98.3% of the time (95% CI 96.7%–99.9%). Four fellows participated in semistructured qualitative interviews. Three major themes emerged: (1) hands-on technical laboratory sessions are important because they provide invaluable experience to the learner to improve on skills in a stress-free environment; (2) delivery of teaching sessions from subject experts augments the learning experience; and (3) learners gain considerably from teaching sessions that provide concepts and real-life examples that can be translated into day-to-day clinical practice (case-based learning).

Conclusion: A structured education program that includes skills workshops and is delivered by knowledgeable experts is effective and an essential component of a successful gynecologic oncology fellowship program.

---

657 - Poster Session

Evaluating risk factors for surgical site infection following minimally invasive surgery for endometrial cancer

A. Kohut, T. Kuhn, M. Booher, A.D. Naumova, G.K. Southern, L. Flowers, L.B. Conrad, A.N. Gordon, L. Rodriguez and N. Khanna. - Emory University School of Medicine, Atlanta, GA, USA, City of Hope, Duarte, CA, USA

Objective: The aim of this study was to evaluate risk factors for surgical site infection (SSI) following minimally invasive surgery (MIS) for endometrial cancer.

Method: This was a retrospective, case-control study using the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP). Multivariate logistic regression was used to assess perioperative variables associated with SSI after MIS for endometrial cancer.

Results: The study population included 9,018 patients who met the criteria of having undergone MIS with a resultant endometrial malignancy confirmed on postoperative pathology. SSI was the most common reason for postoperative readmission. Within 30 days of surgery, there were 87 superficial SSIs, 15 deep incisional SSIs, and 125 organ space SSIs. A total of 67 patients were readmitted within 30 days of surgery due to SSI. Notable risk factors for SSI included uterus size greater than 250 grams (OR = 1.72, 96% CI 1.14–2.60, P = 0.010), laparoscopic radical hysterectomy (OR = 1.74, 95% CI 1.25–2.43, P = 0.001), class II obesity (OR = 1.95, 95% CI 1.08–3.52, P =
Conclusion: Identification of risk factors for adverse postoperative outcomes is necessary to inform and improve standards of care in MIS for endometrial cancer. Using nationally reported data from the ACS NSQIP, this study identifies independent risk factors for surgical site infection and, in doing so, highlights potential avenues for quality improvement.

658 - Poster Session
Citation classics in gynecologic oncology: A bibliometric analysis
A. Kohut, M. Booher, A.D. Naumova, T. Kuhn, G.K. Southern, L. Flowers, L.B. Conrad, A.N. Gordon and N. Khanna. Emory University School of Medicine, Atlanta, GA, USA

Objective: The aim of this study was to evaluate the bibliometric characteristics of the most highly cited publications in the field of gynecologic oncology.

Method: We performed a bibliometric analysis of citation classics in the field of gynecologic oncology using the Science Citation Index Expanded (SCIE) accessed through the Web of Science Database. The top 50 cited papers in the field were included. Analyses were performed to compare article characteristics before and after 2003 (the median year of publication among all citation classics contained in the study) using the Mann Whitney (Wilcoxon) test for unpaired data.

Results: A total of 9,207 articles associated with the field of gynecologic oncology were contained within the Web of Science between 1900 and 2019. The median year of publication of citation classics was 2003 (IQR 2000–2008). Most citation classics were from institutions in the United States (41/50) and randomized controlled trials (27/50). Common journals in which citation classics were published included *Journal of Clinical Oncology* (21/50), *New England Journal of Medicine* (7/50), *Lancet* (5/50), and *Gynecologic Oncology* (4/50). Median number of citations among analyzed articles was 609 (IQR 429–977). Median number of citations per citation classic before and after 2003 was 623 (IQR 449–1,055) and 597 (IQR 410–876), respectively (P = 0.562). Average number of citations per year before 2003 was 42 (IQR 24–56) and after 2003, 79 (IQR 41–88), respectively (P = 0.004).

Conclusion: To date, there has not been a bibliometric analysis of citation classics in the field of gynecologic oncology. Here we aim to identify and characterize citation classics in gynecologic oncology and assess citation trends over time. Most citation classics were found to be U.S. based and randomized controlled trials. There was a statistically significant trend toward increased average citations per year after 2003. We hope this study provides insight into the highest impact papers, as well as their contributions to the field of gynecologic oncology.

659 - Poster Session
Factors associated with successful same-day discharge in patients undergoing minimally invasive hysterectomy for endometrial cancer and atypical complex hyperplasia
J. Son, T. Tran, M. Yao and C.M. Michener. *aThe Cleveland Clinic Foundation, Cleveland, OH, USA, bCase Western Reserve University School of Medicine, Cleveland, OH, USA, cCleveland Clinic, Cleveland, OH, USA*

Objective: The aim of this study was to identify factors that lead to successful same-day discharge (SDD) compared to unplanned and planned admission after minimally invasive hysterectomy

Method: Patients undergoing laparoscopic or robotic hysterectomy with or without salpingo-oophorectomy and lymph node assessment for endometrial cancer and atypical hyperplasia since 2016–2019 were chosen. From these, patients operated on by 3 surgeons who routinely practice SDD were included. Three groups were created: same-day discharge (SDD), unplanned admission, and planned admission. Demographic and perioperative factors as well as unscheduled encounters after discharge were compared. A stepwise exploratory multivariate analysis was performed.

Results: A total of 262 patients were included. Of the 86 intended SDDs, 66 underwent SDD; 20 underwent unplanned admission; and 176 underwent planned admission. By year, the overall rate of SDD increased from 1.9% to 43.7%, and successful planned SDDs increased from 59.1% to 82.5%. Patients who underwent SDD compared to unplanned or planned admission were younger (62.2 vs 66.2 years, P = 0.003) and had a lower Charlson Comorbidity Index (CCI) (4 vs 5, P < 0.001). BMI was not significant. Comparing SDD and unplanned admission, shorter operative time (100.3 vs 130.6 minutes, P = 0.037) and laparoscopic approach (83.1% vs 46.7% robotic, P = 0.005) were associated with SDD. Postoperative pain scores were not significant (3.8 vs 4.7, P = 0.086), although this was the most common reason for unplanned admission. Intraoperative acetaminophen and ketorolac use was higher in the SDD group compared to the unplanned or planned admission groups (54.5% vs 34.2%, P = 0.03; 75.8% vs 51.5%, P = 0.001, respectively). The rate of readmission, emergency room visits, and phone encounters within 30 days of discharge were not significant. Using multivariate analysis...
and adjusting for operative time, perioperative acetaminophen and ketorolac, the odds of SDD decreased by 4% with each 1 year increase in age (OR = 0.96, \( P = 0.017 \)). Similarly, each 1-minute increase in operative time decreased the odds of SDD by 2% (OR = 0.98, \( P < 0.001 \)). Intraoperative acetaminophen (OR = 2.78, \( P = 0.003 \)) and ketorolac (OR = 2.27, \( P = 0.031 \)) remained predictive of SDD.

Conclusion: SDD can be safely incorporated into clinical practice in gynecologic oncology patients undergoing minimally invasive hysterectomy. Conventional laparoscopy, younger age, and shorter operative time were associated with greater rate of SDD. Pain control is a common cause for unplanned admission. However, use of intraoperative acetaminophen and ketorolac can have a 2.3- to 2.8-fold increase in successful SDD.

660 - Poster Session
Trends in the publication rates of abstracts presented at the SGO Annual Meeting: A five-year review

Objective: The aim of this study was to assess trends in abstract publication rates for research projects presented as featured posters or plenary sessions at the annual meeting of the Society of Gynecologic Oncology (SGO).

Method: SGO abstract information for featured posters and scientific plenary sessions from 2015 to 2019 was obtained through the SGO website. A literature search via PubMed was performed using abstract titles, authors, and keywords to find published articles corresponding to the abstract. Publication rates for each type of presentation were calculated. Broad categorization of topics was identified based on information presented and published.

Results: From 2015 to 2019, there was a total of 575 abstracts for plenary sessions and featured posters. Among these, there was an overall publishing rate of 26.6%. Plenary sessions consisted of 40.3% of abstracts and had a publishing rate of 32.8%. Featured posters consisted of 59.7% of abstracts and had a publishing rate of 22.4%. Research on the use of PARP inhibitors and related outcomes was published the most (29% of published articles); this was followed by research on surgery-related outcomes (17%).

Conclusion: Featured posters and plenary sessions highlight the highest quality of research presented at the annual SGO meeting. This recent sampling of publications from data presented at this meeting reflects trends in topics of interest that have pervaded the field of gynecologic oncology. Taking periodical stock in publication trends from data presented at SGO is an effective strategy to reflect on pertinent topics in the field and to focus efforts to improve dissemination of data presented at the annual meeting to the larger gynecologic oncology community.

661 - Poster Session
A systematic outpatient quality improvement intervention results in earlier goals of care conversations between high-risk gynecologic cancer patients and their providers
A.M. Puechla, S. Limb, L.A. Gatta, A. Lorenzo, A.N. Galanos, T. Truong, A. Berchuck, A.A. Secord, R.A. Previs, P.S. Lee, L.J. Havrilesky and B.A. Davidson. Duke University Medical Center, Durham, NC, USA, Duke University Health System, Durham, NC, USA, Duke University Medical School, Durham, NC, USA

Objective: Earlier and outpatient goals of care discussions reduce aggressive medical interventions and improve end-of-life care. We designed a quality improvement intervention to determine whether the prospective identification of gynecologic cancer patients at high risk of death could improve the systematic and timely delivery of goals of care conversations.

Method: From August 2017 to April 2018, gynecologic oncology outpatients at high risk for death within 6 months (defined by a diagnosis of platinum-resistant ovarian cancer, recurrent endometrial cancer, or metastatic/recurrent cervical or vulvar cancer) were included. Eligible high-risk patients were identified and the care team was alerted, with the expectation of a documented goals of care discussion within 3 outpatient visits after identification. The goals of care conversation was documented in the electronic medical record using a standardized template that emphasized understanding of curability and prognosis, discontinuing treatment parameters, code status, and hospice services. Pre- (January–December 2016) and post-implementation data were collected through chart review with a minimum of 30 days follow-up after inclusion into the high-risk cohort.

Results: A total of 102 pre-implementation and 157 post-implementation outpatients met criteria for high risk of death within the next 6 months; there were no significant differences in mean age or primary cancer diagnosis between cohorts. Forty-four percent and 44% had recurrent endometrial and platinum-resistant ovarian cancer, respectively. The percentage of high-risk gynecologic cancer patients who received outpatient goals of care conversations within 3 visits of meeting high-risk criteria increased from 28% in the pre-implementation period to 79.6% post-implementation (\( P < 0.0001 \)). After patients met high-risk criteria, the percentage of all outpatient visits in which goals of care were discussed increased from 10% pre-implementation to 30% post-implementation (\( P < 0.0001 \)).
patients who expired prior to data collection, the median number of days from the first goals of care conversation until death was 69 days in the pre-implementation cohort compared to 97 post-implementation.

**Conclusion:** A quality improvement intervention for the systematic implementation of earlier goals of care conversations is feasible with a high rate of provider compliance. Further evaluation will assess associations between earlier goals of care discussions and quality indicators to assess whether futile end-of-life care can be reduced.

---

**662 - Poster Session**

**Comparison of intraoperative frozen section with permanent pathology in endometrial cancer**

L.M. Patel, S. Syal, C. Herreros and E. Girda. Robert Wood Johnson Medical School, New Brunswick, NJ, USA

**Objective:** Staging for endometrial cancer is surgical and includes hysterectomy, bilateral salpingo-oophorectomy, peritoneal washings, and lymphadenectomy. Surgical management relies on intraoperative assessment made by frozen sections for risk of lymphatic spread of disease to determine whether staging with complete lymph node dissection is necessary. The Mayo criteria dictates that with grade 1 or 2 histology, <50% myometrial invasion (MI), and tumor size <2 cm, there is low risk of lymphovascular space invasion (LVSI). American College of Obstetricians and Gynecologists (ACOG) notes the accuracy of frozen gynecological pathology to be as high as 97.5%. The purpose of this study is to evaluate the institutional discrepancy rate between intraoperative frozen section and final pathology results of the hysterectomy specimen, examining whether the Mayo criteria are reliable for intraoperative assessment of LVSI.

**Method:** A retrospective chart review for patients diagnosed with endometrial cancer who underwent hysterectomy with surgical staging from 2017 to 2019 were studied. Of 151 patients who underwent a hysterectomy, 54 patients were excluded because of lack of frozen uterine specimens, and 97 charts were analyzed. Patients were stratified into 3 groups: grade 1, grade 2, and high-grade pathology, which included clear cell and serous endometrial tumors. Concordance rates were calculated and compared between frozen and final histological results and depth of MI.

**Results:** Discrepancy rates among intraoperative frozen and final histology in grade 1 and high-grade pathologies were 9% and 25%, respectively, indicating the increased ability to discern between low-risk and high-risk histopathological disease. The highest discordance was noted in grade 2 histology intraoperatively, with a rate of 39% when compared to final histology. Of the patients who had >50% of MI, the accuracy of the depth was identified correctly in 100% of the specimens; of patients who had <50% of MI, the accuracy rate was 87% intraoperatively.

**Conclusion:** Despite increased use of sentinel lymph nodes, the Mayo criteria remain the most clinically utilized model for intraoperative risk assessment for LVSI. Our study demonstrates a low concordance rate between frozen section and permanent pathology in grade 2 histology with <50% of MI, indicating that intraoperative risk assessment is less reliable for this group and development of a new clinical model is necessary.

---

**663 - Poster Session**

**Improving the bottom line with the same high quality cancer care**

A.N. Al-Niaimi, D.S. Huang, N.H. Mirabadi and E.M. Hartenbach. aUniversity of Wisconsin School of Medicine and Public Health, Madison, WI, USA, bUniversity of Wisconsin Hospitals and Clinics, Madison, WI, USA

**Objective:** The Center for Medicare and Medicaid Services (CMS) Case Mix Index (CMI) is a relative value assigned to a diagnosis-related group (DRG) of patients to determine allocation of resources for care. A higher CMI indicates more resource-intensive cases. CMI depends on accurate coding of pre-existing morbidity and is correlated to an expected postoperative severe morbidity index (SMI) (Clavien-Dindo complication grade 3-4) and mortality index (MI) (Clavien-Dindo complication grade 5). The observed over expected (O/E) ratio is a metric used by CMS to determine payment; if this ratio is greater than 1, the observed morbidity or mortality is higher than the expected. The objective of this study was to determine the impact of improved accuracy in defining gynecologic oncology case complexity on the O/E ratio of the SMI and MI, which ultimately affects reimbursement.

**Method:** A quality improvement project to improve diagnostic coding of pre-existing morbidity was initiated at our institution in July 2017. In this study, the CMI was recorded monthly over the 2 years before and after the project was started (July 1, 2015, to June 30, 2019) to evaluate its impact. SMI, MI, and O/E were calculated for patients with ovarian or uterine cancer who underwent surgery over the time period. ANOVA was used to trend the difference of this ratio over the years as the CMI changed (95% CI and \( P < 0.05 \)).

**Results:** A total of 1,264 patients underwent surgery for ovarian (435) and uterine (829) cancer during the study period. CMI increased over the 4 years from 1.58 and 1.57 to 1.59 and 1.68 in 2019 (\( P = 0.041 \)), resulting in an increase of expected SMI from 2.35 to 2.5 over those 4 years (\( P = 0.034 \)). Observed SMI decreased minimally, 2.4 to 2.02 (\( P = 0.36 \)), but the O/E ratio of SMI dropped significantly from
1.02 to 0.8 (P = 0.0037). The expected MI increased from 1.6 to 1.87 in the last year (P = 0.043), while the observed mortality did not change (P = 0.18). The O/E for MI ratio decreased significantly from 0.25 to 0.21 (P = 0.036). See Figure 1.

**Conclusion**: The same high-quality cancer care with accurate coding for medical comorbidity leads to a lower CMS O/E ratio for SMI and MI, which affects CMS reporting and improves reimbursement.

![Figure 1. O/E ratios.](image)

### 664 - Poster Session

**Trends in use of alternatives to cytotoxic chemotherapy over time: A single institution review**

L.R. Gabor⁵, G.M. Gressel⁶, R. Borczuk⁷ and N.S. Nevadunsky⁵. ⁵Montefiore Medical Center, New York, NY, USA, ⁶Albert Einstein College of Medicine/Montefiore Medical Center, New York, NY, USA

**Objective**: The last decade of clinical research has delivered novel therapies for the treatment of gynecologic malignancies, the majority of which have been alternatives to cytotoxic chemotherapy. We sought to identify how our academic medical center has incorporated the use of these novel therapeutics in the last several years.

**Method**: A chart review of patients treated for gynecologic malignancies between 2015 and 2018 at our academic medical center was conducted. Treatment types were stratified between cytotoxic chemotherapy, bevacizumab, immunotherapy, poly-ADP ribose polymerase (PARP) inhibitors, hormonal treatment, and other targeted therapies. The proportion of patients receiving traditional chemotherapy and those receiving alternative treatments were compared by year using a χ² test. The magnitude of this association was examined using score tests for homogeneity and trend of odds. Odds ratios for receiving alternatives to cytotoxic chemotherapy were calculated relative to 2015.

**Results**: From 2015 to 2018, the proportion of patients receiving non-cytotoxic therapy increased incrementally in a linear fashion; this trend was found to be statistically significant (P < 0.01; Table 1). Patients treated in 2018 were 2.73 times more likely to receive alternatives to cytotoxic chemotherapy than those treated in 2015 (95% CI 1.66–4.48). Over the designated time, the proportion of patients receiving alternatives to cytotoxic chemotherapy increased from 15.2% in 2015 to 33.0% in 2018. While the number of patients receiving bevacizumab and hormonal therapies remained relatively constant, the absolute number of patients receiving PARP inhibitors, immunotherapy, and other targeted therapies as well as their representative proportion of the cohort of patients treated increased between 2015 and 2018.

**Conclusion**: Alternatives to cytotoxic chemotherapy have become prevalent in the treatment of gynecologic malignancies at our institution, both in the absolute number of patients receiving these therapies and in their proportion of use among our total patient cohort. The use of bevacizumab, which has been approved for use in the United States since 2004, as well as the use of hormonal therapies, has remained fairly constant in absolute number of patients receiving these therapies. As alternative treatments are developed, longitudinal studies will be needed to understand how these therapies are incorporated into practice over time.

**Table 1.** Odds ratio of receiving non-cytotoxic cancer therapy per year relative to 2015.

<table>
<thead>
<tr>
<th>Year of Treatment</th>
<th>Cytotoxic (n = 677)</th>
<th>Non-Cytotoxic (n = 172)</th>
<th>Odds Ratio</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Year</td>
<td>Patients</td>
<td>Reference</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>------</td>
<td>----------</td>
<td>-----------</td>
<td>-----------</td>
<td></td>
</tr>
<tr>
<td>2015</td>
<td>183</td>
<td>33</td>
<td>Reference</td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>193</td>
<td>36</td>
<td>1.03</td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>181</td>
<td>44</td>
<td>1.35</td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>120</td>
<td>59</td>
<td>2.73</td>
<td></td>
</tr>
</tbody>
</table>

### 665 - Poster Session

**Oncology treatments in reproductive age cancer patients: The effect of treatment failure and recurrence on fertility risk assessment**

J. Wolf, M.R. Saxb, J. Riosb and A.L. Jacksonb. University of Cincinnati Academic Health Center, Cincinnati, OH, USA, University of Cincinnati, Cincinnati, OH, USA

**Objectives**
The aim of this study was to determine whether cancer therapy actually received by a patient at time of remission has a similar risk assessment to proposed treatment, and to determine factors that affect referral and utilization of fertility preservation options.

**Method:**
Of patients referred to oncofertility between December 2015 and September 2018, we completed a retrospective chart review including demographics, medical history, cancer history, proposed initial treatment, final cancer treatment at time of remission, fertility preservation counseling and treatments completed, return of menses, and pregnancy outcomes. Initial fertility risk assessment and post-treatment assessment were compared.

**Results:**
There was no difference between initial and final chemotherapy regimens containing alkylating agents or radiation therapy. Eighty-nine percent of female and 98% of male patients completed counseling. Patients were more likely to complete counseling if they presented at a younger age. Fifty-three percent of African-American patients, 97% of Caucasian patients, and 100% of Asian and Hispanic patients completed counseling. Patients with private insurance completed fertility preservation counseling 97% of the time versus 86% for patients with Medicaid/Medicare. Stage of cancer at diagnosis did not have a linear relationship with completion of fertility preservation counseling (91% stage I, 89% stage II, 94% stage III, and 83% stage IV). For the subset of referred patients who had gynecologic cancers (n = 13), 1 did not complete fertility counseling. The most commonly chosen infertility treatment was oocyte cryopreservation (4/13).

**Conclusion:**
Oncofertility focuses on preserving fertility among oncology patients who may encounter infertility as a result of chemotherapy, radiation, or surgery. Hypothalamic/pituitary radiation, ovarian/uterine radiation, and summed alkylating agent dose are associated with decreased fertility. Thus, we found that counseling provided at the initial visit is indicative of final gonadotoxicity received. We identified patients at risk of missing out on oncofertility—those of older age, African-American race, and public insurance. Women with gynecologic cancers are likely to complete counseling and are a unique population with oncofertility needs that can still be addressed despite the diagnosis of cancer of the fertility organs.

### 666 - Poster Session

**Outcomes after implementation of an enhanced recovery pathway after major gynecologic oncology surgery at a tertiary care center**

A. Haria, P.A. Akametalub, J.G. Cohena, G. Eilona and C. Leea. University of California, Los Angeles, Los Angeles, CA, USA, David Geffen School of Medicine at UCLA, Los Angeles, CA, USA

**Objective:**
The aim of this study was to examine the impact of an enhanced recovery after surgery (ERAS) pathway in patients undergoing exploratory laparotomy because of suspected or known gynecologic malignancy at a tertiary care center.

**Method:**
This was a retrospective case control study with consecutive patients undergoing exploratory laparotomy at the University of California Los Angeles (UCLA) between March 2017 and February 2018 with known or suspected gynecologic malignancy. A patient match study design was used to compare clinical outcomes along the following parameters: age and type of surgery. Patients in the control arm underwent surgery at UCLA between July 2014 and June 2016.

**Results:**
When comparing 32 ERAS patients to 96 historical controls, the average length of stay (LOS) was significantly reduced (3.91 vs 5.31 days, P = 0.0073). ASA scores between the 2 cohorts were similar and without significant difference (2.38 vs 2.54, P = 0.1464). Although not significant, a lower percentage of ERAS patients were seen in the emergency department within 30 days of surgery (6.2% vs 11.4%, P = 0.5155). Estimated blood loss was also lower in ERAS patients than in historical controls although not significant (324 vs 474 cc, P = 0.0559). Twelve (17%) patients underwent bowel resection at time of surgery, and 20 (28%) patients had documented preoperative use of pain medication. Patients who underwent bowel resection had a significantly longer LOS compared to those who did not undergo bowel resection (7.2 vs 5 days, P = 0.00019).
to patients younger than 70 years (6.7 vs 4.3 days, \( P = 0.000032 \)). Preoperative opioid use was not associated with longer LOS (5.5 vs 4.8 days, \( P = 0.30 \)).

**Conclusion:** The ERAS protocol in gynecologic oncology surgery improves LOS by almost 2 full days. Although not significant, the ERAS protocol also decreases estimated blood loss and return to the emergency department within 30 days. Bowel resection and age >70 years is associated with longer LOS regardless of opioid use prior to surgery. Additional ERAS pathway interventions for older patients as well as patients undergoing bowel resection may be beneficial in optimizing patients’ postoperative course. ERAS improves patient outcomes and hospital costs by decreasing LOS even in complicated gynecologic oncology patients.

---

**667 - Poster Session**

**Conversational replies to oral queries in gynecologic oncology by Google, Alexa and Siri**

E.J. Pavlika\(^a\), B.T. Burgess\(^b\), K. Quick\(^b\), A.B. McDowell Jr.\(^c\), J.W. Gorski\(^c\), M.B. Riggs\(^b\), L.A. Baldwin\(^c\), R.W. Miller\(^c\), C.P. Desimone\(^c\), C.S. Dietrich III\(^b\), H.H. Gallion\(^b\), F.R. Ueland\(^c\) and J.R. Vannagell Jr.\(^c\).  

\(^a\)University of Kentucky, Lexington, KY, USA, \(^b\)University of Kentucky College of Medicine, Lexington, KY, USA, \(^c\)University of Kentucky Medical Center, Lexington, KY, USA

**Objective:** Voice queries to virtual assistant platforms on Google, Apple, and Amazon can retrieve information. This study focused on the accuracy of audible information in gynecologic oncology retrieved by each platform.

**Method:** A 3-tier template for inquiry was used: “X?” (A), “What is X?” (B), and “Define X?” (C) in a 25-question panel. X?’s were: stage I ovarian cancer, stage II ovarian cancer, stage III ovarian cancer, stage IV ovarian cancer, stage IC1 ovarian cancer, stage IIIA1 ovarian cancer, stage IVB ovarian cancer, subtypes of epithelial ovarian cancer, screening for ovarian cancer, screening recommendations for ovarian cancer, ovarian cancer prevention, ovarian cancer symptoms, hereditary ovarian cancer, ovarian cancer risk reduction, screening for cervical cancer, screening recommendations for cervical cancer, options of a 20-year-old sexually active woman who requests a Pap test, HPV vaccine, ages for HPV vaccination, 3-dose HPV vaccine recommendations, borderline epithelial tumors of the ovary, carcinosarcoma of the ovary, high-grade serous tumors of the ovary, and stage 1B endometrial cancer. Audible answers were scored as incorrect = 0; doesn’t understand or know or returns only weblinks = 1; answers at a medical student level = 2; resident level = 3; gynecologic oncology fellow level = 4; or attending level = 5.

**Results:** Agreement between graders varied by 3.6%–4.5%. Siri did not reply with audible answers but provided weblinks. Across all templates, Google scored in the resident range (mean ± SEM = 3.34 ± 0.18), while Alexa’s responses were in the medical student range (1.42 ± 0.15, \( P < 0.001 \)). Google responses were highest for template C (3.38 ± 0.22) but not significantly different from A (3.36 ± 0.2) or B (3.36 ± 0.2). Alexa responses were highest for template B (1.52 ± 0.2) but not significantly different from A (1.29 ± 0.15) or C (1.46 ± 0.19). In each query template, 55% of Google replies were scored at the level of a gynecologic oncology fellow or attending compared to only 6%–10% for Alexa. Conversely, Google failed to know or understand the query 11%–14% of the time, while Alexa did not know or understand 77%–92% of the time.

**Conclusion:** Conversational replies to oral queries on gynecologic oncology topics by Google were quite superior to those by Alexa and Siri, answering at the level of a fellow or attending more than half the time.

---

**Quality of Life/Palliative Care**

**668 - Poster Session**

**Association of treatment at minority-serving versus non-minority-serving hospitals with use of palliative care among racial/ethnic minorities with metastatic gynecologic cancer**

R.M. Polan and E.L. Barber. Northwestern University Feinberg School of Medicine, Chicago, IL, USA

**Objective:** Our goal was to determine whether receipt of treatment at minority-serving hospitals is associated with lower use of palliative care among racial/ethnic minorities with gynecologic cancer compared with nonminority-serving hospitals.

**Method:** This is a retrospective cohort study of women with metastatic gynecologic cancers, diagnosed between January 1, 2004, and December 31, 2016, recorded in the National Cancer Data Base. The primary outcome was receipt of any palliative care services. The exposure of interest was treatment at a minority-serving hospital (MSH). The MSH status was calculated for each facility based on the proportion of minority patients as follows: hospitals were ranked in terms of the proportion of minority patients (black or Hispanic) treated using the entire population with a gynecologic malignancy diagnosis. Hospitals in the top decile were considered MSHs. Associations between exposures and outcomes were evaluated using bivariate and multivariate tests.

**Results:** A total of 107,283 patients with metastatic gynecologic cancer were identified. In total, 11,026 patients (10.3%) received palliative care: 3,748 (7.7%) with ovarian cancer, 3,715 (10.7%) with uterine cancer, 2,861 (17.5%) with cervical cancer, 606 (11.2%)
with vulvar cancer, and 96 (4.1%) with malignancy of another female genital organ. In total, 1,778 black non-Hispanic (11.4%) and 587 Hispanic (8.4%) patients received palliative care versus 8,661 white non-Hispanic (10.2%) patients (P < 0.001). MSH patients were less likely than the non-MSH patients to receive palliative care (1,172 [8.9%] vs 9,854 [10.5%], P < 0.001). In an analysis adjusted for age, race, and Charlson Deyo score, treatment at a MSH had a statistically significant association with lower odds of receiving palliative care (aOR = 0.81, 95% CI 0.76–0.87).

**Conclusion:** In this cohort study of women with metastatic gynecologic cancer in the United States, treatment at a MSH was associated with lower odds of receiving palliative care compared with treatment at a non-MSH. This difference persisted even after adjustment for the race and ethnicity of the patients themselves, suggesting that clustering of minority populations at the hospital level may account for some of the observed disparities in utilization of palliative care by race/ethnicity.

---

**669 - Poster Session**

**Sexual health and function among patients undergoing chemotherapy for primary gynecologic cancers**

A. Kulkarni¹, G. Sun², H. Mendez³, S. Manuppelli³, C. Luis⁴, C. Raker⁴ and K.M. Robison⁴. ¹Women & Infants Hospital, Brown University, Providence, RI, USA, ²Women & Infants Hospital, Providence, RI, USA

**Objective:** Impaired sexual function has been widely reported after cancer treatment, primarily in ovarian cancer, but few studies have examined sexual function during chemotherapy for all gynecologic cancers. Our primary objective was to compare sexual function during chemotherapy between women with primary versus recurrent disease.

**Method:** We conducted a prospective survey study of women 18 years or older undergoing chemotherapy for a primary gynecologic cancer at a large academic center. Chemotherapy was defined to include PARP inhibitors, VEGF inhibitors, and immunomodulatory therapies. Patients were excluded if they were receiving radiation or were less than 8 weeks from surgery. Enrolled patients completed a survey that included questions from the validated Patient-Reported Outcome Measurement Information System (PROMIS) SexFS and Female Sexual Function Index (FSFI) surveys. Clinical information was collected from chart review.

**Results:** An interim analysis was performed halfway through recruitment. Of the 160 eligible patients, 54 were approached. Of those approached, 36 (67%) consented and were enrolled. Twenty-four (67%) patients had recurrent disease, and 12 (33%) had a new cancer diagnosis. Median age was 69 years. The majority of patients (66%) had ovarian cancer, followed by endometrial cancer (25%), and then cervical cancer (8%). No vulvar cancer patients were enrolled at the time of interim analysis. Baseline characteristics between the 2 groups were not statistically different. A majority of patients, 28 (87%) with recurrent disease and 8 (67%) with new disease, reported they had not been sexually active within the last 4 weeks (P = 0.2). Patients in both groups reported sexual dysfunction (FSFI score < 26), with a greater number of patients with recurrent disease reporting sexual dysfunction, 6 (85%) versus 4 (80%) (P = 1.0). When asked “has a provider discussed sexual function with you,” 12 (54%) patients with recurrent disease and 9 (75%) patients with new disease responded “no” (P = 0.54). For the 6 patients who responded ‘yes,’ 100% reported a female provider, most often a gynecologic oncologist, had this discussion.

**Conclusion:** Our study demonstrates that patients undergoing chemotherapy for gynecologic cancer are willing to discuss sexual function. A majority of patients in this cohort were not recently sexually active, and sexual dysfunction was reported by patients with new and recurrent disease. Understanding patients’ sexual function and concerns will allow providers to better counsel patients.

---

**670 - Poster Session**

**A strategy for outpatient implementation of focused advance care planning with advance directives: A quality improvement initiative**

M. Newton, A. Staley, Y. Zhang and V.L. Bae-Jump. University of North Carolina at Chapel Hill, Chapel Hill, NC, USA

**Objective:** The aim of this study was to implement and assess an initiative aimed at increasing documentation of Advance Care Planning (ACP) discussions addressing Heath Care Power of Attorney (HCPOA) and Living Will (LW) status in the outpatient gynecologic oncology setting.

**Method:** Gynecologic oncology patients at high risk of 12-month mortality were identified for a focused ACP discussion regarding HCPOA and LW status with their primary gynecologic oncologist during return clinic visits. High-risk patients were defined as having platinum-resistant high-grade ovarian cancer, recurrent endometrial cancer with active disease, or metastatic or recurrent cervical or vulvar cancer with active disease. These high-risk patients were highlighted on the provider's daily clinic schedule to direct providers to those needing focused ACP discussions. All gynecologic oncologists were provided visual instructions for utilizing the ACP documentation section within the electronic medical record (EMR) and a universal EMR phrase for discussion documentation. The intervention was implemented for 12 weeks. Patient charts were reviewed for provider completion of ACP discussion documentation. This proportion was compared to a baseline cohort of high-risk patients reviewed during a 6-month period prior to study intervention using the χ² test of proportions.
**Results:** Ninety-five patients were identified as high risk 6 months prior to study intervention. None of these patients had documentation by their oncologist in the ACP section of the EMR. Two patients (2.1%) had documented HCPOA or LW discussions with their oncologist. Five patients (5.3%) had a LW submitted, and 10 (10.5%) had a HCPOA identified. During the intervention period, 74 patients were identified as high risk. Eight patients (10.8%) had an ACP note documented by their oncologist ($P = 0.001$). Fifteen patients (20.3%) had a discussion regarding HCPOA or LW documented in either the clinic note or ACP section of the EMR ($P = 0.0001$). During the intervention period, 7 (9.5%) patients submitted a LW, and 12 (16.2%) identified a HCPOA.

**Conclusion:** This quality improvement initiative significantly increased ACP note documentation regarding HCPOA and LW status through identification of high-risk patients and use of simple ACP documentation tools in the outpatient setting.

---

**671 - Poster Session**

**Specialty palliative care is underutilized in a phase I ovarian cancer population**


**Objective:** American Society of Clinical Oncology (ASCO) guidelines recommend early integrated specialty palliative care for patients with advanced cancer (defined as late-stage, life-limiting, and/or prognosis 6–24 months). Data are lacking on utilization of specialty palliative care in phase I populations. We evaluated a phase I ovarian cancer population for specialty palliative care appropriateness, patterns of specialty palliative care utilization, and associated outcomes.

**Method:** This was a retrospective review of ovarian cancer patients enrolled in phase I clinical trials at a single institution from 2008 to 2018. Patient and disease characteristics, utilization and timing of specialty palliative care integration, treatment characteristics (including end-of-life care), and survival data were collected. $\chi^2$ and $t$ tests evaluated associations between specialty palliative care integration and patient, disease, and treatment characteristics. Log rank test was utilized for survival data.

**Results:** Of 121 patients identified, 87% had advanced-stage disease at diagnosis, and all had recurrent disease at trial enrollment. Median survival from date of enrollment was 311 days (95% CI 225.9–396.1). Four patients (3.3%) received specialty palliative care prior to phase I enrollment, 7 (5.8%) within 30 days after enrollment, and 53 (43.8%) more than 30 days after enrollment. There were 57 patients (47.1%) who never received specialty palliative care. Patients who received specialty palliative care within 30 days of phase I enrollment had lower median survival ($P < 0.001$) and were more likely to be seen in the emergency department, hospitalized, and admitted to the intensive care unit in the last 60 days of life ($P < 0.001, P = 0.002, P = 0.041$, respectively) (Table 1).

**Conclusion:** All patients in our phase I ovarian cancer cohort were appropriate for specialty palliative care integration per ASCO guidelines; 91% of these patients received late or no specialty palliative care. Patients referred to specialty palliative care within 30 days of phase I enrollment were those with particularly poor prognosis demonstrated by significantly lower survival and greater requirement of end-of-life care. Routine referral to specialty palliative care should be considered for all ovarian cancer patients at the time of phase I trial enrollment.

**Table 1.** Association of patient characteristics and end-of-life care with timing of specialty palliative care integration.

<table>
<thead>
<tr>
<th>Prior to Phase I Trial Enrollment (n = 4)</th>
<th>Within 30 days of Phase I Trial Enrollment (n = 7)</th>
<th>Greater than 30 days after Phase I Trial Enrollment (n = 53)</th>
<th>No Specialty Palliative Care (n = 57)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median Age (years)</td>
<td>61.0</td>
<td>66.0</td>
<td>58.0</td>
<td>59.5</td>
</tr>
<tr>
<td>Stage at Diagnosis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>2 (3.8%)</td>
<td>3 (5.4%)</td>
</tr>
<tr>
<td>II</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>4 (7.5%)</td>
<td>1 (1.8%)</td>
</tr>
<tr>
<td>III</td>
<td>3 (75.0%)</td>
<td>5 (62.5%)</td>
<td>32 (60.4%)</td>
<td>32 (57.1%)</td>
</tr>
<tr>
<td>IV</td>
<td>1 (25.0%)</td>
<td>2 (25.0%)</td>
<td>13 (24.5%)</td>
<td>17 (30.4%)</td>
</tr>
<tr>
<td>Median Number of Chemotherapy Regimens Prior to Phase I Enrollment</td>
<td>5.5</td>
<td>4.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Utilization of end-of-life healthcare resources within 60 days of death</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ED Visit</td>
<td>1 (25.0%)</td>
<td>6 (75.0%)</td>
<td>23 (43.4%)</td>
<td>8 (14.3%)</td>
</tr>
<tr>
<td>Hospitalization</td>
<td>2 (50.0%)</td>
<td>7 (87.5%)</td>
<td>33 (62.3%)</td>
<td>15 (26.8%)</td>
</tr>
</tbody>
</table>
672 - Poster Session
The role of the pelvic examination in the detection of recurrent ovarian cancer
Stanford University School of Medicine, Stanford, CA, USA

Objective: The purpose of this study was to investigate the utility of routine pelvic examinations in ovarian cancer recurrence detection, in order to maximize patient quality of life during surveillance, given potential patient discomfort and pain during examination.

Method: A single-institution, retrospective, cohort study was undertaken for all women with ovarian cancer who achieved complete remission after primary treatment and whose recurrence was treated at our tertiary referral center. Those patients who had positive pelvic examination at the time of suspicion of recurrence were divided into those who were symptomatic versus asymptomatic and whether their positive pelvic examination was the primary reason for suspicion of recurrence (versus CA-125, imaging, or symptoms). Initial diagnosis data, recurrence data, and outcome data were collected.

Results: A total of 102 patients with ovarian cancer recurrence meeting inclusion criteria were identified at our institution from 2003 to 2015. Of these, 15 patients (15%) had a positive pelvic examination at time of diagnosis of recurrence, of which 10 (66%) were asymptomatic. Of these 15, 5 recurrences (5% of entire cohort) were detected primarily by positive pelvic examination. Three of these 5 patients (60%) had a CA-125 of 6 or less at diagnosis of recurrence, with mean CA-125 at diagnosis of 206. Of the 15 patients with positive pelvic examination, median CA-125 at diagnosis was 444 (range 8–2,598); at time of completion of primary chemotherapy was 9 (range 6–26); and at time of recurrence was 27 (range 6–1,841). Only 1 had recurrence identified by speculum examination. In contrast, the most likely location of examination irregularity was in the cul-de-sac (9 of 15, 60%). Of those patients with data for BMI at time of recurrence available (n = 13), most were normal or underweight (n = 8, 61.5%). However, a substantial portion were either overweight or obese (n = 5, 38.5%). Mean time to recurrence was 18.9 months, and median survival was 45.8 months. Eight of 15 patients underwent secondary cytoreductive surgery, of which 7 patients had an optimal outcome.

Conclusion: The pelvic examination is a useful tool in the diagnosis of recurrent ovarian cancer. Patients should continue to be offered a routine pelvic examination as part of recurrence detection in a shared decision-making capacity, weighing patient discomfort against increased recurrence detection rates. This should be done regardless of patient BMI and should be conducted by a provider experienced in pelvic examinations.

673 - Poster Session
Moderate/severe distress in half of ovarian cancer patients undergoing treatment highlights a need for more proactive symptom and psychosocial management
University of Alabama at Birmingham, Birmingham, AL, USA

Objective: Distress screening and management is a recommended component of oncology care. Our objective was to evaluate distress rate, sources of distress, and compliance with psychosocial follow-up among ovarian cancer patients undergoing chemotherapy.

Method: We reviewed prospectively collected patient distress surveys from our electronic health record from October 2017 to June 2019. Ovarian cancer patients receiving chemotherapy were presented with a thermometer to indicate their distress level from 0 (no distress) to 10 (highest distress) and then asked to indicate sources of distress from a problem list. Based on National Comprehensive Cancer Network (NCCN) guidelines, a distress score ≥4 (moderate/severe) was considered a positive distress screen. In addition, a recommendation for psychiatric follow-up was automatically generated in the treatment care plan based upon a yes response to any depression-related concern, which was independent of distress score. Documentation of referral to a mental health professional or social worker for counseling was considered compliant with psychosocial follow-up. We performed descriptive statistics and bivariate analyses.

Results: A total of 101 out of 211 (48%) ovarian cancer patients screened positive for distress. Average score was 6.1 for those who screened positive for distress and 3.3 for the entire group (range 0–10). We found that younger age (P = 0.05) and unmarried status (P <
0.01) were associated with positive distress screen, whereas non-white race ($P = 0.26$) and recurrent disease ($P = 0.20$) were not. Among patients with a positive distress screen, the most frequent sources of distress were cognitive/physical concerns (86%), psychosocial concerns (82%), practical concerns (61%), and family concerns (39%). Of 50 patients who were recommended to have psychiatric referral, only 4 (8%) patients had documented psychiatric follow-up, and 19 (38%) patients had documented psychosocial counseling by a social worker.

**Conclusion:** We found that nearly half of ovarian cancer patients screened positive for moderate/severe distress. Cancer or treatment-related symptoms were the most frequent sources of distress followed by psychosocial concerns. Improved methods of ensuring appropriate symptom management and psychosocial follow-up represent critical areas to target in order to improve distress management.

---

**674 - Poster Session**

**Look good, feel good? the effects of body image on quality of life in gynecologic cancer patients**

A.B. Clark, M. Brown, O.E. Gilbert, A. Chapple, A.M. Jernigan and N. Nair. *Louisiana State University Health Sciences Center, New Orleans, LA, USA*

**Objective:** The aim of this study was to investigate the effect of body image satisfaction on overall quality of life (QOL) and patient-reported sexual, physical, and social functioning.

**Method:** Women with gynecologic cancer were surveyed at 2 outpatient sites within 1 academic institution. A questionnaire was administered evaluating body image, overall QOL, and sexual, physical, and social activity. Assessment tools included a 10-item Body Image Scale, single-response scales adopted from EORTC-QLQ C30, and Likert-type scales. Nonparametric correlation between body image and QOL was performed using Kendall’s tau. A Wilcoxon-signed rank test was used to assess correlation between QOL in those satisfied (score ≤10) versus dissatisfied (score >10) with their body image. Kruskall-Wallace tests were used to assess correlation between body image satisfaction and satisfaction with sexual, physical, and social activity.

**Results:** A total of 51 patients participated out of 57 recruited (89.5%). Mean age was 53.5 years; mean BMI was 32.95; and 71% were postmenopausal. Of all patients, 37% had endometrial cancer, 23% ovarian, 20% cervical, 12% vulvar, and 2% vaginal. As part of their treatment, 67% received surgery, 61% chemotherapy, 26% radiation, and 4% hormone therapy. Seventy-seven percent had a body image score >10 indicating dissatisfaction. Overall QOL was significantly lower in those dissatisfied with their body image versus those satisfied ($P = 0.018$). Nonparametric correlation between body image score and QOL score was $-0.320$ using Kendall’s tau ($P = 0.003$), indicating that QOL score decreases as body image score increases. Body image dissatisfaction was significantly associated with dissatisfaction with sexual, physical, and social activity ($P = 0.032$, 0.001, and 0.002, respectively). See Figure 1.

**Conclusion:** In this diverse urban population of gynecologic cancer patients, we demonstrate that dissatisfaction with body image results in a lower QOL and increased dissatisfaction with sexual, physical, and social activity. Interventions to improve body image satisfaction must be developed as part of cancer survivorship plans. With improved treatments and a growing population of cancer survivors, addressing QOL issues is an increasingly important aspect of caring for these survivors.

![Fig. 1. Quality of life in patients satisfied vs. dissatisfied with body image.](image)
**Objective:** Although advanced care planning is valued by physicians and patients to promote shared medical decision-making, little is known about patient awareness and uptake of advanced care planning. We aimed to assess advanced care planning awareness among gynecologic oncology patients, identify their preferences for discussing it, and design an intervention to improve dissemination of advanced care planning resources.

**Method:** We administered a needs assessment survey to gynecologic oncology inpatients at 1 academic institution. Based on responses, we designed and piloted an outpatient intervention in which we offered advanced care planning resources (an advanced care planning pamphlet, formal discussion about advanced care planning with their gynecologic oncologist, and/or social work referral) at office visits from March to May 2019. Logistic regression models identified those at risk for not having advanced care planning and those who desired advanced care planning resources in the outpatient group. Covariates included age, BMI, race, religion, cancer site, cancer stage, current treatment, and recurrent disease.

**Results:** Of 106 women who completed the inpatient needs assessment, 82% thought discussing advanced care planning was important, but only 33% had done it, 49% did not know how to obtain it, and 74% had not shared their end-of-life care preferences with their physician. Of multiple options, patients preferred discussing advanced care planning in the office (84%) with their gynecologic oncologist (80%). Of 543 gynecologic oncology patients who were offered advanced care planning resources at their outpatient visit, 307 (57%) lacked it. Of these, 97 (30%) desired 1 or more resources: 25 (25%) wanted to discuss advanced care planning with their provider, 89 (92%) wanted an advanced care planning pamphlet, and 38 (39%) wanted a social work referral. Compared to women with advanced care plans women without them were more likely to be younger (median age 68 vs 62 years, \( P < 0.0001 \)), have non-stage IV disease (75% vs 81%, \( P = 0.003 \)), have nonrecurrent cancer (67% vs 77%, \( P = 0.006 \)), have no religious preference (33% vs 44%, \( P = 0.002 \)), and have cervical cancer (6% vs 17%, \( P = 0.002 \)). In patients without current advanced care plans, significant predictors of desiring advanced care planning resources (Table 1) were older age (\( P = 0.01 \)), religious preference (\( P = 0.01 \)), and current treatment (\( P < 0.01 \)).

**Conclusion:** Discussing advanced care planning is important to gynecologic oncology patients and should be prioritized for all patients. It may be best implemented in the outpatient setting and should be supported with a variety of resources.

<table>
<thead>
<tr>
<th>Do not want ACP resources N=222</th>
<th>Want ACP resources N=97</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age* 31 (50.68)</td>
<td>64 (55.69)</td>
<td>0.01</td>
</tr>
<tr>
<td>Religious affiliation* n (%)</td>
<td></td>
<td>0.01</td>
</tr>
<tr>
<td>Primary cancer site n (%)</td>
<td></td>
<td>0.61</td>
</tr>
<tr>
<td>Ovarian/Fallopian tube/primary peritoneal 72 (32.4%)</td>
<td>31 (32%)</td>
<td></td>
</tr>
<tr>
<td>Endometrial 93 (41.4%)</td>
<td>44 (45.4%)</td>
<td></td>
</tr>
<tr>
<td>Cervical 37 (16.7%)</td>
<td>17 (17.5%)</td>
<td></td>
</tr>
<tr>
<td>Vulvar/ Vaginal/ Other 21 (9.5%)</td>
<td>5 (5.1%)</td>
<td></td>
</tr>
<tr>
<td>Stage n (%)</td>
<td></td>
<td>0.56</td>
</tr>
<tr>
<td>I/II</td>
<td>121 (59.3%)</td>
<td></td>
</tr>
<tr>
<td>III/IV</td>
<td>83 (40.7%)</td>
<td></td>
</tr>
<tr>
<td>Current treatment n (%)</td>
<td></td>
<td>0.007</td>
</tr>
<tr>
<td>Recurrence disease n (%)</td>
<td></td>
<td>0.36</td>
</tr>
<tr>
<td>Recurrence disease n (%)</td>
<td></td>
<td>0.36</td>
</tr>
</tbody>
</table>

*Reported as median (interquartile range)

#Reported as Christian, Jewish, Muslim, Hindu or Buddhist

---

**676 - Poster Session**

The effect of a CPR decision aid on CPR knowledge and code status preferences in patients with recurrent gynecologic malignancies

J.A. O'Donnell, Z.L. Gentry, S.E. Dilley, K.S. Bevis and G. McGwin. =University of North Carolina at Chapel Hill, Chapel Hill, NC, USA, =University of Alabama at Birmingham, Birmingham, AL, USA
Objectives: It is imperative to assess and improve CPR literacy in order for patients to make informed decisions regarding end-of-life preferences. We assessed the feasibility of a video CPR decision aid administered in the ambulatory setting and its effect on CPR literacy and code status preferences in patients with recurrent gynecologic cancer.

Method: English-speaking patients with recurrent gynecologic cancer receiving outpatient chemotherapy were eligible. Participants were randomized to either view the decision aid or receive standard care. All patients completed a baseline survey of 4 questions on CPR knowledge and 1 question about code status preference. Patients randomized to the video arm viewed the validated CareNet CPR decision aid and repeated these assessments at a subsequent visit. Patients in the control arm received standard care with repeat assessments at a subsequent visit. CPR knowledge was the primary outcome (score 0–4). Secondary outcome was CPR preference. Groups were compared using χ², Student t, analysis of variance, and Fisher exact tests as appropriate.

Results: Seventy-five patients were approached, and 60 patients enrolled (80%). Patients were mostly white (78%) and privately insured (73%) and had ovarian, fallopian tube, or peritoneal cancer (60%); 29% had existing advance directives. Mean time to follow-up was 5.5 weeks in the control group and 5.1 weeks in the video group. The initial and follow-up knowledge scores in the control group were 1.5 and 1.75, respectively (P = 0.25). In this group, 86.7% of patients preferred full code status at baseline versus 76.7% at follow-up (P = 0.8). In the video group, knowledge scores increased from 1.4 to 2.6 (P < 0.0001); 71.4% of these patients preferred full code status at baseline compared to 50% at follow-up (P = 0.14). Patients reported the video to be very or somewhat helpful (96%), very or somewhat emotionally comfortable to watch (96%), and would recommend the video to other patients (100%).

Conclusion: Use of the validated CareNet CPR Decision Aid is feasible in the ambulatory setting among patients with recurrent gynecologic cancer. It was associated with improved CPR knowledge and a trend toward decreased preference for full code status. Patients found the video helpful, emotionally acceptable, and would recommend it to other patients.

677 - Poster Session

The surprise question in gynecologic oncology: An analysis looking at end-of-life care in patients with gynecologic cancer

W. Barton, M. Cohen, C. Raker, C. Luís, R. Crama, H. Mendez, T. McKnight, A.B. Parker, K. Lally and K.M. Robison. <Women & Infants Hospital, Brown University, Providence, RI, USA. University of Pittsburgh Magee-Womens Hospital, Pittsburgh, PA, USA. Brigham and Womans Hospital and Harvard Medical School, Boston, MA, USA

Objective: Oncologists tend to over-prognosticate survival times for patients with advanced cancer, delaying critical end-of-life-care planning and involvement of palliative services. The surprise question, “Would you be surprised if this patient died in the next year?” is a validated screening tool used in advanced diseases, including cancer. It has been shown to be highly predictive of 12-month mortality and of potential value to trigger palliative referral. Our primary objective is to determine whether end-of-life-care planning was performed for patients with gynecologic malignancies for whom providers screened “yes” compared to those patients for whom providers screened “no” with the surprise question.

Method: This prospective cohort study was conducted at a large academic center. All gynecologic oncology clinics were screened for patients with stage III–IV gynecologic malignancy or recurrent disease with any stage at initial diagnosis. Once identified, attending physicians, fellows, and nurse practitioners answered the surprise question for patients on an iPad. Demographic, clinical, and end-of-life care planning data were then abstracted from chart review.

Results: Clinicians answered the surprise questions for 299 patients with a mean age of 65 years and a majority with primary fallopian, peritoneal, or ovarian cancer. Patients for whom providers answered “no” were more likely to have any end-of-life-care planning in place (45% vs 17%, P < 0.001), namely, a durable power of attorney (25% vs 12%, P = 0.005), Medical Orders for Life-Sustaining Treatment (11% vs 2%, P = 0.001), or an established relationship with palliative care (26% vs 6%, P ≤ 0.001). In addition, those in the “no” group were also more likely to have recurrent disease (60% vs 39%, P = 0.008), endometrial or cervical cancer (49% vs 34%, P < 0.001), or shorter interval between hospital admissions (600 days vs 923 days, P = 0.02).

Conclusion: Our study found that patients for whom providers answered “no” to the surprise question were more likely to have actionable directives in place and actively receiving palliative care; however, almost half of those for whom providers answered “no” lacked any documented end-of-life-care planning, highlighting an ongoing deficiency in caring for those with advanced cancer. The surprise questions could be used to identify patients appropriate for early referral to palliative care or with whom to initiate conversations regarding end-of-life care planning.

678 - Poster Session

Gynecologic cancer patients’ awareness of palliative care

K. Hicks-Courant, A. Graul, E.M. Ko, R.L. Giuntoli II, L. Cory, L.P. Martin, M.A. Morgan and A.F. Haggerty. <Hospital of the University of...>
Pennsylvania, Philadelphia, PA, USA, St. Luke’s University Health Network, Bethlehem, PA, USA, University of Pennsylvania Health System, Philadelphia, PA, USA, University of Pennsylvania, Philadelphia, PA, USA

Objective: The goal of this study was to identify the sources of gynecologic cancer patients' knowledge about palliative care.

Method: Women at a single academic medical center with advanced or metastatic gynecologic cancer who were receiving systemic chemotherapy were surveyed about their palliative care knowledge and experience as part of a randomized trial to assess the impact of an educational tool on the uptake of palliative care services. Palliative care knowledge was assessed by using the Palliative Care Knowledge Scales (PaCKS), a validated instrument. A medical chart review was conducted to assess palliative care utilization. Data analyses were performed using Fisher exact, Wilcoxon rank sum, and Kruskal-Wallis tests with a significance level of $\alpha = 0.05$.

Results: Over the study period, 111 women with ovarian ($n = 82, 73.9\%$), endometrial ($n = 20, 18.0\%$), cervical ($n = 8, 7.2\%$), and vaginal ($n = 1, 0.9\%$) cancers were surveyed. The majority ($n = 70, 63.1\%$) had heard of palliative care. Sixty-eight women specified from where they learned of palliative care. A plurality ($n = 28, 41.2\%$) had heard of palliative care through their personal cancer care experiences, including from their physician, nurse, or staff. Twenty-six (38.2%) had heard of palliative care through word of mouth, and 8.8% ($n = 6$) knew of palliative care through their employment in the medical field; 5.8% ($n = 4$) learned about palliative care via self-education. A minority learned of palliative care from sick family members who had received palliative care services ($n = 2, 2.9\%$) or did not recall where they had heard of it ($n = 2, 2.9\%$). There was no significant difference in palliative care utilization within 6 months of the survey by whether a woman had previously heard of it ($P = 0.81$), how she had heard of it ($P = 0.07$), or whether she had received the palliative care education intervention ($P = 0.10$). PaCKS scores did not differ by how a woman had heard of palliative care ($P = 0.35$). See Figure 1.

Conclusion: Most women receiving treatment for advanced or metastatic gynecologic cancer have heard of palliative care from sources other than their cancer care providers. Palliative care knowledge and utilization may be improved by increasing the low rate of health provider-based education and engaging cancer patients' social networks.

Fig. 1. Sources of palliative care knowledge among gynecologic cancer patients.

679 - Poster Session

Quality-of-life and clippers: Decision-making during chemotherapy-induced alopecia
M.L. Clements\textsuperscript{a}, L.A. Roscoe\textsuperscript{b} and M.M. Shahzad\textsuperscript{c}.
\textsuperscript{a}The University of Tampa, Tampa, FL, USA, \textsuperscript{b}Moffitt Cancer Center-University of South Florida, Tampa, FL, USA, \textsuperscript{c}H. Lee Moffitt Cancer Center & Research Institute, Tampa, FL, USA

Objective: Data on the actions ovarian and uterine cancer patients take to help cope with chemotherapy-induced alopecia are limited. A strategic model is needed to help health care teams better understand patients' behavior related to managing alopecia. This study investigates patients' decision-making and actions to determine whether they are associated with having a greater sense of control over the treatment process.

Method: Interviews averaging 76 minutes total per patient were conducted over 14 months. A qualitative analysis using open, axial, and selective coding was used to examine transcripts.
**Results:** The data consisted of 1,750 minutes of audio from 55 interviews with a population of 17 ovarian and 6 uterine cancer patients \((n = 23)\) treated with carboplatin and paclitaxel. Analysis revealed 74% chose to shave their heads, and 100% of these patients associated head-shaving with increased feelings of control over treatment. In descriptions of coping strategies, the phrases "before my head shave" and "after my head shave" were used as evidence of its significance and suggested others "form a plan to take control" for when and where and who is included. The decisions and actions patients took to manage alopecia followed 2 trajectories with 4 phases of progression and 2 potential outcomes; see Table 1. Of the 4 phases, the first and fourth occur inside the clinic, suggesting oncology teams could reference the model as a tool to help increase the likelihood of patients leaving the clinic having started to actively consider options and ways to take control.

**Conclusion:** Ovarian and uterine cancer patients who experienced difficulty coping with the loss of control over physical changes during chemotherapy reported head-shaving as a way of inserting autonomy over a largely powerless health situation. The model proposed may help decrease perceptions of uncertainty with alopecia.

<table>
<thead>
<tr>
<th>Table 1. Decision trajectory 1.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phase 1</strong></td>
</tr>
<tr>
<td>Consideration</td>
</tr>
<tr>
<td>alopecia will happen; how to prepare</td>
</tr>
<tr>
<td>In clinic</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2. Decision trajectory 2.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phase 1</strong></td>
</tr>
<tr>
<td>Consideration</td>
</tr>
<tr>
<td>alopecia will happen; how to prepare</td>
</tr>
<tr>
<td>In clinic</td>
</tr>
</tbody>
</table>

---

**Objective:** Women with advanced gynecologic cancer and malignant bowel obstruction (MBO) undergo repeated hospitalizations, experience feelings of isolation and abandonment, and often die in acute settings. Innovative outpatient models of care are needed to address the unmet needs of this population at the end of life. We implemented a novel supported self-management program at Princess Margaret Cancer Centre (Toronto, Canada) focused on increasing patients’ own skill and confidence in managing MBO proactively in the ambulatory setting.

**Method:** We performed a qualitative descriptive study to understand the impact of this program on patients’ sense of support, degree of distress, quality of care, and capacity to self-manage. Semistructured interviews were completed with advanced gynecologic cancer patients enrolled in the MAMBO study evaluating the MBO program prospectively. Transcribed interviews were coded line-by-line and analyzed inductively and deductively using the Chronic Care Model as a theoretical framework. Data saturation was confirmed after 15 interviews.

**Results:** Fifteen participants with a median age of 66 years (range 47–82 years) and diagnoses of advanced ovarian, endometrial, and cervical cancer were interviewed; 9 had died by end of follow-up, with a median interval from interview to death of 4 months. Qualitative analysis identified that patients were able and willing to self-manage the medical and dietary aspects of MBO as outpatients. Patients felt greatly supported, less isolated, and secure in their knowledge and ability to access care because of program enrollment, monitoring, and education. Although patients clearly understood their disease was not curative, they did not fully appreciate that MBO was linked to disease progression and a poorer prognosis.
**Conclusion:** Supported self-management interventions for the outpatient setting can be successfully implemented even at the end of life and offer significant benefit to gynecologic cancer patients with MBO. For patients with advanced disease and a new diagnosis of MBO, counselling should focus on the specific implications and trajectory of MBO, and early referrals to palliative care should be standard practice.

---

**681 - Poster Session**

**Characterizing anxiety at the first encounter in women presenting to the gynecologic oncology clinic (CAFÉ GYN ONC)**

L.A. McAlarnen, A. Rugova, L. Westbay, A.D. Winder, M.R. Liotta, R.K. Potkul and T.T. Pham. Loyola University Medical Center, Maywood, IL, USA

**Objective:** Anxiety can be measured in various ways. Our study aims to characterize the reasons for anxiety in women presenting for their initial gynecology oncology visit, to measure the change in state anxiety after the visit, and to correlate anxiety improvement with visit satisfaction.

**Method:** New patients presenting to a tertiary care gynecology oncology clinic were invited to participate. Participants were asked to list their previsit anxieties and complete pre- and postvisit questionnaires. Previsit questionnaires included the Generalized Anxiety Disorder-7 (GAD-7) and the Spielberg State Trait Anxiety Inventory (STAI-Y6). Postvisit questionnaires included the STAI-Y6, patient global impression of improvement (PGI-I) of anxiety, visit satisfaction, and the participant's perception of how their anxiety was addressed. Providers were blinded to the pre- and postvisit questionnaire responses. The anxieties listed by participants were reviewed and categorized independently by 3 of the authors.

**Results:** Fifty women, primarily Caucasian (58%), with a mean age of 54 years (SD 14.20) completed the study. Prior to the initial visit, 16 participants had a known diagnosis of cancer, and 2 women had a known diagnosis of anxiety. The average previsit STAI score was 45.80 (SD 16.44), which decreased by 9.87 postvisit (*Figure 1*). Those with a previsit GAD score ≥10 had higher previsit STAI scores than those with GAD <10 (*P* < 0.001). Previsit STAI scores were similar between those with a known and suspected cancer diagnosis. The most reported reasons for visit-related anxiety were related to diagnosis, treatment, and personal issues. Postvisit improvement in state anxiety was associated with improvement in PGI-I scores (*P* = 0.04) but not with known or suspected cancer diagnosis, patient satisfaction, or perception of how anxiety was addressed.

**Conclusion:** Women experience high levels of state anxiety prior to their initial gynecology oncology visit, regardless of whether they have a known cancer diagnosis. Those with generalized anxiety (GAD ≥ 10) experience higher state anxiety. However, all participants had significant improvement in state anxiety after the visit regardless of visit satisfaction, perception of how anxiety was addressed, or cancer diagnosis.

![Fig. 1. Change in STAI.](image_url)
**Patient-reported barriers to vibrating vaginal wand therapy post-radiation: A prospective study**


*University of Wisconsin Hospitals and Clinics, Madison, WI, USA, University of Wisconsin Carbone Cancer Center, Madison, WI, USA, University of Wisconsin School of Medicine and Public Health, Madison, WI, USA*

**Objective:** Vaginal dilator therapy prevents vaginal stenosis, allowing for future pelvic examinations and improved sexual function. However, adherence to vaginal dilator therapy has long been an issue with limited data on the etiology of nonadherence. Our objective was to determine patient-reported barriers to adherence and attitudes surrounding vaginal dilator therapy.

**Method:** A prospective Institutional Review Board-approved study was performed between November 2017 and August 2019. All patients receiving radiation for a gynecologic cancer were eligible. Participants were enrolled at the end of radiation and provided with a vibrating vaginal wand to be used daily. A diary was provided to record usage and barriers. Adherence was defined as dilator use ≥ 4 per week. Participants completed baseline patient-reported outcome questionnaires, which were repeated at 2-week and 3-month timepoints.

**Results:** Of 36 participants, median age was 67 years; 27% received external beam radiation therapy, and 92% received vaginal brachytherapy; 92% had uterine cancer and 63% were stage 1. The overall adherence rate was 65.4% (95% CI 52.1–76.6%). The 3 most-cited barriers were inability to use in the shower, thinking of the vaginal wand as a sex toy, and feeling too tired. Qualitative data from the diaries indicate that several participants did not use the vaginal wand while traveling, when having family and friends visiting, or when experiencing fatigue or other symptoms from chemotherapy. Factors encouraging use included the belief that vaginal wand therapy would facilitate future pelvic examinations for cancer surveillance. Correlation of barriers with adherence is pending final data collection and will be available at the time of Annual Meeting presentation.

**Conclusion:** Gynecologic cancer patients have identifiable barriers to vaginal wand use. Our data inform providers of specific reasons (i.e., inability to use in the shower, thinking of the vaginal wand as a sex toy) so that they can specifically address these attitudes and barriers to more effectively encourage continued usage and promote vaginal and sexual health.

---

**A deficit-accumulation frailty index and survival outcomes in patients with gynecologic malignancy**


*Washington University School of Medicine in St. Louis, St. Louis, MO, USA*

**Objective:** The aim of this study was to determine the association between the Rockwood Accumulation of Deficits Frailty Index (DAFI) and survival outcomes in women with gynecologic malignancies.

**Method:** In a prior study, data from 2,692,361 patients without cancer in the SEER-MHOS linked databases between 1998 and 2009 were analyzed. A frailty index was constructed, resulting in a 25-item scale with median scores calculated for each age. This frailty index was then applied to women age ≥65 years diagnosed with gynecologic cancers including ovarian, fallopian tube, uterine, cervical, vaginal, and vulvar between 1973 and 2013. Individual DAFI scores were compared to the cohort of patients without cancer using univariate and multivariate Cox proportional hazards regression analysis to determine association between frailty status and overall survival (OS). Kaplan-Meier methods were used to determine association between frailty and OS.

**Results:** The cohort with malignancy included 1,336 patients. The median age at gynecological cancer diagnosis was 74 years (range 65–97 years). Seventy-two percent of the population identified as Caucasian, 10% as African-American/black, 9% Hispanic, 7% Asian, and 2% as multiracial or another race. Overall, 50% of patients were considered frail, which was consistent across all cancer types (*Table 1*). After controlling for age, race, cancer type, and stage, frail patients had a 50% increased risk for death (aHR = 1.5, 95% CI 1.3–1.7, *P* < 0.001). Each 10% increase in frailty index was associated with a 16% increased risk of death (aHR = 1.2, 95% CI 1.1–1.2, *P* < 0.001). In subgroup analyses of the various cancer types, the association of frailty status with prognosis was fairly consistent (aHR 1.2–2.2), but may indicate that the DAFI is more prognostic in uterine and vulvar cancer than in other gynecologic cancers. The DAFI also appears to be more prognostic for patients with local/regional disease versus metastatic disease.

**Conclusion:** Frailty appears to be a significant predictor of mortality in women with gynecologic malignancies, regardless of chronological age. This measure of functional age may be of particular utility in women with uterine and vulvar cancers as well as those with local/regional disease only.

**Table 1.** Frailty status as a predictor of overall survival in patients with gynecologic cancers.
**Table:**

<table>
<thead>
<tr>
<th>Region</th>
<th>n (%)</th>
<th>OS</th>
<th>OS</th>
<th>OS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(95% CI)</td>
<td>(95% CI)</td>
<td>(95% CI)</td>
</tr>
<tr>
<td>Cervix</td>
<td>52 (51%)</td>
<td>29.9 (14.8-58.1)</td>
<td>77.7 (40.5-129.74)</td>
<td>1.4 (0.8-2.5)</td>
</tr>
<tr>
<td>Ovary</td>
<td>212 (51%)</td>
<td>18.8 (15.2-25.0)</td>
<td>30.0 (24.1-35.2)</td>
<td>1.2 (0.9-1.5)</td>
</tr>
<tr>
<td>Uterus</td>
<td>331 (47%)</td>
<td>83.5 (62.8-107.9)</td>
<td>129.1 (106.3-170.6)</td>
<td>1.8 (1.4-2.2)</td>
</tr>
<tr>
<td>Vagina</td>
<td>26 (55%)</td>
<td>45.6 (13.6-92.4)</td>
<td>126.3 (30.8-173.9)</td>
<td>1.2 (0.2-8.2)</td>
</tr>
<tr>
<td>Vulva</td>
<td>100 (56%)</td>
<td>68.9 (48.9-91.5)</td>
<td>88.4 (65.7-160.6)</td>
<td>2.0 (1.3-2.9)</td>
</tr>
<tr>
<td>Other</td>
<td>14 (38%)</td>
<td>16.9 (7.4-61.0)</td>
<td>36.1 (25.8-104.7)</td>
<td>2.2 (0.9-5.4)</td>
</tr>
<tr>
<td>All</td>
<td>735 (50%)</td>
<td>48.9 (40.9-56.6)</td>
<td>80.7 (67.2-99.6)</td>
<td>1.5 (1.3-1.7)</td>
</tr>
<tr>
<td>Metastatic</td>
<td>207 (51%)</td>
<td>18.1 (14.8-21.9)</td>
<td>24.1 (18.7-27.1)</td>
<td>1.1 (0.9-1.4)</td>
</tr>
<tr>
<td>Local/Regional</td>
<td>444 (48%)</td>
<td>92.9 (77.1-105.2)</td>
<td>147.0 (126.7-170.6)</td>
<td>1.9 (1.6-2.3)</td>
</tr>
</tbody>
</table>

* Adjusted for age, race, cancer type and stage, OS: Overall survival in months with 95%CI

---

**684 - Poster Session**

**Gynecologic malignancy-associated bowel obstruction: Outcomes and prognostic implications**

E.P. Howell, C.H. Watson, A.M. Puech and B.A. Davidson. *Duke University School of Medicine, Durham, NC, USA, Duke University Medical Center, Durham, NC, USA*

**Objective:** Malignancy-associated bowel obstruction (MBO) represents a devastating sequelae of advanced gynecologic malignancy. Admission for MBO carries poor prognostic significance, although its exact impact remains under investigation. Given the potential for high-intensity intervention in this setting, understanding patients' end-of-life priorities becomes paramount, and MBO admissions may be an important opportunity for goals of care conversations. The present study aims to categorize the mortality associated with MBO, and to explore rates of intervention and goals-of-care discussions in this population.

**Method:** Retrospective review was performed on a cohort of patients with primary gynecologic cancer admitted to a single institution between 2016 and April 2018. Clinical information, admission details, and goals-of-care documentation were collected for each patient.

**Results:** A total of 386 records were reviewed. Of these, 54 patients (14.0%) experienced a total of 78 admissions for MBO. Fifteen patients (27.8%) had more than 1 MBO-related admission. Thirty patients were diagnosed with ovarian (55.6%), 17 with endometrial (31.5%), and 7 with cervical (13.0%) cancer. Median length of stay for MBO-associated admissions was 5 days (range 1–46 days). With respect to inpatient interventions, 17 patients underwent gastrostomy or jejunostomy tube placement; 4 received colonic stenting; and 4 underwent diverting colostomy. Fifty-five admissions were discharged home (70.5%), 19 to hospice (24.4%), and 3 (3.85%) to a skilled nursing facility, and 1 patient (1.28%) died while hospitalized. Readmission within 30 days of discharge occurred in 41.0% of cases. Rates of mortality within 3 and 6 months of first MBO-associated admission were 46.3% and 63.0%, respectively. Median time from first MBO admission to death was 70 days (range 1–426). Goals-of-care discussions were documented for 44.8% of patients during first MBO-associated admission, and for 64.1% during any MBO-associated admission.
Conclusion: These data are consistent with the growing body of evidence regarding the mortality associated with MBO, and reinforce the dismal prognosis conferred by this diagnosis. Rates of mortality, readmission, and discharge to hospice following hospitalization for MBO are high, and goals-of-care discussions should be considered at time of first MBO diagnosis.

685 - Poster Session
Pelvic floor dysfunction in the cervical cancer survivor
A. Greenwood, T. Castellano, A.K. Crim and L.L. Holman. The University of Oklahoma Health Sciences Center, Oklahoma City, OK, USA

Objective: Cervical cancer survivors are at risk of long-term side effects from their cancer therapy. Pelvic surgery and pelvic radiation can both cause changes to the vasculature and innervation of the pelvis, leading to pelvic floor dysfunction (PFD). PFD includes bladder, bowel, or sexual side effects, all of which have a negative impact on quality of life for women. The primary goal of this study is to evaluate PFD among cervical cancer survivors, which has not been well-described in the literature to date.

Method: An Institutional Review Board-approved prospective survey of cervical cancer survivors in remission ≥3 months was performed between 2017 and 2019. Patients with history of pelvic exenteration were excluded. Patients were surveyed with items from the NCI’s Patient Reported Outcomes–Common Terminology Criteria for Adverse Events (PRO-CTCAE). Composite impact scores for gastrointestinal (GI), urinary symptoms, and pelvic pain were compiled. Demographic and clinical data were collected from the medical record and tested for association with PFD symptoms.

Results: Of the 98 patients surveyed, 49% reported pretreatment PFD. Constipation (39.8%), diarrhea (21.4%), urinary urgency (59.2%), and urinary frequency (60%) were the most common pretreatment symptoms. One or more of these symptoms started after treatment in 36.7% of patients. Of the sexually active patients, 53.7% reported dyspareunia. Pelvic pain was reported by 42.7% of respondents, with 9.4% reporting frequent or almost constant pelvic pain. Stage, parity, and Charleson comorbidity index were not associated with PFD composite scores (all, \( P > 0.05 \)). BMI was negatively associated with having a higher composite GI PFD score (\( P = 0.02 \)). Cervical cancer survivors who received radiation (\( n = 62 \)) had higher GI-related PFD composite scores than those who did not (\( P = 0.03 \)). Pain and urinary PFD composite scores were also higher, but not statistically significant (\( P = 0.07 \) and \( P = 0.08 \), respectively). There was no association between surgery alone or surgery and radiation with composite PFD scores (all, \( P > 0.05 \)). See Table 1.

Conclusion: Many cervical cancer survivors report PFD symptoms, both prior to and after treatment. Radiation therapy is associated with ongoing symptoms. Screening for PFD prior to treatment initiation may aid in the triage of high-risk individuals to early interventions, thereby potentially improving long-term quality of life.

Table 1. Baseline characteristic for PFD study.

<table>
<thead>
<tr>
<th>Characteristic (N=98)</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years (median)</td>
<td>48.7 (range 25-98)</td>
</tr>
<tr>
<td>BMI in kg/m² (median)</td>
<td>29.6 (range 17-52)</td>
</tr>
<tr>
<td>Race</td>
<td></td>
</tr>
<tr>
<td>White/Caucasian</td>
<td>70</td>
</tr>
<tr>
<td>Black/African American</td>
<td>7</td>
</tr>
<tr>
<td>Hispanic/Native American</td>
<td>11</td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
</tr>
<tr>
<td>Parity</td>
<td></td>
</tr>
<tr>
<td>No Pregnancies</td>
<td>14</td>
</tr>
<tr>
<td>1-2 Pregnancies</td>
<td>28</td>
</tr>
<tr>
<td>&gt;2 Pregnancies</td>
<td>50</td>
</tr>
<tr>
<td>Radiation</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>63</td>
</tr>
<tr>
<td>No</td>
<td>33</td>
</tr>
<tr>
<td>Surgery</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>53</td>
</tr>
<tr>
<td>No</td>
<td>47</td>
</tr>
<tr>
<td>Tobacco Use</td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>52</td>
</tr>
<tr>
<td>No</td>
<td>45</td>
</tr>
</tbody>
</table>
**Objective:** The aim of this study was to assess outcomes of gynecologic cancer patients who received inpatient chemotherapy and to assess the impact of diminished ability to complete activities of daily living (ADLs) using the Katz score.

**Method:** A retrospective cohort study of women with gynecologic cancer who received inpatient chemotherapy at a single tertiary care center from January 2015 to June 2019 was performed. Patients receiving planned inpatient chemotherapy (e.g., EMA-CO) were excluded. Readmission rates and 30-, 60-, and 90-day mortality were evaluated. The Katz score (0–12) was used to evaluate performance status (**Table 1**). Patients were divided into 2 cohorts based on 60-day mortality in order to identify risk factors for poor outcomes.

**Results:** A total of 83 patients were identified, including 54 (65.1%) with ovarian cancer and 22 (26.5%) with uterine cancer. Fifty-eight (69.9%) patients were treated for primary disease. Patients were most often admitted for disease-related symptoms (n = 59, 71.1%) or initial malignancy evaluation (n = 19, 22.9%). The mean Katz score for the entire cohort was 10.9. Overall outcomes were poor, with 34 (41.0%) patients requiring readmission within 30 days and 30-, 60-, and 90-day mortality rates of 18.1% (n = 15), 25.3% (n = 21), and 39.8% (n = 33), respectively. Fifty-one patients (61.4%) were able to receive additional cycles of chemotherapy. Patients who died within 60 days were older (69 vs. 60 years, P = 0.01) and had lower mean Katz scores (10.0 vs 11.3, P = 0.01). Patients who were healthy enough to undergo planned diagnostic laparoscopy and subsequently receive inpatient chemotherapy had significantly lower 60-day mortality rates compared to others (5.5% vs 30.8%, P = 0.03). There was a trend toward higher 60-day mortality in patients who received single-agent rather than multiagent chemotherapy (37.5% vs 20.3%, P = 0.16).

**Conclusion:** Administering inpatient chemotherapy in patients with gynecologic cancers is associated with high rates of 30-day readmission and mortality, especially in older patients with decreased ability to complete ADLs. Significant consideration should be given to a patient’s goals, her quality of life, and cost to the health care system prior to administering inpatient chemotherapy.

**Table 1.** Adapted Katz index of independence in activities of daily living.

<table>
<thead>
<tr>
<th>Activities</th>
<th>Independence</th>
<th>Minimal Assistance</th>
<th>Dependence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bathing</strong></td>
<td>Points: ____</td>
<td>Bathes self completely or needs help in bathing only a single part of the body such as the back, genital area, or disabled extremity</td>
<td>Abilities greater than Dependence but less than Independence</td>
</tr>
<tr>
<td><strong>Dressing</strong></td>
<td>Points: ____</td>
<td>Gets clothes from closets and drawers and puts on clothes and outer garments complete with fasteners. May have help tying shoes.</td>
<td>Abilities greater than Dependence but less than Independence</td>
</tr>
</tbody>
</table>
Toileting Points: ____
Goes to toilet, gets on and off, arranges clothes, cleans genital area without help.
Abilities greater than Dependence but less than Independence
Needs help transferring to the toilet, cleaning self, or uses bedpan or commode.

Transferring Points: ____
Moves in and out of bed or chair unassisted. Mechanical transfer aids are acceptable.
Abilities greater than Dependence but less than Independence
Needs help in moving from bed to chair or requires complete transfer.

Continence Points: ____
Exercises complete self-control over urination and defecation.
Abilities greater than Dependence but less than Independence
Is partially or totally incontinent of bowel or bladder

Feeding Points: ____
Gets food from plate into mouth without help. Preparation of food may be done by another person.
Abilities greater than Dependence but less than Independence
Needs partial or total help with feeding or requires parental feeding.

Total points: ____
12 = High (Complete independence)
0 = Low (Complete dependence)

687 - Poster Session
Patient experience with medical marijuana in women with gynecologic malignancies: A single-institution survey-based study
aYale University School of Medicine, New Haven, CT, USA, bBaylor College of Medicine, Houston, TX, USA, cPenn Medicine, University of Pennsylvania, Philadelphia, PA, USA, dUniversity of Pennsylvania Health System, Philadelphia, PA, USA, eUniversity of California, San Francisco, San Francisco, CA, USA, fYale New Haven Health System - Bridgeport Hospital, Bridgeport, CT, USA, gYale New Haven Health System, New Haven, CT, USA, hSmilow Cancer Hospital at Yale and Yale University, New Haven, CT, USA

Objective: Research regarding the use and effects of medical marijuana is lacking in the field of gynecologic oncology. This study seeks to evaluate patient experience with medical marijuana in gynecologic malignancies.

Method: A 35-question survey exploring patient experience with medical marijuana was administered to women with gynecologic malignancies who use medical marijuana through licensed marijuana dispensaries.

Results: Of the 22 patients (patients) approached for consent, 16 were consented and completed the survey (72%). Sixty-eight percent had ovarian cancer, 25% had uterine, and 6% had cervical. Of the patients using medical marijuana at the time of the survey, 81% were receiving chemotherapy or immunotherapy; 62% had stage III or IV disease; 68% had recurrent disease; and 43% had actively progressive disease. The majority of patients (81%) had never used recreational marijuana or only tried it in the past. Eighty-one percent reported medical marijuana provided relief from cancer-related symptoms. Sixty-eight percent used medical marijuana to address more than 1 symptom, including neuropathy (37%), nausea (37%), decreased appetite (37%), insomnia (31%), bone pain (31%), anxiety (25%), abdominal pain (25%), depression (25%), and joint pain (18%). Seventy-five percent of patients reported medical marijuana worked the same or better than other traditional medications (e.g., opioids, appetite stimulants, anxiolytics) for their cancer-related symptoms. Of patients using opioids (56% of survey participants), 67% reported medical marijuana reduced their opioid use. Of all patients using medical marijuana, 56% reported no side effects from medical marijuana, and 81% felt medical marijuana had a better side effect profile than that of other medications. Of patients who reported favorable symptom control and side effect profile, most (>80%) had never used recreational marijuana or only tried it in the past. See Table 1.

Conclusion: Patients felt that medical marijuana provided effective symptom control with a side effect profile comparable to, or better than, other traditional medication options. More than half of patients who used opioids believed medical marijuana reduced their opioid use. Most patients used medical marijuana to improve multiple cancer or treatment-related symptoms. This study suggests that medical marijuana may be useful for relief of a broad number of cancer-related symptoms at all stages and treatment phases of gynecologic malignancies. Further, medical marijuana appears to have the potential to decrease opioid use.

Table 1. Participant characteristics and experience with MM.

<table>
<thead>
<tr>
<th>Age</th>
<th>How often do you use MM?</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median (range)</td>
<td>Years</td>
<td>6-7 days/week</td>
</tr>
<tr>
<td>60 (24-75)</td>
<td>5 (31)</td>
<td>6 (37)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>n (%)</td>
<td>What forms of MM do you prefer?</td>
</tr>
<tr>
<td>---------------------------</td>
<td>-------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>Caucasian</td>
<td>14 (87)</td>
<td>Smoked</td>
</tr>
<tr>
<td>Black/African American</td>
<td>2 (12)</td>
<td>Vaporized</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Oil</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Edible</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Topical</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year of cancer diagnosis</th>
<th>Median (range)</th>
<th>Would MM help you when admitted to the hospital?</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>No</td>
<td>4 (24)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unanswered</td>
<td>2 (12)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ECOG performance status</th>
<th>n (%)</th>
<th>Was the process of enrolling and gaining access to MM easy?</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>6 (37)</td>
<td>Yes</td>
<td>10 (62)</td>
</tr>
<tr>
<td>1</td>
<td>6 (37)</td>
<td>No</td>
<td>5 (31)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other</td>
<td>1 (6)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Prescription opioid use</th>
<th>n (%)</th>
<th>Do you have concerns about the legality of MM in your state?</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>9 (56)</td>
<td>Yes</td>
<td>4 (25)</td>
</tr>
<tr>
<td>No</td>
<td>7 (43)</td>
<td>No</td>
<td>12 (75)</td>
</tr>
</tbody>
</table>

| Substance use             | n (%) | |
|---------------------------|-------||
| Smoking                   | 0 (0) | |
| Alcohol                   | 8 (50) | |
| Non-RM illicit drugs      | 0 (0) | |

688 - Poster Session
The patient perspective: Timing of routine sexual function screening in women with cancer
J. Sobecki-Rausch, M.F. Peterson, J.K. Rash, L.A. Seaborne and D.M. Kushner. University of Wisconsin School of Medicine and Public Health, Madison, WI, USA

Objective: Sexual problems are prevalent among women with cancer; however, there is a scarcity of data regarding timing of sexual function screening in this population. We aimed to determine optimal timing of routine sexual function screening by investigating experiences of women who sought care for sexual problems after their cancer diagnoses.

Method: We administered a cross-sectional, web-based survey to all cancer patients seen at the Women’s Integrative Sexual Health (WISH) clinic at the University of Wisconsin–Madison since clinic inception. We elicited timing of onset of sexual problems, sexual function communication with providers, and WISH clinic referrals. We performed bivariate analyses to investigate associations between responses and clinicodemographic data including cancer type and age.

Results: A total of 106 women (median age 53 years, range 31–77, 70.2% postmenopausal) responded (response rate = 46.5%). Most had breast (54.7%) or gynecologic cancers (31.1%). Among those without baseline sexual problems (75.2%), most first noticed sexual problems during (38.0%) or <1 year after completing cancer treatments (45.6%). Most discussed sexual problems with an oncology provider during this timeframe (during, 15.1%; <1 year, 52.8%). More than half initiated this conversation themselves (57.1%); 21.9% reported an oncology provider did. Nearly all had their first WISH clinic appointment after completing treatment (89.6%); 53.8% wished they had their appointment sooner. Respondents recommended the ideal time to address sexual problems was during (26.2%) or <1 year after completing treatment (51.5%). Breast cancer patients were more likely than others to initiate conversations about sexual problems themselves (80.0% vs 60.6%, P = 0.05). Women ≤53 years were more likely than women >53 years to first notice sexual problems (75.6% vs 50.0%, P = 0.02) and discuss them with a provider (79.6% vs 55.7%, P = 0.03) during or <1 year after completing cancer treatment.

Conclusion: Women with cancer first noticed sexual problems within 1 year of completing treatment. Many wish they had sought care for sexual problems sooner. Our data support routine sexual function screening within the first year of cancer treatment. Routine screening during treatment may be warranted for younger women.

689 - Poster Session
Palliation of advanced pelvic malignancies via quad shot regimen: A single institution experience
A. Kellogg, G. Vidal, T. Gunter, C. Henson and J.S. Thompson. The University of Oklahoma Stephenson Cancer Center, Oklahoma City, OK, USA
Objective: RTOG 8502 outlines a palliative external beam radiotherapy (EBRT) regimen commonly known as the Quad Shot, wherein cycles of 4 twice-daily treatments are delivered; here our goal is to review techniques used for Quad Shot delivery at our institution and outcomes.

Method: This is a retrospective study of 59 patients, age 35–90 years, with advanced pelvic malignancies, treated at the University of Oklahoma Health Sciences Center Department of Radiation Oncology using the Quad Shot with a cumulative dose of 1,480 cGy per cycle. Patients were eligible to receive up to 3 cycles if needed. We queried our electronic medical records for treatment courses that included 4 total BID treatments delivered over the course of 2 days from 2005 to 2017. We identified 60 patients. One patient did not meet inclusion criteria because of disease process. Treatment response, treatment modality, and overall survival were investigated.

Results: A total of 59 female patients were treated with the Quad Shot regimen and met inclusion criteria. Patients were treated with either conformal radiation or IMRT, 54% and 46%, respectively. Bleeding was seen in 78% of patients. Pain was initially reported by 20% of patients. One patient presented with both bleeding and pain. Only 19% of patients required a third cycle of radiation. Twenty-seven patients (46%) completed 2 cycles, and 21 patients (36%) completed only 1 cycle. Follow-up data are available for 64% of patients. The majority of patients had a good response to therapy with alleviation of symptoms (84%, n = 38); 10.5% (4 patients) had a partial response; and 2 patients had no response to treatment. When comparing response to number of quad shot cycles (total dose delivered), a good response was seen in all groups. Median overall survival was 3.75 months from end of treatment.

Conclusion: Our results confirmed what has been reported, that the Quad Shot is effective in the palliative setting. The majority of our patients reported symptomatic relief. No correlation between the number of cycles delivered and response to therapy was seen, as cycles were delivered based on clinical response. Treatment modality was noted to be almost equally dispersed between IMRT and conformal therapy. Next steps in this retrospective study include further evaluation of toxicity, specifically late toxicity, as well as how treatment modality affects toxicity.

690 - Poster Session
Complementary and alternative medicine use and disclosure in gynecologic oncology patients
H. Chen, R. Ruskin and V. Kennedy. UC Davis Medical Center, Sacramento, CA, USA

Objective: The objective of this study is to determine the frequency with which gynecologic oncology patients disclose their complementary and alternative medicine (CAM) use to their providers.

Method: Patients with gynecologic malignancies or precancerous conditions were approached to complete a 15-minute questionnaire about their use of CAM, their communication with their providers about CAM, and their quality of life. Types of CAM therapies queried were based on categories from the National Institute of Health Office of Cancer and Complementary and Alternative Medicine. Quality of life assessments were performed using the Edmonton Symptom Assessment System (ESAS) and Measure Yourself Concerns and Wellbeing (MYCaW) tools.

Results: From May to July 2018, 129 gynecologic oncology patients were approached. Of these, 100 patients agreed to participate and completed the survey; 87% reported some CAM use. Of these, 63.2% did not identify as being a CAM user. Forty-five percent reported using CAM while undergoing standard therapy, including surgery, chemotherapy, or radiation. Most common types of CAM used were spiritual therapies (77%) and nutrition therapies (70%). The least frequently used form of CAM was energy therapies (19.5%). Other modalities of CAM, including alternative medical systems, exercise therapies, manipulative and body-based methods, mind-body interventions, and pharmacological and biology treatments, were employed by between 28.7% and 50.6% of respondents. Only 30% of patients disclosed their CAM use to their providers. The most common reason for nondisclosure was that providers did not ask (41%). For those who did speak to their providers, 85.7% were satisfied with their provider's knowledge about CAM. Quality of life assessments were similar between CAM users and nonusers.

Conclusion: CAM practice is very common among gynecologic oncology patients. However, only a minority of patients disclose these practices to their cancer providers, mostly because their providers do not ask. When patients do speak to their providers, they are satisfied with their provider's knowledge. CAM therapies during standard treatment can be both beneficial and detrimental to patients. It is important for gynecologic oncologists to initiate conversations about these practices to provide safe care for their patients.

691 - Poster Session
Support for women with recurrent gynecologic cancer and their spouses: A novel program to address a core need
S.L. Wethingtona, A.L. Beavisa, R.L. Stoneb and A.N. Faderb. *Johns Hopkins School of Medicine, Baltimore, MD, USA, *Johns Hopkins Hospital, Baltimore, MD, USA

Objective: The objective of this study is to determine the frequency with which gynecologic oncology patients disclose their complementary and alternative medicine (CAM) use to their providers.
Objective: The interpersonal stressor of recurrent, incurable cancer on a gynecologic cancer survivor and her spouse is significant. As a result, we sought to develop a program that would provide gynecologic cancer survivors and their partners the tools to improve their endurance, communication, intimacy, and hope.

Method: A 3-day, 2 night gynecologic cancer-specific retreat was developed based on a model program in breast cancer care. The program occurred 3 times at a local retreat center from 2017 to 2019 and was led by oncology nurses, palliative care nurse practitioner, yoga/meditation expert, hospital chaplain, administrative coordinator, and physicians. The retreat was free of charge for participants. At the conclusion of the last 2 retreats, participants were asked to give feedback in a survey.

Results: Twenty-six couples were recruited to participate from an urban, academic gynecologic oncology clinic on the recommendation of the women’s physicians. The gynecologic cancer survivors were a median of 64 years old (range 33–74) and receiving palliative treatment for recurrent gynecologic cancer (ovarian, uterine, and cervix). The session topics varied by the needs of each group; however, all included discussion of coping with a diagnosis of recurrent cancer and the uncertainty it brings, building legacy, providing and finding support, and intimacy. In addition, there is meditation, yoga, introduction to journaling, Q&A with an oncologist, and game night. Key program elements included (1) rapid establishment of a safe space for sharing and commonality, (2) group sessions as well as time for individuals and couples to reflect on the content of the group sessions, and (3) a concluding session on hope. Of the 27 participants who completed the survey, 100% answered that their expectations were met or exceeded and that they and their spouse will be more likely to discuss issues related to cancer. The cost per participant in 2019, including meals and lodging, was US$453.

Conclusion: A weekend retreat can offer women with recurrent gynecologic cancer and their spouses a high-yield, cost-effective, supportive experience to assist them on the cancer journey. Given the high participant satisfaction, this novel program could be considered at other institutions with sharing of best practices to allow for further program optimization.

692 - Poster Session
Sexual concerns, psychosocial morbidity and quality of life in gynecologic cancer survivors
L.M. Lazoa, R. Ratnaparkhib, T.J. Vogelc, E.D. Moorec, G.C. Rodriguezc and C.V. Kirschnerc. aThe University of Chicago Medicine, Chicago, IL, USA, bStanford University School of Medicine, Stanford, CA, USA, cNorthShore University Health System, Evanston, IL, USA

Objective: Our study aims to identify the prevalence of sexual concerns among gynecologic cancer survivors and its correlation to global well-being, including psychosocial factors and quality of life (QOL).

Method: Women diagnosed with a gynecologic malignancy participating in a weekend survivorship program or treated at our integrated cancer center from 2017 to 2018 completed our survey. Cross-sectional data on patient and medical characteristics were self-reported. QOL and symptoms were assessed with the Functional Assessment of Cancer Therapy (FACT-G) and scored on a 5-point Likert scale. Comparisons were made between women who expressed increased sexual life concerns or no sexual concerns and were considered significant for $P < 0.05$.

Results: Of 59 responders, 31 had no sexual concerns, 23 had some degree of increased sexual life concerns, and 5 did not respond. The no sexual concerns group was older at diagnosis (62 vs 56 years) and was less commonly married (55% vs 83%). The majority of women in both groups had endometrial or ovarian cancer. There were no significant differences in cancer type, stage, or chemoradiation use between groups. The increased sexual life concerns group more often had significant concerns because of negative body image (70% vs 32%) and strain on their relationship with a significant other (61% vs 24%). Increased sexual life concerns patients also reported greater rates of menopausal symptoms, sexual dysfunction, worried mood, and memory issues in the past month. Increased sexual life concerns was associated with lower satisfaction with sex life (mean 1.5) as well as low QOL (mean 2.3) and decreased enjoyment of fun activities (mean 2.6). Sixty-five percent of increased sexual life concerns patients identified interest in assistance with strategies to enhance their sex life and 43% a need for help in improving relationships.

Conclusion: Gynecologic cancer survivors with increased sexual life concerns have high subjective morbidity across multiple physical, psychological, and social components. Although a causative association cannot be inferred from these data, sexual health is an indicator of morbidity, particularly in regard to psychosocial health and overall QOL. This highlights the importance of sexual health assessment, personalized education, and treatment as part of survivorship care.

693 - Poster Session
Fear of cancer recurrence in survivors of gynecologic malignancies
R. Ratnaparkhi, L.M. Lazob, T.J. Vogelc, E.D. Moorec, G.C. Rodriguezc and C.V. Kirschnerc. aStanford University School of Medicine, Stanford, CA, USA, bThe University of Chicago Medicine, Chicago, IL, USA, cNorthShore University Health System, Evanston, IL, USA
**Objective:** Prior studies suggest fear of cancer recurrence is common among cancer survivors and not specific to cancer type. This study characterized and compared fear of cancer recurrence severity between endometrial and ovarian cancer patients in a gynecologic oncology survivorship clinic. Associations between fear of cancer recurrence, medical and demographic factors, and patient-reported quality of life (QOL) were also evaluated.

**Method:** Surveys were administered to women with a diagnosed gynecologic malignancy who (1) participated in a weekend survivorship program or (2) completed treatment at our center from 2017 to 2018. Cross-sectional data on demographics, medical characteristics, and patient needs/concerns were collected with self-report questionnaires. QOL was assessed with the Functional Assessment of Cancer Therapy (FACT-G), and fear of cancer recurrence was scored on a 5-point Likert scale from 0 (no concern) to 4 (very significant concern). Descriptive statistics were analyzed, and Student t test, χ² test, Spearman correlation, and rank biserial correlation were conducted as appropriate.

**Results:** A total of 17 endometrial and 22 ovarian cancer survivors completed the survey. Both endometrial and ovarian cancer patients had considerable fear of cancer recurrence (mean 2.58, SD 1.37, vs mean 2.52, SD 1.40, respectively); there was no significant difference in fear of cancer recurrence between cancer types ($P = 0.09$). In univariate analysis, age, stage, time since diagnosis, active ongoing treatment, level of education, and religious participation were not significantly associated with fear of cancer recurrence. Fear of cancer recurrence was not well correlated with QOL (r = −0.19). Patients reported a negative impact on QOL from fear of worsening clinical status (mean 2.49, SD 1.11) or death (mean 2.92, SD 1.17). Approximately half of the cohort endorsed regular exercise (47%), while few reported vegetable intake (26%) or self-identified a need for assistance with weight loss (mean 1.33, SD 1.63) and nutrition (mean 1.56, SD 1.46).

**Conclusion:** Fear of cancer recurrence was prevalent among gynecologic cancer survivors with similar intensity even in patients with good prognostic factors including younger age, earlier stage, and increasing interval since diagnosis. This suggests opportunity for physician intervention to educate and encourage low-risk cancer survivors and provide personalized support of healthy lifestyle changes as part of survivorship care.

---

**Gait speed change during first chemotherapy cycle may predict later dose-reduction in ovarian cancer patients over 70: An exploratory analysis**

**E. Hile**, A. Valente, A. Gandhi, C. Xu, R. Neuhold and K.N. Moore. *The University of Oklahoma Health Sciences Center, Oklahoma City, OK, USA, Stephenson Cancer Center, The University of Oklahoma Health Sciences Center, Oklahoma City, OK, USA*

**Objective:** With chemotherapy increasingly offered to women with ovarian cancer older than 70 years, clinically feasible predictors of chemotherapy tolerance are needed. We conducted a secondary analysis in older ovarian cancer patients to explore how gait speed and grip strength trajectories relate to adverse events over a course of chemotherapy in older women.

**Method:** We analyzed longitudinal data from 17 women age 70–86 years (mean 75.9 ± 4.5 years) with stage III–IV ovarian cancer enrolled in an exercise feasibility study. Grip strength and gait speed were measured at up to 4 visits: before chemotherapy cycles C1, C2, and C3 and after C3/surgery if applicable. Four dichotomous (yes/no) adverse events were recorded for each cycle: hospitalization, dose reduction, treatment delay, and grade 3–5 toxicity. After plotting individual grip strength and gait speed trajectories, we calculated gain speed change with each cycle. We stratified the sample by each adverse event and used Wilcoxon rank sum test to compare adverse event and no adverse event groups on gait speed change prior to that cycle. We then transformed grip strength and gait speed change to 5-point scales (±2 = moderate; ±1 = small significant; 0 = no change) to test adverse event associations by Cochran-Armitage Trend Test (CATT). All alpha were 0.05.

**Results:** Decline in gait speed with cycle 1 exceeded meaningful change of 0.05 m/sec in 58% of women, while grip strength declined in 33%. Compared to women with no C3 dose reduction, women with C3 dose reduction ($n = 3$, mean age 73 years) had 5-fold greater median gait speed decline in C1 (0.28 vs −0.05 m/sec, $P = 0.03$), but 15-fold greater improvement in C2 (+0.36 m/sec vs −0.02, $P = 0.036$). Ordinal grip strength change trend associated with dose reduction and treatment delay at visit 4 (CATT exact $P < 0.001$). See Figure 1.

**Conclusion:** In older ovarian cancer patients, large gait speed decline in chemotherapy cycle 1 may predict need for dose reduction in future cycles, even if gait speed recovers in cycle 2. These exploratory trajectories warrant further investigation, as they may inform clinical prediction of chemotherapy tolerance.
Objective: The aim of this study was to examine how engagement in end-of-life care by women with gynecologic cancers is shaped by ideological commitments of patients, caregivers, and providers to a political economy of hope and culture of cure. Coconstructed narratives produce a culture that serves as a barrier to utilization of palliative and hospice care. This explains how current interventions centered on education or communication fall short in overcoming this limitation of gynecologic oncologic care.

Method: Semistructured qualitative interviews were conducted with 18 women with recurrent or advanced gynecologic cancer referred to palliative and/or hospice care at an urban academic medical center. Thirteen patient-identified primary caregivers and 8 oncologists and mid-level providers were also interviewed. Transcripts were coded and themes developed through grounded theory analysis. Clinical data were analyzed using descriptive statistics.

Results: Of the 18 women interviewed, 14 enrolled in hospice or palliative care. All but 2 discussed family obligations as a major factor in decision-making. Primary caregivers expressed relief when end-of-life care options were discussed, despite reluctance to begin the conversation. Providers expressed hesitance to initiate these discussions because they felt patients would feel abandoned or undervalued.

Conclusion: The political economy of hope in American oncological care has been explored from the perspectives of physicians. This study demonstrates the coconstruction of narratives by multiple stakeholders, including patients and caregivers, and resultant commitments to innovative curative therapeutics. Personal and collective hope produces shared narratives of curing cancer as the only best course, as alternatives function to undermine the very sociocultural context that drives oncological care forward. The nature of political economy of hope has not previously been explored within gynecologic oncology and is particularly salient given roles of many patients as caregivers within their families. This paper emphasizes the production of this important cultural facet of oncology from the perspectives of patients and caregivers, whose shared narratives offer insight into the complex and intersubjective barriers to greater utilization of palliative and hospice care.
Objective: The aim of this study was to determine the effect of cross-protection, viral shift, and herd immunity after implementation of the quadrivalent (4vHPV) vaccine in adult women.

Method: Data were obtained from the National Health and Nutrition Examination Survey from 2003 to 2016. Participants were divided into the pre-vaccine era (2003–2006) and the post-vaccine era (2007–2016). Vaccine-targeted HPV serotypes included 6, 11, 16, and 18, and nonvaccine-targeted HPV serotypes were defined as all HPV strains other than 6, 11, 16, and 18. HPV serotype testing was performed using vaginal swabs in conjunction with Digene Hybrid Capture and Roche Linear Array. $\chi^2$ test was used for statistical analyses.

Results: Of 4,030 female participants, the median age was 25 years (range 18–36 years). The average number of lifetime sexual partners was 9; 91.2% of women identified as heterosexual. To assess the potential effect of cross-protection, we evaluated the prevalence of nonvaccine-targeted serotypes in those who received 4vHPV and found an increase in these serotypes compared to individuals in the pre-vaccine era (43.9% to 53.3%, $P = 0.001$). Of those vaccinated with 4vHPV, 53.6% had documented infection with other HPV strains, including HPV 53 (18.6%), HPV 54 (16.3%), HPV 89 (14.9%), HPV 62 (13.7%), and HPV 52 (13.1%). To assess the potential effect of herd immunity, we evaluated the unvaccinated population and showed that the rate of vaccine-targeted HPV serotypes in the pre- and post-vaccine era did not significantly change (11.4% to 10.9%, $P = 0.66$).

Conclusion: In this population analysis, our data did not demonstrate any evidence of cross-protection against nontargeted HPV serotypes in the 4vHPV vaccinated participants. With current vaccination rates, there is no evidence of herd immunity.

697 - Poster Session Stepping into survivorship: Harnessing mobile health and principles of behavioral economics to increase physical activity in ovarian cancer survivors


Objective: Physical activity improves physical function, quality of life, and mental health, yet <80% of ovarian cancer survivors meet activity guidelines. We piloted an intervention designed to increase physical activity in ovarian cancer survivors by leveraging fitness trackers, gamification, and social support.

Method: This 24-week study (12-week intervention, 12-week follow-up) enrolled women with ovarian cancer 6–30 weeks after initial treatment with a self-selected “teammate.” Participants used fitness trackers to track daily steps, establish a baseline, select a step goal increase, and enroll in a collaborative game designed with insights from behavioral economics, including points and levels for achieving step goals. Primary outcomes were feasibility (i.e., ≥60% approach-to-consent ratio among eligible patients, ≥70% adherence to fitness tracker), acceptability (i.e., ≤20% of participants reported burden or regretted taking part in the study), and preliminary efficacy (i.e., ≥70% reported increased motivation for activity).

Results: We recruited 24 participants (mean age 63 years, range 37–79 years; mean daily steps, 7,219, range 1,152–12,825) with a 94% approach-to-consent ratio. All participants completed the 12-week intervention with 94% adherence to the tracker. Among the 15/24 who completed the 24-week follow-up at abstract submission, 0% agreed/strongly agreed that the study was burdensome; 0% agreed/strongly agreed when asked if they regretted participating; and 93% agreed/strongly agreed with the statement “the study motivated me to increase activity levels.” Change in mean daily steps will be reported at the meeting.

Conclusion: A mobile health intervention leveraging fitness trackers, gamification, and social support is feasible, acceptable, and perceived to be effective for increasing physical activity among ovarian cancer survivors. A randomized trial is warranted to test the effectiveness of the intervention.

698 - Poster Session Impact of standardized criteria for palliative care consultation in gynecologic oncology

G. David-West, I. Dhanuka and T.S. Pradhan.

Objective: To evaluate the impact of implementing standardized criteria for palliative care consultation in gynecologic oncology.

Method: A retrospective chart review was conducted for patients with gynecologic cancer who were referred for palliative care consultation from 2018 to 2020. The criteria included symptom control, referral for hospice, and discussion of end-of-life preferences. The primary outcome was the number of patients referred for palliative care consultation.

Results: A total of 120 patients were reviewed. The number of patients referred for palliative care consultation increased from 20% in 2018 to 30% in 2020. The percentage of patients who had symptom control discussed increased from 50% in 2018 to 70% in 2020. The number of patients referred for hospice consultation increased from 10% in 2018 to 20% in 2020. The percentage of patients who had end-of-life preferences discussed increased from 30% in 2018 to 50% in 2020.

Conclusion: The implementation of standardized criteria for palliative care consultation in gynecologic oncology resulted in an increase in the number of patients referred for palliative care consultation and improved discussion of symptom control, hospice referral, and end-of-life preferences.
Objective: The benefits of palliative care consultation in advanced cancer have been well studied, and the early utilization of palliative care has been endorsed by the American Society for Clinical Oncology (ASCO) and the Society of Gynecologic Oncology (SGO). The aim of this study was to improve the early utilization of palliative care services in the gynecologic oncology inpatient population by following standardized criteria triggering a suggested palliative care consult and to determine whether this standardized approach has a positive impact on length of stay (LOS), readmission rate, and services provided at time of discharge (i.e., VNS, hospice, rehabilitation).

Method: This was a cross-sectional study of all gynecologic oncology patients admitted to the gynecologic oncology service at an acute care hospital from October 1, 2018, to April 30, 2019, a 6-month period during the initiation of standardized criteria triggering a suggested palliative care consult. Criteria that were previously identified and standardized for a palliative care solid tumor study were adapted to the gynecologic oncology population. They include advanced-stage gynecologic malignancy with either readmission within 30 days of last hospitalization or admission for active symptoms including pain, dyspnea, nausea and/or vomiting, constipation, and psychosocial distress. Patients admitted for primary cancer surgery were excluded. This intervention group was compared to a matched historic control group from 1 year prior to initiation of the intervention. χ^2 and Fisher exact tests were used for data analysis.

Results: A total of 26 patients were identified in the intervention and 25 in the control group. Of 26 patients in the intervention group, 13 (50%) had a palliative care consultation compared to 5/24 (20%) patients in the control group (P < 0.05). Of the patients who received palliative care, 7/13 (54%) in the intervention group had >7 day LOS versus 3/5 (60%) in the control group (P > 0.05); 5/13 (38%) in the intervention group had at least 1 readmission versus 3/5 (60%) in the control group (P > 0.05); and 11/13 (85%) in the intervention group had services at time of discharge versus 0/7 (0%) in the control group (P < 0.05).

Conclusion: Standardizing criteria for suggested palliative care consultation statistically significantly increased the number of patients receiving palliative care consultation. In addition, the intervention significantly increased the services provided at time of discharge. Because of small sample size, our data did not show a significant improvement in length of stay or readmission rates. However, based upon our results, using standardized criteria in the inpatient setting for palliative care consults is beneficial and may allow for more timely referrals and access to services.

Uterine carcinosarcomas and metaplastic breast carcinomas: Genetically related cancers?
Memorial Sloan Kettering Cancer Center, New York, NY, USA, University of Genoa, Genoa, Italy, University of Basel, Basel, Switzerland, Fondazione IRCCS Ca’ Grande – Ospedale Maggiore Policlinico, Milan, Italy, University of Turin, Torino, Italy, Institut Curie, Paris, France

Objective: Uterine carcinosarcoma (UCS) and metaplastic breast carcinoma (MBC) are aggressive cancers characterized by an admixture of epithelial and mesenchymal-appearing histologic components, poor clinical outcome, and relative resistance to conventional chemotherapy regimens. We sought to define whether UCSs and MBCs harbor similar patterns of genetic alterations, and whether the different histologic components of UCSs and MBCs are clonally related.

Method: Whole-exome sequencing (WES) data from 55 UCSs from The Cancer Genome Atlas and 35 MBCs previously reported from our laboratory were reanalyzed to define somatic genetic alterations. In addition, the epithelial and mesenchymal components of 6 UCSs and 11 MBCs were microdissected separately and subjected to WES, and their clonality was assessed.

Results: The repertoire of somatic mutations in UCSs and MBCs shared many similarities, including PIK3CA (33% UCSs vs 29% MBCs) and PTEN mutations (16% UCSs vs 14% MBCs). Mutations in TP53 (93% UCSs vs 69% MBCs), FBXW7 (38% UCSs vs 0% MBCs), and PPP2R1A (27% UCSs vs 0% MBCs) were significantly more frequent in UCSs than in MBCs. Both UCSs and MBCs displayed high levels of copy number alterations (CNAs). Pathway analysis using somatic mutations and amplifications/homozygous deletions revealed an enrichment of the Wnt and Notch signaling pathways in UCSs (29/55 Wnt pathway alterations; 31/55 Notch pathway alterations) and MBCs (15/35 Wnt pathway alterations; 15/35 Notch pathway alteration), which are known to play a role in epithelial-to-mesenchymal transitions (EMT). Despite the similar repertoire of somatic mutations and CNAs, UCSs (7%) displayed genomic features of homologous recombination DNA repair defects (HRD) less frequently than MBCs (42%, P < 0.001). WES analysis of the histologically distinct components revealed that the epithelial and mesenchymal components of all MBCs and UCSs were clonally related, and that in a subset of cases the sarcoma component was bioinformatically inferred to stem from a minor subclone of the carcinoma component.

Conclusion: Given their similar histology and signaling pathways affected by genetic alterations involved in EMT, UCSs may constitute the uterine counterpart of MBCs; however, HRD is uncommon in UCSs. In both UCSs and MBCs, the carcinoma and sarcoma components are clonally related.
Impact of ergonomic-friendly total laparoscopic hysterectomy on operative outcome among women with pre-invasive cervical cancer

H. Lee, K.J. Eoh, J.Y. Lee, S. Kim, S.W. Kim, Y.T. Kim and J.W. Kim. Yonsei University College of Medicine, Seoul, South Korea

Objective: As the field of minimally invasive surgery grows, laparoscopists are exposed to risk of developing musculoskeletal disease due to increase in physical workload. We sought to compare surgical outcomes among ergonomic-friendly total laparoscopic hysterectomy (EF-TLH) that aims to ease the physical workload of laparoscopists, conventional total laparoscopic hysterectomy (TLH), and total abdominal hysterectomy for pre-invasive cervical cancer without underlying benign condition in order to minimize biased outcome.

Method: The prospectively collected demographic and surgical data of 277 patients with pre-invasive cervical cancer who underwent EF-TLH (n = 150), TLH (n = 81), or TAH (n = 46) between July 2013 to May 2019 were evaluated. Pre-invasive cervical cancer included high-grade cervical intraepithelial neoplasia and pathologically proven carcinoma in situ. The ergonomic-friendly setting of laparoscopic surgery begins with adjustment of operator seating position with minimal musculoskeletal pressure and flexibility of port site locations suitable for each operation.

Results: Three groups shared similar patients' characteristics including age, BMI, parity, preoperative hemoglobin, and number of previous abdominal surgeries. The EF-TLH group showed shortest operating time (P < 0.001) and least estimated blood loss (P < 0.001), compared to the other two groups. In terms of perioperative outcome, three groups showed no difference in postoperative hemoglobin drop and intraoperative transfusion rate. In the TAH group, the weight of the uterus was heavier, which is assumed to inevitably have more open cases as the uterus is larger. See Table 1.

Conclusion: EF-TLH is an efficient substitution for conventional TLH and TAH under similar circumstances with less operating time and blood loss when a hysterectomy is considered to be performed while supporting optimal position of laparoscopists during surgery.

Table 1.

<table>
<thead>
<tr>
<th>Patients characteristics by group (n=277)</th>
<th>EF TLH (n=150)</th>
<th>TLH (n=81)</th>
<th>TAH (n=46)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, mean (SD)</td>
<td>52.6 (11.4)</td>
<td>53.5 (11.7)</td>
<td>55.7 (10.9)</td>
<td>0.735</td>
</tr>
<tr>
<td>Body mass index, kg/m² mean (SD)</td>
<td>23.7 (3.6)</td>
<td>23.4 (3.3)</td>
<td>23.7 (3.4)</td>
<td>0.178</td>
</tr>
<tr>
<td>Parity</td>
<td>0.083</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>23 (8.3%)</td>
<td>11 (4.0%)</td>
<td>12 (4.3%)</td>
<td></td>
</tr>
<tr>
<td>≥1</td>
<td>127 (45.8%)</td>
<td>70 (25.3%)</td>
<td>34 (12.3%)</td>
<td>0.158</td>
</tr>
<tr>
<td>Patients with abdominal surgery histories</td>
<td>23 (8.3%)</td>
<td>17 (6.1%)</td>
<td>11 (4.0%)</td>
<td>0.328</td>
</tr>
<tr>
<td>Patients with cesarean deliveries</td>
<td>18 (24.4%)</td>
<td>15 (5.4%)</td>
<td>12 (4.3%)</td>
<td>0.062</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Comparison of surgical outcomes between EF-TLH, Conventional TLH, and TAH</th>
<th>Ergonomic-friendly TLH (n=150)</th>
<th>Conventional TLH (n=81)</th>
<th>Conventional TAH (n=46)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating time, min mean (SD)</td>
<td>56.9 (18.6)</td>
<td>80.8 (42.7)</td>
<td>96.3 (40.3)</td>
<td>0.001</td>
</tr>
<tr>
<td>Estimated blood loss, mL mean (SD)</td>
<td>32.3 (35.9)</td>
<td>52.2 (105.5)</td>
<td>102.8 (162.9)</td>
<td>0.000</td>
</tr>
<tr>
<td>Initial Hb mean (SD)</td>
<td>13.0 (1.3)</td>
<td>12.8 (1.4)</td>
<td>13.0 (1.4)</td>
<td>0.212</td>
</tr>
<tr>
<td>Δ Hb mean (SD)</td>
<td>1.9 (0.9)</td>
<td>1.8 (1.2)</td>
<td>1.5 (1.0)</td>
<td>0.465</td>
</tr>
<tr>
<td>Intraoperative transfusion (%)</td>
<td>0 (0.0%)</td>
<td>1 (0.4%)</td>
<td>0 (0.0%)</td>
<td>0.297</td>
</tr>
<tr>
<td>Uterus weight, g mean (SD)</td>
<td>108.2 (78.7)</td>
<td>91.0 (49.6)</td>
<td>138.0 (143.1)</td>
<td>0.000</td>
</tr>
</tbody>
</table>
complex atypical hyperplasia
R.S. Mandelbaum, a, M. Ciccone b, M. Khoshchehreh b, H. Purswani b, E.B. Morroco a, S. Matsuzaki a, H. Machida a, C.E. Dancz b, B. Ozel b, L.D. Roman a, R.J. Paulson a and K. Matsuo b. aUniversity of Southern California, Los Angeles, CA, USA, bKeck School of Medicine of USC, Los Angeles, CA, USA

Objective: Previous studies have suggested that metformin may enhance the therapeutic effect of progestin therapy for endometrial hyperplasia or malignancy. However, it is not known how the route of progestin therapy, either local administration via an intrauterine device or systemic, affects treatment outcomes in conjunction with metformin. This study examined the effectiveness of concurrent metformin and progestin therapy for women with complex atypical hyperplasia (CAH), stratified by progestin route (systemic vs local).

Method: This single-institution retrospective study examined consecutive women with CAH who received progestin therapy from 2003 to 2018. Time-dependent analyses for complete response (CR) rate were performed comparing concurrent metformin users with nonusers in the oral progestin group and in the levonorgestrel-releasing intrauterine device (LNG-IUD) group.

Results: In the oral progestin group (n = 176), the mean age and BMI were 36.8 years and 39.1 kg/m², respectively. A total of 36 (20.5%) of these women used both oral progestins and metformin. After controlling for diabetes status, metformin users had a CR rate similar to those who did not take metformin (1-year cumulative rates, 32.4% vs 32.9%, aHR = 0.75, 95% CI 0.37–1.52, P = 0.426). In the LNG-IUD group (n = 69), the mean age and BMI were 36.9 years and 42.1 kg/m², respectively. There were 15 (21.7%) women who took metformin in addition to the LNG-IUD. After controlling for diabetes status, metformin users had a significantly higher CR rate compared to nonusers (1-year cumulative rates, 100% vs 73.2%, aHR = 2.920, 95% CI 1.392–6.124, P = 0.005).

Conclusion: In this predominantly obese population, concurrent metformin may be more effective with local rather than systemic progestin therapy for women with CAH. Systemic progestins appear to offset the added benefit of concurrent metformin therapy in this setting.

Does genomic loss of heterozygosity (gLOH) in endometrial carcinomas (EC) predict platinum sensitivity (PS)?
aZucker School of Medicine at Hofstra/Northwell, New Hyde Park, NY, USA, bHofstra - North Shore Long Island Jewish School of Medicine, Manhasset, NY, USA, cFoundation Medicine, Cambridge, MA, USA

Objective: Homologous recombination deficiency (HRD), identified by HRD genomic alterations (GA) or percentage gLOH, correlates with PARP inhibitor response in ovarian cancer (OC). Since the copy number high (CN-H) TCGA EC molecular subtype (EC-MS) shares molecular features with high-grade OC, our aim was to evaluate the role of gLOH in predicting PS and as a marker of HRD.

Method: Tumor tissues collected from 89 EC patients at our institution were analyzed for all classes of genomic alterations (GA) by hybrid-capture, next-generation sequencing for up to 324 genes. Algorithms evaluated microsatellite instability (stable vs high), tumor mutation burden (TMB; mutations/Mb), and percentage high gLOH (high ≥16%). Sixty-nine evaluable cases with percentage gLOH were assigned EC-MS (ultramutated, MSI-H; copy number [CN]-low; CN-high). Retrospective chart review established clinical characteristics, including response to platinum agents (PS defined per OC literature as PFS >6 months) in 46 of 69 cases. (See Table 1. Relationships of PS, GA, EC-MS, and percentage gLOH were assessed using Fisher exact test.

Results: The mean gLOH percentage varied by EC-MS, with MSI-H at 1.7% (SD 1.4), CN-low at 4.7% (SD 3.0), and CN-high at 12.4 (SD 7.8). Correlation of high gLOH with PS approached statistical significance (P = 0.054), with all high gLOH patients (n = 5) who received platinum therapy, qualifying as PS. High gLOH significantly correlated with CN-H subtype (n = 10, P = 0.011). Expected survival advantage was seen in the PS group, and a trend toward improved OS was seen in the 10 high gLOH patients but was not statistically significant (P = 0.099). Cox proportional regression model showed importance of percentage gLOH in predicting OS (P = 0.004), along with stage IV and black race. Detection of CCNE1 amplification was significantly correlated with platinum resistance (P < 0.05).

Conclusion: High gLOH patients tend to fall into CN-high serous-like tumor types based on TCGA categories. A relationship between gLOH and PS in EC appears to be approaching statistical significance. A larger sample size is required to predict the therapeutic advantage of platinum-based therapy or the best percentage gLOH threshold for EC. If the biologic basis for high gLOH in EC is similar to that in OC, PARP inhibitors may be effective for high gLOH EC and could be tested in a biomarker-selected patient population.

Table 1. A: Patient characteristics. B: Predictors of platinum sensitivity.
### Demographics

<table>
<thead>
<tr>
<th></th>
<th>n= 69</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age median:</strong></td>
<td>69.0 [62.0; 74.0]</td>
</tr>
<tr>
<td><strong>BMI mean:</strong></td>
<td>30.9 SD +/- 6.09</td>
</tr>
<tr>
<td><strong>Race:</strong></td>
<td></td>
</tr>
<tr>
<td>Asian and others</td>
<td>16 23.2%</td>
</tr>
<tr>
<td>Black</td>
<td>16 23.2%</td>
</tr>
<tr>
<td>White</td>
<td>37 53.6%</td>
</tr>
<tr>
<td><strong>Ethnicity:</strong></td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>8 11.8%</td>
</tr>
<tr>
<td>Non-Hispanic</td>
<td>60 88.2%</td>
</tr>
<tr>
<td><strong>Histology:</strong></td>
<td></td>
</tr>
<tr>
<td>Carcinosarcoma</td>
<td>10 14.5%</td>
</tr>
<tr>
<td>Clear cell</td>
<td>6 8.7%</td>
</tr>
<tr>
<td>Serous</td>
<td>27 39.1%</td>
</tr>
<tr>
<td>Endometrioid</td>
<td>17 24.6%</td>
</tr>
<tr>
<td>Grade 1</td>
<td>5 7.25%</td>
</tr>
<tr>
<td>Grade 2</td>
<td>6 8.7%</td>
</tr>
<tr>
<td>Grade 3</td>
<td>6 8.7%</td>
</tr>
<tr>
<td>Other</td>
<td>9 13.0%</td>
</tr>
<tr>
<td><strong>Stage:</strong></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>23 33.3%</td>
</tr>
<tr>
<td>II</td>
<td>1 1.45%</td>
</tr>
<tr>
<td>III</td>
<td>22 31.9%</td>
</tr>
<tr>
<td>IV</td>
<td>23 33.3%</td>
</tr>
<tr>
<td><strong>Platinum Status:</strong></td>
<td>n=46</td>
</tr>
<tr>
<td>Sensitive</td>
<td>25 54.3%</td>
</tr>
<tr>
<td>Resistant</td>
<td>21 45.7%</td>
</tr>
<tr>
<td><strong>LOH score median:</strong></td>
<td>8.19 [3.10;12.6]</td>
</tr>
</tbody>
</table>

### Molecular Subtype

<table>
<thead>
<tr>
<th></th>
<th>Sensitive</th>
<th>Resistant</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Platinum</strong></td>
<td>n= 25(%)</td>
<td>n= 21(%)</td>
<td></td>
</tr>
<tr>
<td>CCNE1</td>
<td>1(4)</td>
<td>6(30)</td>
<td>0.033</td>
</tr>
<tr>
<td>Median LOH</td>
<td>8.6[5.0;11.2]</td>
<td>8.2[3.8;12.8]</td>
<td></td>
</tr>
<tr>
<td>%gLOH ≥14</td>
<td>6(75)</td>
<td>2(25)</td>
<td>0.26</td>
</tr>
<tr>
<td>%gLOH ≥16</td>
<td>5(100)</td>
<td>0(0)</td>
<td>0.054</td>
</tr>
<tr>
<td><strong>Molecular Subtype</strong></td>
<td>0.51</td>
<td></td>
<td></td>
</tr>
<tr>
<td>POLE/Ultramutated</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>MSI-High</td>
<td>3 (12.0%)</td>
<td>2 (9.52%)</td>
<td></td>
</tr>
<tr>
<td>Copy number low</td>
<td>6 (24.0%)</td>
<td>2 (9.52%)</td>
<td></td>
</tr>
<tr>
<td>Copy number high</td>
<td>16 (64.0%)</td>
<td>17 (81.0%)</td>
<td></td>
</tr>
</tbody>
</table>

---

703 - Poster Session

**Impact of adjuvant therapy on oncologic outcomes in early-stage uterine clear cell carcinoma**

S. Pedra Nobre\(^a\), B. Ataseven\(^b,c\), A.D. Bois\(^b\), V. Makkers\(^a\), K. Alektiar\(^a\), M.M. Leitao Jr.\(^a\), N.R. Abu-Rustum\(^a\) and J.J. Mueller\(^a\).

\(^a\)Memorial Sloan Kettering Cancer Center, New York, NY, USA, \(^b\)Kliniken Essen-Mitte, Essen, Germany, \(^c\)University of Munich, München, Germany
Objective: The aim of this study was to determine the impact of adjuvant therapy on oncologic outcomes in patients with uterine clear cell carcinoma (UCCC).

Method: We conducted a retrospective review at 2 institutions from 2000 to 2015. Patients with clinical stage I and stage II disease of either clear cell or mixed histology with a clear cell component were included. Appropriate statistical analyses were performed.

Results: Forty-eight patients were identified and analyzed. Median age at diagnosis was 67 years (range 49–91 years). Median BMI was 27.7 kg/m² (range 16.7 kg/m²–52.5 kg/m²). All patients underwent hysterectomy and bilateral salpingo-ooophorectomy. Twenty-eight (58%) of 48 patients had an open, 7/48 (15%) a laparoscopic, and 13/48 (27%) a robotic procedure. In all, 87.5% of patients had clear cell histology, and 12.5% had mixed histology with a clear cell component. Stage distribution was as follows: stage I, 94%, and stage II, 6%. Forty (83%) of 48 patients received adjuvant therapy; 19 (48%) of 40 received chemotherapy and radiation therapy (RT); 18 (45%) of 40 received RT alone; and 3 (7%) of 40 received chemotherapy alone. Eight (17%) of 48 patients recurred. Median follow-up was 65 months (range 1–199 months). For all patients, the 5-year progression-free survival (PFS) rate was 81.7% (SE ± 5.9), and the 5-year overall survival (OS) rate was 89.5% (SE ± 5.1). There was no significant difference in either PFS or OS, regardless of type of adjuvant therapy ($P = 0.56$ and $P = 0.42$, respectively). See Figure 1.

Conclusion: In this multiinstitution series in patients with treated early-stage uterine clear cell carcinoma, there was no significant difference in survival regardless of adjuvant therapy used. Further evaluation of adjuvant therapy in early-stage UCCC based on stage, age, patient factors, and molecular phenotype should be undertaken.
Objective: The purpose of this study was to compare perioperative and oncologic outcomes between minimally invasive surgery (MIS) and an open approach in the treatment of uterine carcinosarcoma.

Method: We retrospectively identified all patients with newly diagnosed uterine carcinosarcoma who underwent primary surgery via any approach at our institution from January 2009 to January 2018. Patients with known bulky disease identified on preoperative imaging were excluded. \( \chi^2 \) and Mann-Whitney U tests were used to compare categorical and continuous variables, respectively. Kaplan-Meier curves were used to estimate survival, compared using log rank test.
**Results:** We identified 152 patients. Forty-four (29%) underwent an open approach, and 108 (71%) an MIS approach. Within the MIS group, 90/108 (83%) had a robotic procedure, and 14/108 (13%) had a laparoscopic procedure. There were 4 (3.7%) patients converted to open procedure. Median age, BMI, operative time, stage, complication grade, and use of adjuvant treatment were clinically and statistically the same between both groups. Median length of stay in the open group was 4 days (range 2–21 days) compared to 1 day (range 0–6 days) in the MIS group ($P \leq 0.001$). Any 30-day complication rate was 43% in the open group compared to 10% in the MIS group ($P < 0.001$). Median follow-up for the entire cohort was 29.8 months (range 1–121 months). Two-year progression-free survival rates were 57% (SE ±7.7) and 58% (SE ±5.1), respectively ($P = 0.9$). Two-year disease-specific survival rates were 69% (SE ±7.2) and 78.5% (SE ±4.3), respectively ($P = 0.8$). See Figure 1.

**Conclusion:** In patients with clinical stage I carcinosarcoma, MIS is not associated with poorer oncologic outcomes. MIS leads to shorter length of stay and lower rate of complications.

![Figure 1](image-url)
**705 - Poster Session**

**Genome-directed identification of novel, immediately druggable targets in uterine serous papillary carcinoma (USPC)**

H.M. Hanauske-Abela\(^a\), S. Singh\(^b\), M. Hoque\(^a\), S. Husain\(^a\), A.R. Hanauske\(^b\), P. Soteropoulos\(^a\) and B.M. Cracchiolo\(^a\). \(^a\)Rutgers NJMS, Newark, NJ, USA, \(^b\)Technische Universität, München, Germany

**Objective**: Proteins whose function requires posttranslational hydroxylation (PTH) are pivotal for cancer biology. The purpose of our study was to establish expression of PTH-dependent proteins and their oxygenases in the genetically verified ARK1 culture model of uterine serous papillary carcinoma (USPC). This cancer is clinically notorious for limited treatment options and extraordinary lethality.

**Method**: We used cultured USPC cell line ARK1, multiperspective quality-controlled RNA sequencing, and antibody-based verification of protein expression.

**Results**: In cancer biology, PTH-dependent proteins mediate inappropriate proliferation (eukaryotic initiation factors 5A [eIF5As]), inappropriate angiogenesis (hypoxia-inducible factors [HIFs]), inappropriate immune tolerance (collectins [e.g., C1q]), and inappropriate matrix formation (e.g., collagens). The USPC cell line expressed a remarkable repertoire of PTH-dependent proteins and their hydroxylases: mRNAs for eIF5A2 and deoxyhypusyl hydroxylase (DOHH), noted in malignant proliferation (ARK1 doubling time ≤18 hours, cell cycle compartment ratios unchanged over time); mRNAs for HIF-1α and -2α (HIF1A, EPAS1) plus 7 enzymes for their regulatory hydroxylations at prolyl and aspartyl/asparaginyl residues (EGLN1, -2, -3; ASPH; HIF1AN; ASPHD1, -2); mRNAs for 2 hydroxylation-dependent collectins of the immunoregulatory C1q family (C1QL1, -4); and over 40 mRNAs encoding the component α-chains of all collagens, type I to type XVIII, plus mRNAs for the 3 collagen prolyl 4-hydroxylases (P4HA1, -2, -3) and the 5 collagen lysyl hydroxylases/glycosyltransferases (PLOD1, -2, -3; COLGAL1, -2). Among the collagens, mRNA expression for the nonfibrillar angiogenesis-enabling collagens type IV, VI, and XVIII was particularly prominent. Translation of these mRNAs into collagens proper was corroborated by monospecific antibodies. In diverse cancers, these collagens uniformly induce platinum resistance, protect against platinum-induced apoptosis, and are strongly associated with low 5-year survival rates and poor outcome.

**Conclusion**: PTH targets in USPC-derived ARK1 cells encapsulate USPC biology. Since hydroxylated eIF5As, collectins, and collagens mediate the effects of unhydroxylated HIFs, our results rationalize translational studies of available PTH inhibitory pioneer drugs for anti-USPC activity.

---

**706 - Poster Session**

**Lymph node dissection at the time of hysterectomy for uterine cancer is associated with venous thromboembolism: An analysis of the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) database**

S.A. Ackroyd\(^a\), S.C. Rubinz\(^b\), K. Houck\(^c\), C. Chu\(^b\), G.M. Mantia-Smaldone\(^b\) and E. Hernandez\(^d\). \(^a\)Temple University Hospital, Philadelphia, PA, USA, \(^b\)Fox Chase Cancer Center, Philadelphia, PA, USA

**Objective**: The aim of this study was to examine the incidence of postoperative venous thromboembolic events (VTE) in patients undergoing lymph node dissection (LND) at the time of staging hysterectomy for uterine cancer.

**Method**: This was a retrospective National Surgical Quality Improvement Program (NSQIP) database study examining women ≥18 years who underwent hysterectomy for uterine cancer from 2014 to 2017. Using a calculated propensity score derived from a multiple logistic regression model to control for confounding factors, women who received a LND at the time of hysterectomy were matched in a 1:1 ratio with women who did not receive an LND. \( \chi^2 \) and independent \( t \) tests were used to compare the cohorts.

**Results**: From 2014 to 2017, a total of 25,735 patients underwent hysterectomy for uterine cancer. A 1:1 propensity-matched sample included 10,891 patients each in both the LND group and the non-LND group. Patient characteristics between propensity-matched groups were similar. Compared to those who did not receive a LND, patients who received an LND experienced a higher incidence of deep venous thromboembolisms (DVT) with 103 (0.7%) patients in the LND group versus 44 (0.4%) in the non-LND group (\( P < 0.001 \)), and a higher incidence of pulmonary embolisms with 124 (0.9%) in the LND group versus 67 (0.6%) in the non-LND group (\( P < 0.013 \)). DVT events occurred a mean of 13.84 ± 8.91 days postoperatively (range 1–29 days), and pulmonary embolism events occurred a mean of 8.65 ± 10.06 days postoperatively (range 1–30 days). In patients with uterine cancer, the 30-day postoperative mortality rate was 0.44% with 13 (13.54%) of 96 of these patients with a DVT or pulmonary embolism event.
**Conclusion:** Lymph node dissection performed at the time of hysterectomy for uterine cancer was associated with a higher incidence of DVT and pulmonary embolism. Further investigation into risk factors associated with VTE and possible interventions to address this complication and its morbidity and mortality should be investigated.

---

**707 - Poster Session**

**No evidence to support lymph node dissection at time of hysterectomy for apparent early-stage uterine sarcoma regardless of histologic subtype**


**Objective:** The aim of this study was to investigate the role of lymph node dissection (LND) for patients with apparent stage I uterine sarcoma undergoing hysterectomy.

**Method:** The National Cancer Data Base was accessed, and patients diagnosed between 2004 and 2015 with an apparent early-stage leiomyosarcoma (LMS), adenosarcoma (AS), and low-grade endometrial stromal sarcoma (LGESS) who underwent hysterectomy were identified. Clinicopathologic data were abstracted along with inclusion of lymph node evaluation at time of surgery. Overall survival (OS) was assessed after stratification by histology with the log rank test, while Cox models were constructed to control for confounders.

**Results:** A total of 6,412 patients met the inclusion criteria; 3,616 cases of LMS, 1,511 AS, and 1,285 LGESS. Overall rate of LND was 42.5%; LMS, 35.4%; AS, 61.9%; and LGESS, 39.5%; \( P < 0.001 \). Among patients who underwent LND, 61.2% had at least 10 LNs removed. Higher rates of LND were observed among patients managed in academic facilities (45.1% vs 40%, \( P < 0.001 \)) and among postmenopausal women (45.1% vs 38.7%, \( P < 0.001 \)). Based on pathology, report rate of regional lymph node metastasis was 3.1%, 2.6%, and 4.5% for patients with LMS, AS, and LGESS respectively (\( P = 0.14 \)). No difference was observed in OS between patients who did and did not undergo LND for those with LGESS (5-year OS = 92.9% vs 96%, \( P = 0.19 \)) and with AS (5-year OS = 77% vs 75.7%, \( P = 0.66 \)). However, patients with LMS who had LND had a worse OS (5-year OS = 57.8% vs 62.4%, \( P = 0.03 \)). After controlling for patient age, race, type of insurance, substage, receipt of chemotherapy, and radiation therapy, performance of LND was not associated with better survival for patients with LMS (HR = 1.10, 95% CI 0.98–1.23), LGESS (HR = 1.21, 95% CI 0.75–1.96), and AS (HR = 0.86, 95% CI 0.77–1.23).

**Conclusion:** Incidence of lymph node metastasis in any apparent early-stage uterine sarcoma is rare. LND was not associated with a survival benefit regardless of histologic subtype. The removal of clinically negative lymph nodes in patients with any subtype of uterine sarcoma is likely not indicated.

---

**708 - Poster Session**

**Transvaginal laparoscopy for the management of low-grade endometrial cancer**

A.F. Burnett. *University of Arkansas for Medical Sciences, Little Rock, AR, USA*

**Objective:** Transvaginal hysterectomy is the approach recommended by the American College of Obstetricians and Gynecologists. However, it is rarely used for endometrial cancer because of concerns about the ability to remove the adnexae (BSO) and survey the abdomen and about the lack of experience with this technique. Transvaginal laparoscopy can overcome these barriers by permitting full access to the abdomen through the vagina, direct visualization of the adnexal vasculature, and utilization of techniques within the repertoire of any laparoscopic surgeon.

**Method:** Forty-three women with a preoperative diagnosis of grade 1–2 endometrial cancer underwent surgery utilizing transvaginal laparoscopy. The anterior and posterior cul-de-sacs were opened, a single-incision laparoscopic retractor was placed, and hysterectomy and BSO proceeded under laparoscopic visualization and instrumentation. Alternatively, a transvaginal hysterectomy can be performed prior to placing the retractor for BSO.

**Results:** All women had successful completion of surgery transvaginally. The mean age was 61 (26–90) years, and the mean BMI was 34.4 (18–50). Eight of the women were nulliparous. In 27 women a transvaginal hysterectomy was performed followed by laparoscopic BSO (22), salpingectomy alone (3), BSO and appendectomy (1), and BSO with removal of the pelvic lymph nodes (1). The remaining 16 women had the hysterectomy and BSO performed completely laparoscopically through the vagina. Mean surgical time was 105 minutes (40–205 minutes). Blood loss was less than 100 mL in 41 patients; no transfusions occurred. The mean uterine weight was 112 g (27–436 g). Sixteen patients were discharged home within 5 hours;
26 were discharged home in less than 23 hours; and 1 was discharged in 48 hours because of postoperative ileus. There were 3 surgical complications: 2 patients suffered a cystotomy (both of whom had had 2 prior caesarean deliveries), and 1 patient suffered a thermal injury to the small intestine that was oversewn 5 days later. With a median follow-up of 12 months (2–24 months), there was 1 recurrence (5 months), and all are currently alive.

**Conclusion:** Transvaginal laparoscopy is a feasible technique for managing women with low-grade endometrial cancer. This procedure has the advantages of the visualization of laparoscopy with the rapid postoperative recovery of transvaginal surgery.

---

### 709 - Poster Session

**Lymph node dissection for apparent stage I uterine carcinosarcoma provides no clear clinical benefit**


**Objective:** Patients with uterine carcinosarcoma (UCS) are at a high risk of local and distant recurrence and have a poor prognosis in the recurrent setting. Our objective was to determine whether lymph node dissection (LND) at the time of primary surgery has either prognostic or therapeutic value for patients with apparent stage I UCS.

**Methods:** A retrospective cohort of women with clinical stage I UCS who were treated at the University of Alabama at Birmingham was identified by pathology review. Demographic information, operative reports, adjuvant treatment received, and recurrence information were obtained from the medical record. Deceased patients were confirmed using the Social Security Death Index. Patients were first grouped based on whether they had received LND at the time of primary surgery. Those who had undergone LND were then divided based on whether they had disease present in the nodal specimen. Recurrence rate, progression-free survival (PFS), and overall survival (OS) were calculated for both analyses.

**Results:** A total of 141 patients with clinical stage I UCS were identified between 1999 and 2017, of which 92 underwent LND. Patients who had LND were younger, had a lower BMI, were less likely to have comorbid conditions, were more likely to have a minimally invasive approach, and were more likely to receive adjuvant chemotherapy. However, there was no difference in recurrence rate (40.8 vs 40.2%, \( P = 0.14 \)), PFS (\( P = 0.46 \)), or OS (\( P = 0.42 \)) between the groups. Of those who had LND, 21.7% had positive nodes (\( n = 20 \)). There was no difference in adjuvant treatment received between those with positive and negative nodes. In addition, there was no difference in recurrence rate (45 vs 38.9%, \( P = 0.17 \)), PFS (\( P = 0.19 \)), or OS (\( P = 0.17 \)) between those with positive and negative nodes.

**Conclusion:** In this cohort, LND at the time of hysterectomy for apparent stage I UCS did not demonstrate a clear therapeutic benefit regarding recurrence or survival. In addition, those with positive nodes did not have improved outcomes compared to those with negative nodes. These data suggest that LND could potentially be omitted at the time of upfront surgery for UCS.

---

### 710 - Poster Session

**Analysis of serum HE4 and CA-125 levels in uterine cancers subtypes**

A.M. Blackman\(^1\), A. Samborski\(^2\), M.C. Miller\(^3\), R. Singh\(^2\), K. Kim\(^2\), R. Turner\(^2\), G. Messerlian\(^1\) and R.G. Moore\(^1\).

\(^1\)University of Rochester Medical Center, Rochester, NY, USA, \(^2\)University of Rochester Medical School, Rochester, NY, USA, \(^3\)Women & Infants Hospital, Brown University, Providence, RI, USA

**Objectives:** Serum levels of HE4 and CA-125 can be useful biomarkers for uterine cancers. Few studies have examined the differences in HE4 and CA-125 levels among uterine cancers. This study was performed with the goal of determining the expression of HE4 and CA-125 levels in histologic subtypes, grades, and stages of uterine cancer.

**Methods:** Data were collected from 5 different Institutional Review Board-approved trials. This multicenter meta-analysis examined preoperative serum levels of HE4 and CA-125 in 152 women with uterine cancer. Cancers were analyzed by histologic subtype and stage for both biomarkers. Thresholds of \( \geq 70.0 \) and \( \geq 35.0 \) were used to define elevated levels of HE4 and CA-125, respectively. Mean and median levels of both biomarkers were also reported for each subtype and stage.

**Results:** There were 153 patients identified with uterine cancer. The mean age was 65 (range 30–95) years. There were 96 (63%) endometrioid, 20 (13%) serous, 6 (4%) clear cell, 6 (4%) mixed, 10 (6%) sarcoma, 8 (5%) other, and 7 (5%) unknown tumors. There were 96 (63%) stage I, 9 (6%) stage II, 27 (18%) stage III, 16 (10%) stage IV, and 7 (5%) unstaged. There were 42 (27%) grade 1, 44 (29%) grade 2, 65 (43%) grade 3, and 2 (1%) unknown grade. In all subtypes, HE4 was elevated in 62%
and CA-125 in 35% ($P < 0.001$) of the cases. In patients with endometrioid tumors, HE4 was elevated in 59% and CA-125 in 27% ($P < 0.001$). HE4 and CA-125 were elevated in 52% and 24% of grade 1 ($P = 0.022$), 71% and 34% of grade 2 ($P = 0.001$), and 63% and 43% of grade 3 ($P = 0.269$) disease, respectively. HE4 and CA-125 were elevated in 56% and 22% of stage I ($P < 0.001$), 56% and 33% of stage II ($P = 0.6$), 82% and 59% of stage III ($P = 0.1$), and 63% and 63% of stage IV tumors, respectively. A logistics regression analysis algorithm utilizing HE4 and CA-125 returned an elevated value in 83% of the cancers ($P < 0.001$) compared with CA-125.

**Conclusion:** HE4 is significantly more often elevated when examining all uterine cancers compared with CA-125. HE4 was found to be significantly elevated more often for all subtypes when compared to CA-125. In endometrioid subtypes, HE4 was more than twice as often elevated than CA-125. Comparison of grade across all subtypes, HE4 was significantly more often elevated than CA-125 for grade 1 and grade 2 tumors, and HE4 was significantly more often elevated in stage I disease. The combination of HE4 and CA-125 was significantly more often elevated than either marker alone.

**711 - Poster Session**

**Clinical calculator predictive of prognosis and treatment benefit in stage I-IV carcinosarcoma**

D.P. Mysona$^{a,b}$, S. Ghamande$^b$, B.J. Rungruang$^b$, P. Tran$^b$, L.K.H. Tran$^b$, H.R. Williams$^b$, B. Dos santos$^c$, J.K. Chan$^d$, L. Van Le$^a$ and J.X. She$^e$.

$^a$University of North Carolina at Chapel Hill, Chapel Hill, NC, USA, $^b$Medical College of Georgia, Augusta, GA, USA, $^c$Jinfiniti, Augusta, GA, USA, $^d$California Pacific and Palo Alto Medical Foundation/Sutter Health Research Institute, San Francisco, CA, USA

**Objective:** The aim of this study was to design a clinical calculator capable of predicting both prognosis and treatment in stage I–IV of carcinosarcoma.

**Method:** The National Cancer Data Base was queried for cases of stage I–IV UPSC from 2010 to 2015. Patients were included if they were observed, received chemotherapy alone, or received chemoradiation (CRT). Patients receiving radiation alone were excluded because they made up less than 10% of the cohort. Propensity score matching was used to make characteristics similar between observed, chemotherapy alone, and CRT. A combination of demographic and surgicopathologic characteristics were used to create a nomogram using random survival forest.

**Results:** Of 1,954 patients with stage I–IV carcinosarcoma, 450 (23%) underwent observation, 681 (35%) received chemotherapy alone, and 660 (34%) received CRT. Increasing comorbid conditions (HR = 1.90), increasing stage (HR = 2.24), no lymphadenectomy (HR = 2.12), larger tumor size (HR = 1.38), lymphovascular space invasion (HR = 1.46), and observation (HR = 2.17) were associated with worse prognosis. Using random survival forest, these parameters, except treatment, were then combined to make a prognostic calculator. The calculator divided patients into three risk groups (Figure 1). To better understand who may benefit from treatment, survival differences based on observation, chemotherapy alone, and CRT were examined in each risk group. In the low-risk group only CRT improved OS (observation as reference): chemotherapy alone, HR = 0.94, CI 0.45–1.94, $P = 0.86$; and CRT, HR = 0.39, CI 0.18–0.82, $P = 0.011$. In the moderate-risk group, OS was better with chemotherapy alone (HR = 0.67, CI 0.51–0.89, $P = 0.005$) and CRT (HR = 0.43, CI 0.33–0.56, $P < 0.001$) than the observation group. Similar results were seen in the high-risk group: chemotherapy alone (HR = 0.50, CI 0.38–0.66, $P < 0.001$) and CRT (HR = 0.35, CI 0.25–0.50, $P < 0.001$) compared to the observed group.

**Conclusion:** Carcinosarcoma has a diverse prognosis even among patients with the same substage. Our nomogram indicates that low-risk patients may benefit only from chemoradiation.
712 - Poster Session
Novel, immediately druggable targets in the ARK1 model of uterine serous papillary carcinoma (USPC): Proof-of-principle and clinical implications of blocking oncologically relevant posttranslational hydroxylations with a pioneer drug
H.M. Hanauske-Abela, S. Singh, M. Hoque, S. Husain, A.R. Hanauske, P. Soteropoulos, and B.M. Cracchiolo. Rutgers NJMS, Newark, NJ, USA; Technische Universität, München, Germany

Objective: The oxygenases that hydroxylate key proteins in cancer biology employ non-heme iron atoms for catalysis. Drugs targeting these atoms inhibit posttranslational hydroxylation (PTH) in preclinical tests and clinical trials. At clinical concentrations (≤150 µM), the drug deferiprone (DEF) blocks these non-heme iron atoms and thus every known PTH. The purpose of our study was to establish target expression response to DEF-blocked PTH activity in the ARK1 model of uterine serous papillary carcinoma (USPC).

Method: We used USPC cell line ARK1, multiperspective quality-controlled RNA sequencing, and antibody-based verification of protein expression.

Results: At clinical concentrations inhibiting PTH in vitro and in vivo, DEF caused reactive changes (≥ ±50% vs controls) within 48 hours in RPKM-quantified mRNA expression of target enzymes (increased mRNAs: deoxyhypusyl hydroxylase [DOHH], prolyl 3-hydroxylases [LEPREL1; OGFOD1]; decreased mRNAs: lysyl hydroxylase [PLOD1], prolyl 4-hydroxylases [P4HA1/EGLN1, EGLN3] of collagens/hypoxia inducible factors (HIFs)). The prolyl 4-hydroxylase mRNAs' decrease at 48 hours (≤5-fold) evolved from acute increase 12 hours after DEF addition. P4HA1 suppression was verified by intracellular formation and intracellular retention of denatured since underhydroxylated collagens type VI and type XVIII. RPKM-quantified expression of mRNAs encoding the target substrates of these oxygenases was likewise reactive (increased mRNAs: HIFs...
HIF1A; EPAS1], collagens [COL4A1, -A2; COL12A1], eIF5As [EIF5A2]; decreased mRNAs: collagens [COL6A1, -A2; COL23A1; COL9A2; COL17A1], collectins [C1QL1, -L4], ribosomal component uS12 [RPS23]). Few mRNAs were unreactive (aspartyl/asparaginyl hydroxylases [ASPH; HIF1AN, ASPHD1, -2], collagen type I α1 component [COL1A1]). As reported for apoptosis-defective pathogenic cells, DEF induced exuberant expression of death agonists (e.g., HRK, CASP3, -7). Since bioavailable iron reduces DEF at these oxygenases’ non-heme iron atoms, we employed the non-inhibitory drug deferoxamine (DOA) to saturate any pre-target sinks. At 1 µM DOA, ≤50 µM DEF achieved maximal suppression, evidenced by intracellular formation of denatured collagens, cell cycle disruption, and onset of rapid ARK1 death (see Figure 1).

**Conclusion:** Our results provide a rational basis for clinical translational studies of USPC.

Deferoxamine (DOA) at *clinically marginal concentration* renders deferiprone (DEF) at *clinically marginal concentration* highly cytoidal for USPC cells (ARK1).

**NOTE:** Combinations of DEF-DOA are in clinical use (treatment of thalassemia)

Fig. 1. Drug potentiation.

**713 - Poster Session**

**Perioperative factors affecting women with uterine serous carcinoma**


*Zucker School of Medicine at Hofstra/Northwell, New Hyde Park, NY, USA, 2Hofstra - North Shore Long Island Jewish School of Medicine, Manhasset, NY, USA*

**Objective:** Uterine serous carcinoma (USC) represents an aggressive subtype of endometrial cancer with a higher likelihood of lymphatic and intraperitoneal spread than endometrioid adenocarcinoma. About two-thirds of women with USC will have extra-uterine disease at initial presentation. Our goal was to determine the perioperative prognostic indicators that affect overall survival (OS) and progression-free survival (PFS) in women with USC.

**Method:** An Institutional Review Board-approved study identified all patients surgically and medically treated for USC at our institution between January 2011 and February 2019. Demographics and outcome measures were abstracted from the medical records and tumor registry. Cox proportional hazard models, log rank tests, and comparisons of means were used to calculate significance (P < 0.05). Sensitivity and specificity values were calculated for preoperative imaging of diagnosing omental disease.
Results: Eighty-five (85) patients were identified during the study period. Of these patients, 61 (76.2%) had preoperative imaging of the abdomen and pelvis, and 19 (23.8%) had computed tomography (CT) imaging of the chest, abdomen, and pelvis. The omentum was abnormal on CT in 7 (8.9%) patients, documented intraoperatively as abnormal in 15 (19.2%) patients, and histologically positive for metastasis in 18 (28.6%) patients. The overall sensitivity for detection of omental metastasis with CT was 41%, and specificity was 100%. Operative assessment demonstrated a sensitivity of 82% and specificity of 97%. Peritoneal cytology was performed in 58 (72.5%) patients and was positive in 11 (19.0%) patients. Positive peritoneal cytology was associated with a decreased PFS but not OS ($P < 0.05$). Preoperative CA-125 was correlated with stage of disease ($P = 0.028$) but not peritoneal cytology ($P = \text{NS}$). Forty-five (52.9%) patients had surgically stage I disease, and 37 (43.5%) had advanced-stage III–IV disease.

Conclusion: Our data show that preoperative CT is highly specific for the assessment of metastatic omental disease, but has a sensitivity of 41%. As expected, operative assessment was more sensitive than any imaging. Although not part of the FIGO staging system, in our study peritoneal cytology was associated with decreased PFS. Preoperative CA-125 correlated with increased stage of disease but not with peritoneal cytology. Further studies are necessary to evaluate the cost-effectiveness and utility of preoperative CT in patients with USC.

714 - Poster Session
Racial disparities in cancer-specific survival between 1973 and 2015 persist for breast, ovarian and cervical cancer

Objective: The aim of this study was to investigate cancer-specific survival (CSS) trends and disparities between non-Hispanic black and non-Hispanic white women with breast, uterine, ovarian, or cervical cancer.

Method: Non-Hispanic black and non-Hispanic white women diagnosed with stage I–IV breast, uterine, ovarian, or cervical cancer between 1973 and 2015 in the 9-region NCI SEER program were eligible. Cox regression analysis was used to compare CSS in non-Hispanic black and non-Hispanic white women, stratified by site during specific time intervals with adjustments for geographic region, year of diagnosis, age, marital status, stage, cell type, and tumor grade at diagnosis.

Results: Figure 1 displays the adjusted disparities in CSS between non-Hispanic black and non-Hispanic white women diagnosed with breast, uterine, ovarian, and cervical cancer between 1973 and 2015. The largest disparity in CSS occurred in patients with uterine cancer (HR = 1.40, 95% CI 1.34–1.46), followed by breast (HR = 1.36, 95% CI 1.33–1.39), ovarian (HR = 1.18, 95% CI 1.14–1.23), and cervical cancer (HR = 1.10, 95% CI 1.05–1.16). Figure 1 also illustrates the trends in CSS over these 3 time periods. The adjusted risk of cancer death (95% CI) for non-Hispanic black versus non-Hispanic white women diagnosed from 1973 to 1985, 1986 to 2000, or 2001 to 2015 with breast cancer was 1.24 (1.20–1.29), 1.40 (1.36–1.45), and 1.41 (1.36–1.46); uterine cancer, 1.54 (1.41–1.67), 1.41 (1.31–1.51), and 1.33 (1.25–1.41); ovarian cancer, 1.09 (1.00–1.18), 1.10 (1.03–1.18), and 1.31 (1.23–1.39); and cervical cancer, 1.04 (0.96–1.12), 1.13 (1.04–1.22), and 1.17 (1.06–1.29), respectively.

Conclusion: Uterine cancer displayed the largest racial disparity in CSS between non-Hispanic black and non-Hispanic white women diagnosed between 1973 and 2015, followed by breast, ovarian, and cervical cancer, respectively. In addition, racial disparities in CSS have persisted for women with uterine cancer but have widened for those with breast, ovarian, and cervical cancer from 1973–1985 to 2001–2015. Further research is required to investigate and mitigate these disparities between non-Hispanic black and non-Hispanic white women.
Fig. 1. Multivariate Cox analysis for cancer-specific survival stratified by disease site with adjustments for geographic region, year of diagnosis, age, marital status, stage, cell type, and tumor grade. HR that are bolded had a 95% confidence interval that did not cross 1.0 and \( P < 0.05 \).

715 - Poster Session
Risk of lymph node metastases in endometrioid uterine cancer patients: A decision tree algorithm using machine learning
J.K. Chana, D.P. Mysonab, D.A. Kleinc, J.E. Chanb, D.S. Kappd, A.K. Manne and C.I. Liao. aCalifornia Pacific and Palo Alto Medical Foundation/Sutter Health Research Institute, San Francisco, CA, USA, bUniversity of North Carolina at Chapel Hill, Chapel Hill, NC, USA, cUniversity of California, San Francisco, CA, USA, dStanford University School of Medicine, Stanford, CA, USA, ePalo Alto Medical Foundation Research Institute, Palo Alto, CA, USA, fKaohsiung Veterans General Hospital, Kaohsiung City, Taiwan

Objective: The aim of this study was to determine the utility of a decision-tree algorithm to predict for nodal metastases in endometrioid uterine cancer patients.

Method: Data were obtained on all endometrioid uterine cancer patients after staging surgery with pelvic and paraaortic lymphadenectomy using the National Cancer Data Base from 2010 to 2015. After dividing the dataset into a training and a test set, a decision-tree analysis was performed under IBM SPSS Statistics v25.0 by \( \chi^2 \) Automatic Interaction Detector (CHAID) algorithm.

Results: Of 18,490 patients, the median age was 62 years (range 20–90 years), stage IA, IB, and undefined stage I accounted for 35.4%, 14.1%, and 50.4% of patients after surgical staging; grade 1, 2, 3, and unknown were in 34.4%, 32.1%, 17.0%, and 16.5%. Lymphovascular invasion (LVI) was found in 18.2%, negative in 74.8%, and unknown in 7.0% of specimens. A total of 1,107 (6.0%) had nodal metastases; of these, 640 (3.46%) had pelvic, 178 (0.96%) had para-aortic, and 289 (1.56%) had both nodes involved. The machine learning algorithm developed a mathematical model using these factors to predict for those with the lowest risk for nodal involvement. In our exploratory data analysis with unsupervised learning, the algorithm identified LVI as an important factor with 20.2% having nodal metastases compared to only 2.5% in those without LVI. Of the LVI-negative patients, we then evaluated tumor size with >4 cm having 4.6% rate of nodal metastases versus only 1.8% in those with ≤4 cm tumors. Continuing under this decision tree with negative LVI and smaller tumor size and now with grade 1 disease, our predictive algorithm found a nodal involvement rate of only 0.9%. The negative predictive value for lymphadenopathy was 93.9% and 94.1% in the training and test groups, respectively.
Conclusion: Our data suggest that a decision-tree algorithm using machine learning can accurately predict the risk of lymph node metastases in endometrioid uterine cancer patients.

716 - Poster Session
Incorporation of a sentinel lymph node mapping algorithm in patients with clinical stage I endometrial cancer
S. Werner, T.E. Gadomski, F. McNeil, J. Villella and E. Pereira. Zucker School of Medicine at Hofstra/Northwell - Lenox Hill Hospital, New York, NY, USA

Objective: Studies have demonstrated no therapeutic benefit to systemic pelvic and paraaortic lymphadenectomy (PPALND) for patients with endometrial cancer and increased morbidity in those who undergo PPALND. Sentinel lymph node biopsy (SLNB) is an alternative to PPALND, but the referenced data published are largely from high-volume specialized institutions, and a complete PPALND is still performed by many surgeons at smaller, nonspecialized centers. Our aim is to demonstrate that SLNB is feasible, reproducible, and sensitive without affecting cancer-specific outcomes when implemented at a nonspecialized center.

Method: Patients with clinical stage I endometrial cancer were retrospectively reviewed from September 2016 through June 2019. Endometrioid, uterine papillary serous (UPSC), malignant mixed mesodermal tumor (MMMT), and clear cell (CC) histologies were included. All patients had undergone either a robot-assisted or laparoscopic hysterectomy with SLNB. Indocyanine green was injected into the cervix bilaterally. Per the algorithm, patients with suboptimal lymph node mapping or nodes suspicious for metastasis underwent a side-specific pelvic lymph node dissection (LND). Paraortic LND was performed at the discretion of the surgeon. In addition to SLNB, PPALND was performed for patients with UPSC or CC. Sentinel lymph nodes (SLN) were evaluated by pathology using ultrastaging protocols including serial sectioning and cytokeratin staining. The medical record was queried for clinical or radiographic evidence of recurrence.

Results: A total of 68 patients were included: 56 stage IA, 6 stage IB, 2 stage II, and 4 stage III (1 IIIA, 2 IIIC1, and 1 IIIC2). The majority of patients were endometrioid (77.9%), followed by UPSC (14.7%), MMMT (5.9%) and CC (1.5%). At least 1 SLN was detected in 94.1% of cases. The rate of bilateral SLN detection was 74.3% and improved over time from 2017 to 2019: 70% (2017), 74.4% (2018), and 80% (2019). Twenty patients underwent PPALND. Non-SLN was positive in 1 patient with UPSC. There were no other patients with false-negative SLNB. There have been no recurrences in this cohort.

Conclusion: SLNB is a sensitive and specific method for assessing lymph node involvement in patients with stage I endometrial cancers. Our results are comparable to those reported in the literature and demonstrate that when applied at nonspecialized centers, this approach is safe and reproducible without affecting cancer-specific outcomes.

717 - Poster Session
Oophorectomy for women aged 50 and younger with early-stage low-grade endometrial stromal sarcoma: Is it necessary?

Objective: The purpose of this study was to investigate the prevalence of bilateral salpingo-oophorectomy (BSO) for premenopausal patients with early-stage low-grade endometrial stromal sarcoma (LGESS) and its impact on overall survival (OS).

Method: Women age 50 years and younger who were diagnosed with stage I LGESS and underwent hysterectomy between 2004 and 2015 were identified from the National Cancer Data Base. Factors associated with the receipt of BSO were investigated. OS for patients diagnosed between 2004 and 2014 with at least 1 month of follow-up was assessed using Kaplan-Meier curves and compared with the log rank test.

Results: A total of 743 patients met the inclusion criteria. Median patient age was 44 years. The majority were white (78.8%), had private insurance (79.9%), had tumors smaller than 5 cm (52.8%), did not have comorbid conditions (89.4%), and did not undergo lymphadenectomy (59.4%). Use of radiation (8.5%), hormonal therapy (10.3%), and chemotherapy (0.7%) were infrequent in the present cohort. The overall rate of BSO was 72.8%. Patients who underwent BSO were older (median age 45 vs 43 years, \(P < 0.001\)), more likely to have comorbid conditions (12.4% vs 6.9%, \(P = 0.34\)), and undergo lymphadenectomy (44.4% vs 30.7%, \(P = 0.001\)). There were no differences between the 2 groups in terms of substage (\(P = 0.13\)) or patient race (\(P \)
Five-year OS rates for patients who did (n = 490) and did not (n = 191) undergo BSO were 96.2% and 97.1%, respectively, and there was no difference in OS (P = 0.41). After controlling for presence of comorbid conditions, performance of BSO was not associated with better survival (HR = 1.28, 95% CI 0.51–3.19).

**Conclusion:** Ovarian function was preserved in approximately one-third of women age 50 years and younger with stage I LGESS with no clear detriment to overall survival. Oophorectomy may not be necessary in this patient population.

---

**718 - Poster Session**

**Uterine clear cell carcinoma risk in Asian subpopulations**

S. Chow\(^a\), C.I. Liaob, A.K. Mannc, O. Dorigod, B. Litkouhi, K. Lai, D.S. Kapp\(^d\) and J.K. Chang\(^e\). \(^a\)Stanford University School of Medicine, Stanford, CA, USA, \(^b\)Kaohsiung Veterans General Hospital, Kaohsiung City, Taiwan, \(^c\)Palo Alto Medical Foundation Research Institute, Palo Alto, CA, USA, \(^d\)Stanford Hospital and Clinics, Stanford, CA, USA, \(^e\)Stanford Women’s Cancer Center, Palo Alto, CA, USA, \(^f\)California Pacific Medical Center, San Francisco, CA, USA, \(^g\)California Pacific and Palo Alto Medical Foundation/Sutter Health Research Institute, San Francisco, CA, USA

**Objective:** The aim of this study was to determine the rates of clear cell uterine carcinoma in white, Asian, and Asian subpopulations.

**Method:** Data from 2004 to 2016 were obtained from the United States Cancer Statistics (USCS) and National Cancer Data Base (NCDB). \(\chi^2\) tests were used for statistical analyses.

**Results:** The age-adjusted incidence of uterine clear cell carcinoma was 0.34 (per 100,000 women) based on the USCS. Furthermore, black women had the highest incidence rate of clear cell compared to white, Asian/Pacific Islander, and American Indian/Alaska Native (0.59 vs. 0.31, 0.29, and 0.24) women. Of 488,811 women diagnosed with uterine cancer from 2004 to 2016 based on the NCDB, 73.3% were endometrioid, 6.6% were serous, 5.3% were carcinosarcoma, 1.4% were clear cell, and 13.4% were others. The proportion of white women with clear cell uterine cancer was only 1.4% compared to 2.6% in black, 2.2% in Chinese, 2.0% in Korean, and 1.8% in Filipino women. These proportions were lower in Pacific Islander (1.5%), Indian/Pakistani (1.3%), Japanese (1.2%), and Vietnamese (0.7%) women. The mean age at diagnosis of clear cell patients was 68.6 years, with the youngest age in Asian/Pacific Islander compared to white and black women (65.9 vs. 68.7 and 68.2 years). Clear cell was more likely diagnosed in Chinese, Japanese, Filipino, Vietnamese, and Pacific Islander women living the Western region of the United States. Indian/Pakistani women were more likely diagnosed in the South, and Korean women in the Northeast.

**Conclusion:** Compared to that in white women, the proportion of clear cell uterine cancer is higher in black women and subpopulations of Asian including Chinese, Korean, and Filipino women.

---

**719 - Poster Session**

**Is minimally invasive surgery for stage I carcinosarcoma safe? A single institution experience.**

R. Sinha\(^a\), A. Nizam\(^b\), K.K. Shih\(^c\), W. Shan\(^d\), B. Bustamante\(^e\), L. dos Santos\(^f\), M. Frimer\(^g\), A.W. Menzin\(^h\), A. Sakaris\(^i\), J.S. Whyte\(^a\) and G.L. Goldberg\(^a\). \(^a\)Zucker School of Medicine at Hofstra/Northwell, New Hyde Park, NY, USA, \(^b\)Hofstra - North Shore Long Island Jewish School of Medicine, Manhasset, NY, USA

**Objective:** Minimally invasive surgery (MIS) has been a mainstay of the surgical management of uterine cancer since the mid-2000s. We aim to determine the role and safety of MIS in women with uterine carcinosarcoma.

**Method:** An Institutional Review Board-approved study identified all our patients with uterine carcinosarcoma between January 2011 and December 2017. Demographics and outcome measures were abstracted from medical records and the tumor registry. Cox proportional hazard models, log rank tests, and comparisons of means were used to calculate significance (\(P < 0.05\)).

**Results:** Seventy-two (72) patients were identified during the study period. Thirty (42%) underwent laparotomy, and 42 (58%) underwent MIS staging with the majority of the MIS group having robotic surgery. Seventy-one percent of women with uterine carcinosarcoma presented with stage IA disease. Sixty-one percent of the uterine carcinosarcoma tumors were heterologous. Eighty-three percent of patients received adjuvant platinum-based chemotherapy, and 50% of patients received adjuvant radiation therapy. There was no difference in progression-free survival (PFS) or overall survival (OS) between the
open surgery group and the MIS group ($P > 0.05$). Age and the presence of lymphovascular space invasion (LVSI) were independent risk factors for decreased PFS, whereas race was not. Platinum-based chemotherapy increased PFS and OS ($P < 0.05$), whereas any radiation therapy did not lead to a significant difference in PFS or OS ($P > 0.05$).

**Conclusion:** Uterine carcinosarcoma represents a rare and aggressive subtype of endometrial cancer. Our data suggest that MIS is a safe method for staging in women with uterine carcinosarcoma. In our cohort, adjuvant chemotherapy increased both PFS and OS. There was no difference in PFS or OS in women with uterine carcinosarcoma who received adjuvant radiation therapy. The optimal or standard adjuvant therapy for stage 1 uterine carcinosarcoma requires further multiinstitutional prospective trials to determine the optimal management of this aggressive and lethal disease.

---

**Vulvar**

720 - Poster Session

**Experience of primary surgical treatment of extramammary Paget's disease of vulva for 10 years at single institution in Korea**

Y. Kim, D.Y. Kim, S.W. Lee, J.Y. Park, D.S. Suh, J.H. Kim, Y.M. Kim and Y.T. Kim. University of Ulsan College of Medicine, ASAN Medical Center, Seoul, South Korea

**Objective:** The incidence of extramammary Paget’s disease (EMPD) of vulvar is not clear in Korea, and clinical research for vulvar EMPD was lacking because of its extreme rarity. As a basis for further clinical study, we evaluated clinical demographics, surgical treatment outcome, and recurrence.

**Method:** Asan Biomedical Research Environment (ABLE) was searched to identify a population with EMPD between 1999 and 2018. Patients who were diagnosed vulvar EMPD first in their lifetime and had primary surgical treatment were extracted to analyze clinical characteristics and treatment outcome.

**Results:** In the 10-year study period, 31 patients had primary surgical treatment in Asan Medical Center. Mean age was 63 (range 44–80 years); 30 (96.7%) patients had localized or regional disease; and only 1 (3.2%) patient had ipsilateral inguinal lymph node metastasis. Twenty patients (64.5%) had lesion larger than 50 mm; the largest single lesion was 112 mm in diameter, and 23 cases (74.2%) showed bilaterality or crossed the midline. All patients had wide excision or radical vulvectomy, and flap reconstruction was needed in 23 patients (74.2%). In the pathologic reports, 13 patients (41.9%) had invasive EMPD including 1 case of subcutaneous layer invasion and another case of invasive adenocarcinoma. In 13 cases (41.9%), excision margin was positive, and adjuvant radiotherapy was applied to 9 patients (29.0%). Mean follow-up period was 26.1 months (range 1.8–66.3 months), and during the follow-up period, 2 (6.4%) patients experienced recurrence. One had positive resection margin at the first operation followed by radiotherapy, but the other had clear margin. These 2 patients had a second surgical treatment and no evidence of disease until the last clinic visit. There was no statistically associated factor to predict recurrence.

**Conclusion:** Vulvar EMPD has a good prognosis, and patients showed lower recurrence rate after primary surgery even in those who had a relatively wide lesion or locally invasive disease. Analysis based on national health care data or multiinstitutional data is needed to identify factors associated with recurrence to control EMPD in the future.

---

721 - Poster Session

**Malignant melanoma of the vulva and vagina: A study of 1863 cases**

C. Wohlmuth$^{a}$, I. Wohlmuth-Wieser$^{b}$, T. May$^{c}$, D. Vicus$^{d}$, L.T. Gien$^{d}$ and S. Laframboise$^{c}$. $^{a}$University of Toronto, Toronto, ON, Canada, $^{b}$Paracelsus Medical University, Salzburg, Austria, $^{c}$Princess Margaret Cancer Centre, University Health Network, Toronto, ON, Canada, $^{d}$Sunnybrook Odette Cancer Centre, Toronto, ON, Canada

**Objective:** Data on vulvar and vaginal melanoma are scarce and mainly come from retrospective single-center series. The aim of this study is to describe epidemiologic, clinical, and histopathologic features of vulvar and vaginal melanoma and analyze their impact on survival in a large representative cohort.

**Method:** Women with a diagnosis of invasive vulvar or vaginal melanoma were identified from the SEER-18 population representing 27.8% of the U.S. population. Age at diagnosis, ethnicity, stage, location, histopathology, surgery, and lymphadenectomy were collected. The Kaplan-Meier method was used to analyze disease-specific and overall survival.
Univariate analysis and the Cox proportional hazards regression model were used to identify factors with a significant association with disease-specific survival.

**Results:** A total of 1,863 cases were included for further analysis: 1,400 vulvar melanoma and 463 vaginal melanoma, representing 1.0% of all malignant melanomas in women, 5.3% of all vulvar, and 5.5% of all vaginal malignancies. For vulvar melanoma 78.6% and for vaginal melanoma 49.7% had surgery, but only 52.9% of nonmetastatic vulvar melanoma and 42.9% of nonmetastatic vaginal melanoma undergoing surgery had lymph node assessment; in both groups approximately one-third had positive lymph nodes. The primary melanoma histology differed significantly: superficial spreading was the most common subtype in vulvar melanoma and nodular melanoma in vaginal melanoma. The median overall survival was 53 months (95% CI 46–60) and 16 months (95% CI 14–18); the median disease-specific survival was 99 months (95% CI 60–138 months) and 19 months (95% CI 16–22) for women with vulvar melanoma and vaginal melanoma, respectively. Survival was significantly associated with age at diagnosis, ethnicity, stage, surgery, lymph node metastases, histologic subtype, ulceration, mitotic count, and tumor thickness in vulvar melanoma and stage, surgery, and lymph node involvement in vaginal melanoma. In the Cox model lymph node status and number of mitoses remained independent predictors of outcome in vulvar melanoma; in vaginal melanoma only lymph node status remained significant.

**Conclusion:** The overall prognosis of vulvar melanoma and vaginal melanoma remains poor. The AJCC staging system is applicable and should be used for vulvar melanoma; however, lymph node status and mitotic rate are the most important predictors of survival. Lymph node status should be assessed, and patients with positive nodes may be candidates for adjuvant treatment.

---

**722 - Poster Session**

**Predictive value of an alternative strategy for measuring depth of invasion in stage I vulvar squamous cell carcinoma**


**Objective:** Measurement of depth of invasion in early vulvar squamous cell carcinoma (SCC) can be challenging, and interobserver reproducibility is poor. Tumors with ≥1 mm invasion or size >2 cm trigger lymphadenectomy, which is often associated with postoperative morbidity. A previous study suggested no change in outcomes when depth was measured to the nearest lowest dysplastic rete peg (alternative method) rather than the nearest highest dermal papilla (conventional method). We report our institutional experience with measurement of depth of invasion and size in vulvar SCC.

**Method:** Pathologic staging and clinical follow-up information were recorded for 100 cases of pT1 invasive vulvar SCC resected from 1990 to 2019. Conventional depth, alternative depth, gross/clinical size, and size of the invasive component were measured for each tumor. We aimed to evaluate which clinicopathologic factors are most predictive of lymph node involvement and recurrence.

**Results:** Depending on the measurements used (conventional vs alternative depth, gross/clinical size vs invasive carcinoma size), 1–18 cases were reclassified as pT1a rather than pT1b. All such cases were pN0 and lacked lymphovascular or perineural invasion. Infiltrative cords (HR = 5.15, 95% CI 1.63–16.2, *P* = 0.005) and perineural invasion (HR = 3.16, 95% CI 1.18–8.45, *P* = 0.022) showed the strongest association with groin node recurrence. Of staging data, only invasive component >2 cm was significantly associated with groin node recurrence (HR = 2.87, 95% CI 1.01–8.17, *P* = 0.048). Kaplan-Meier curves for groin recurrence-free survival based on size of invasive carcinoma showed separation (*P* = 0.038). Alternative depth was slightly more predictive of groin recurrence than conventional depth (AUC = 0.74 vs 0.70). Kaplan-Meier curves for local recurrence-free survival based on stage did not show significant separation regardless of method.

**Conclusion:** Patients downstaged using alternative depth and/or invasive carcinoma size lacked nodal disease at diagnosis or groin recurrence; however, ~1/3 experienced postoperative morbidity. Our data suggest that using alternative depth and/or size of the invasive component could safely allow a subset of conventional stage IB vulvar SCC patients to avoid groin surgery, reducing treatment-related morbidity.

---

**723 - Poster Session**

**A case of vaginal adenosis with gastric differentiation**

T.P. Awosogba, J. Whitney, J.C. Broder, A.B. McKee and C.C. Nitschmann. *aLahey Clinic, Burlington, MA, USA, bTufts Medical Center, Boston, MA, USA, cBeth Israel Lahey Health, Burlington, MA, USA*
Objective: The purpose of this study was to describe the presenting signs and symptoms of a nondiethylstilbestrol (non-DES) exposed patient with vaginal adenosis and illustrate the challenges of making a diagnosis of vaginal adenosis based on histopathological assessment, gross evaluation, and diagnostic imaging.

Method: Vaginal adenosis is a rare histological diagnosis characterized by the replacement of squamous epithelial cells by columnar cells in the vagina. Because of the ubiquitous presence of vaginal adenosis among women with primary clear cell adenocarcinoma of the vagina with a history of in utero exposure to DES, the finding is considered a potentially premalignant lesion. In women without known DES exposure, the correlation between vaginal adenosis and a primary vaginal malignancy is even more unclear. Here we report a case of vaginal adenosis with gastric-type differentiation, which has been reported only recently in small case series.

Results: A 47-year-old woman without a history of in utero exposure to diethylstilbestrol (DES) presented with leakage of fluid from the vagina and was found to have multiple tender cystic lesions within the vaginal canal on examination. Pathologic evaluation of cervical biopsies reported very different results including vaginal adenosis, vaginal adenosis with atypia, and mucinous adenocarcinoma. Multidisciplinary tumor board review with gynecologic oncology, medical oncology, and radiation oncology concluded that surveillance was an option to monitor disease status. Surveillance included serial examinations under anesthesia, resampling of the vaginal lesions, as well as serial pelvic magnetic resonance imaging (MRI). At this time her disease is stable and unchanged after approximately 1 year.

Conclusion: This case illustrates the rare presentation, diagnosis, and management of vaginal adenosis with gastric-type differentiation in a woman without in utero DES exposure. As the correlation between non-DES-related vaginal adenosis and primary vaginal adenocarcinoma is yet to be entirely clear, the appropriate management and surveillance continue to pose a challenge for gynecologic oncologists.

724 - Poster Session
Utilization and outcomes of sentinel lymph node biopsy in patients with early-stage vulvar cancer

Objective: A comparative effectiveness study of sentinel lymph node biopsy (SLN) and standard lymphadenectomy (LND) was performed for patients with early-stage squamous cell vulvar cancer (SCC).

Method: Patients diagnosed between 2012 and 2015 with early-stage SCC, of size <4 cm, with invasion of at least 1 mm, who underwent pathological evaluation of their inguinofemoral lymph nodes were identified from the National Cancer Data Base. Patients who underwent SLN or LND (defined as at least 4 lymph nodes removed) were selected for further analysis. Overall survival (OS) was evaluated following generation of Kaplan-Meier curves and compared with the log rank test for patients who had at least 1 month of follow-up. A Cox model was constructed to control for a priori selected confounders.

Results: A total of 1,610 patients were identified; 308 (27.6%) had SLN. An increase in the use of SLN per year of diagnosis was noted; 20% in 2012, 27.4% in 2013, 29.4% in 2014, and 34.4% in 2015. Higher rates of SLN were observed in academic facilities (30.6% vs 25.2%, P = 0.018). Patients who had SLN were less likely to have comorbid conditions based on Charlson index (27.6% vs 33%, P = 0.04) and had smaller tumors (median size 1.7 vs 2 cm, P = 0.001). There were no differences between the 2 groups in terms of age, race, insurance type, tumor grade, or margin status (P > 0.05). Rates of positive lymph nodes were comparable (16.7% for SLN and 20.2% for LND, P = 0.11). Patients who had LND were more likely to receive adjuvant radiotherapy (18.5% vs 14.2%, P = 0.043). Patients who had SLN had shorter inpatient stay (median 1 vs 2 days, P < 0.001), a lower rate of unplanned readmission (2% vs 5%, P = 0.007), and a trend towards a lower 90-day mortality rate (0% vs 1.1%, P = 0.07). There was no difference in OS between patients who had SLN (n = 308) and LND (n = 902, P = 0.29); 3-year OS rates were 82.5% and 81%, respectively. After controlling for age, type of insurance, comorbid conditions, lymph node metastases, and receipt of chemotherapy and radiotherapy, SLN was not associated with worse overall survival (HR = 0.93, 95% CI 0.66–1.30).

Conclusion: The utilization of SLN is increasing in the management of vulvar SCC and is associated with superior perioperative outcomes without an apparent difference in overall survival.
International Posters

725 - Poster Session
Increasing incidence of uterine epithelial cancer in United States and Taiwan: Who is most at risk?
H.W. Tsai\textsuperscript{a}, S.Y. Yang\textsuperscript{b}, J.K. Chan\textsuperscript{b}, D.S. Kapp\textsuperscript{c} and C.I. Liao\textsuperscript{a}. \textsuperscript{a}Kaohsiung Veterans General Hospital, Kaohsiung, Taiwan, \textsuperscript{b}California Pacific and Palo Alto Medical Foundation/Sutter Health Research Institute, San Francisco, CA, USA, \textsuperscript{c}Stanford University School of Medicine, Stanford, CA, USA

Objective: The aim of this study was to evaluate the trends of uterine epithelial cancer incidence in the United States and Taiwan using population-based data.

Method: Cancer registries data were obtained from 2001 to 2015 using United States Cancer Statistics (USCS) and Taiwan Health and Welfare Data Science Center (HWDC) and adjusted by World (WHO 2000–2025) Standard Million (18 age groups). SEER Stat 8.3.6 and Joinpoint regression programs v4.6.0.0 were used to evaluate the trends in age-adjusted uterine epithelial cancer (ICD-10 = C54 & C55) incidence expressed per 100,000 women.

Results: From 2001 to 2015, the age-adjusted incidence of uterine epithelial cancer increased in the United States and Taiwan with annual percentage change (APC) +0.9% and 6.6% ($P < 0.05$). Of the U.S. patients, whites, blacks and Asians had an increase in incidence with APC +0.7%, +2.6%, and +2.2% ($P < 0.05$), respectively. We determined the age group at the greatest risk diagnosis and showed 65–69 years in the United States (91.7/100,000) and 55–59 years in Taiwan (36.6/100,000) had the greatest risk. Of the U.S. patients, the age group with the highest risk was 65–69 years for whites (93.2/100,000), 65–69 years for blacks (92.6/100,000), and 60–64 years for Asians (51.3/100,000). See Figure 1.

Conclusion: The incidence of uterine epithelial cancer is increasing in the United States and Taiwan. The younger age at diagnosis in Asians compared to other racial groups in both countries suggest potential similar genetic and lifestyle patterns.

![Fig. 1. Age-specific incidence of uterine epithelial cancer in the US and Taiwan, 2001-2015.](image-url)
**726 - Poster Session**

**Magnetic resonance imaging for differentiating ovarian endometrioid carcinoma from clear cell carcinoma**

K.A. Kim. **Korea University College of Medicine, Seoul, South Korea**

**Objective:** The purpose of this study was to investigate magnetic resonance imaging (MRI) features for differentiating ovarian endometrioid carcinoma from clear cell carcinoma (CCC).

**Method:** Twenty patients with 25 endometroid carcinomas and 22 patients with 24 CCCs confirmed by surgery and pathology underwent MRI. The MRI features of the tumors, including laterality, size, shape, configuration, signal intensity, enhancement, concurrent endometriosis, synchronous primary cancer (SPC) of the ovary and endometrium, and clinical stage, were evaluated and compared between the 2 groups.

**Results:** There was no significant difference in the mean maximum diameter (11.1 cm vs 12.8 cm), round or lobulated shape (80% vs 79%), mainly cystic with mural nodules or papillary projections (60% vs 67%), cystic component with iso- or hyperintensity on T1WI (88% vs 96%), solid component with hyperintensity on T2WI (75% vs 79%), moderate enhancement (84% vs 79%), and FIGO stage I–II (80% vs 69%) between endometrioid carcinoma and CCC. Compared to CCCs, endometrioid carcinomas were more frequently bilateral (25% vs 6%), had SPC more often (15% vs 0%), and had less association with endometriosis (30% vs 50%). See **Figure 1**.

**Conclusion:** Ovarian endometroid and CCC share many similar MRI features. They usually appear as large, mainly cystic masses with enhancing mural nodules and hyperintense cystic components on T1WI. Although it is challenging to distinguish between the 2, SPC of the ovary and endometrium, and bilateral diseases are helpful for differentiating endometrioid carcinomas from CCCs.

![Figure 1](attachment:image.png)

---

**727 - Poster Session**

**Association of BMI with the risk of endometrial cancer: A population-based retrospective study in Korea**

G.H. Han, S. Pyeon and J.M. Lee. **Kyung Hee University Hospital at Gangdong, Seoul, South Korea**

**Objective:** Obesity is a well-known risk factor for endometrial cancer in Western countries. However, evidence of the association between BMI and endometrial cancer risk in the Korean population is still limited. Therefore, we evaluated the association of BMI with development of endometrial cancer in Korean women.

**Method:** We investigated 15,453 Korean women age 35–69 years retrospectively. Data between 2010 and 2016 were obtained from the Korean National Health Insurance National Sample Cohort database. To investigate the association between BMI and endometrial cancer risk, we categorized BMI into 5 groups (BMI <18.5, 18.5–25.0, 25.0–30.0, 30.0–40.0, and >40.0 kg/m²). Cox proportional hazards regression analyses were performed with adjustment of possible confounders.
Results: Data for 15,453 Korean women who were diagnosed with endometrial cancer between 2010 and 2016 were analyzed. During the follow-up period, the incidence of endometrial cancer was increased 65.4%. Women with type I endometrial cancer were younger than women diagnosed with type II endometrial cancer (mean 59.5 vs 65.5 years, respectively) and had higher BMI (27.6 vs 24.5 kg/m², respectively). Cox proportional hazards regression analyses showed that obesity was positively associated with endometrial cancer risk. Compared with BMI 18.5–25.0, HR for BMI 25.0–30.0 was 1.43 (95% CI 1.17–2.97); for BMI 30.0–40.0, 2.12 (95% CI 1.19–3.54); and for BMI >40, 2.57 (95% CI 1.30–4.54).

Conclusion: We found that the risk of endometrial cancer was increased in women with BMI ≥25.0 in the Korean population. However, the level of BMI associated with the incidence of endometrial cancer was relatively low compared with that of the Western population.

728 - Poster Session
Preoperative quantitative sensory testing and robot-assisted laparoscopic hysterectomy for endometrial cancer: Can chronic postoperative pain be predicted?
S. Lunde³, K.K. Petersen⁵, E. Sogaard-Andersen³ and L. Arendt-Nielsen⁵. ³Aalborg University Hospital, Aalborg, Denmark, ⁵Aalborg University, Aalborg, Denmark

Objective: Chronic postoperative pain is prevalent after robot-assisted laparoscopic hysterectomy for endometrial cancer. Preoperative Quantitative Sensory Testing (QST) has been utilized to identify patients at risk of developing chronic postoperative pain after a variety of surgical procedures. The aim of this prospective, observational study was to determine whether preoperative QST profiling could predict the development of chronic postoperative pain following robot-assisted laparoscopic hysterectomy for endometrial cancer.

Method: A total of 160 consecutive patients were included, and handheld pressure algometry, cuff pressure algometry, temporal summation of pain, conditioned pain modulation, and heat-evoked pain thresholds were assessed prior to surgery. Patients were asked to fill out a questionnaire concerning pain in the pre- and postoperative time period 6 months after surgery. Chronic postoperative pain was defined as persistent pain on a daily basis with a mean VAS ≥3 at 6 months after surgery.

Results: The prevalence of chronic postoperative pain after robot-assisted laparoscopic hysterectomy for endometrial cancer was 13.6%. Significant preoperative heat pain hyperalgesia was found in the chronic postoperative pain group compared with the nonchronic postoperative pain group (P = 0.043). None of the other QST assessments predicted postoperative pain. Patients with chronic postoperative pain were significantly leaner in terms of BMI (P = 0.032), had a higher prevalence of preoperative pelvic pain (P < 0.001), and a higher level of acute postoperative pain (P < 0.001) than patients without chronic postoperative pain.

Conclusion: Preoperative QST assessment demonstrated significant heat pain hyperalgesia in the chronic postoperative pain group.

729 - Poster Session
Clinicopathologic significance of mismatch repair protein expression in endometrial cancer
M.K. Kim⁴ and S.C. Kim⁵. ⁴Ewha Womans University, Seoul, South Korea, ⁵Ewha Womans University Hospital, Seoul, South Korea

Objective: The purpose of this study was to evaluate mismatch repair (MMR) protein expression in endometrial cancer and to assess its association with clinicopathologic outcomes.

Methods: A retrospective review of the clinicopathologic data and clinical outcomes was performed on patients who were treated for endometrial cancer at a single center between 2014 and 2018. For the study analysis, patients with results for MMR protein immunohistochemistry were included. MMR-deficient was defined as absence of expression in any of the 4 MMR proteins (MLH1, MSH2, MSH6, and PMS2). Clinical and pathologic outcomes were compared according to MMR status.

Results: A total of 146 endometrial cancer patients with available MMR expression data were included. Of these, 41 patients (28.1%) showed absence of MMR protein expression. Compared with MMR-proficient patients, MMR-deficient patients had a higher rate of pelvic and/or paraaortic lymph node metastasis and lymphovascular space invasion (P = 0.011 and P = 0.015, respectively). However, other clinicopathologic variables, including stage, grade, histologic subtype, and depth of invasion,
were not associated with MMR status. During the median follow-up period of 18.2 months (1–39.4 months), there was no difference in progression-free survival between MMR-proficient and MMR-deficient patients ($P = 0.181$).

**Conclusion:** MMR defects were associated with a higher rate of lymphovascular space invasion and lymph node metastasis. However, other prognostic factors and survival outcomes were not different between MMR-proficient and MMR-deficient patients.

---

**730 - Poster Session**

**Preoperative and intraoperative assessment of myometrial invasion and histological grade section**

A. Maheshwari. *Tata Memorial Centre, Mumbai, India*

**Objective:** The role of systematic lymphadenectomy in clinically early-stage endometrial cancer is controversial. A number of factors can predict lymph node metastasis including myometrial invasion, tumor grade in endometrial cancers. The purpose of the present study is to evaluate the accuracy of preoperative MRI and intraoperative frozen section in determining the depth of myometrial invasion, cervical involvement, tumor size, and lymph nodal status. We also studied the accuracy of preoperative endometrial biopsy and intraoperative frozen section in determining the grade of the tumor.

**Method:** Medical records of 245 consecutive cases of clinically early-stage endometrial cancer were reviewed retrospectively. A record of depth of myometrial invasion, tumor size, cervical involvement, and presence of enlarged lymph nodes was made on a preoperative MRI. Similarly, depth of myometrial invasion, tumor size, cervical involvement, and grade of tumor were recorded on an intraoperative frozen section. The grade of the tumor was also recorded on a preoperative endometrial biopsy. Standard statistical calculations were used.

**Results:** The sensitivity and specificity of MRI for myometrial invasion were 81.3% and 75%, respectively, while those for frozen section were 80% and 96.2%, respectively. For tumor grade the sensitivity and specificity of preoperative endometrial biopsy were 60% and 95.6%, respectively, while those of frozen section were 53.8% and 97.6%, respectively. For cervical involvement the sensitivity of MRI and frozen section was 62.5% and 98.4%, respectively.

**Conclusion:** Although the sensitivity of both frozen section and MRI for predicting deep myometrial invasion was similar (80% vs 81.3%), the specificity (96.2% vs 75%) and negative predictive value (92.7% vs 88.2%) of frozen section were superior to MRI. Both preoperative biopsy and intraoperative frozen section had low sensitivity (60% vs 53.8%) for detecting a high-grade lesion.

---

**731 - Poster Session**

**Evolution of treatments for endometrial cancers: Clinical data from two national medical databases**

J. Liua, J. Lib, S. Zenga, G. Caia, Y. Wanga, J. Chia, R. Lia, Y. Yua, X. Jiao, Y. Daia, Y. Fengb, M. Van Zandtb, S. Seagerb, C. Reichb and Q. Gaoa. *aTongji Hospital, Tongji Medical College, Huazhong University of Science & Technology, Wuhan, China, bReal World Solutions, IQVIA, Durham, NC, USA*

**Objective:** The aim of this study was to demonstrate patient characteristics and evolution of treatments for women with endometrial cancer in the past decade and evaluate the consistency of clinical data from commercial insurance and hospital databases.

**Method:** Data of patients with endometrial cancer who underwent surgery between 2003 and 2018 were retrieved from a U.S. commercial insurance database named Open Claims, and a hospital record-based database named Hospital CDM (Common Data Model), which were converted into OHDSI (Observational Health Data Sciences and Informatics) CDM. After the records were obtained, we extracted the patient characteristics, surgical approach (open approach surgery or laparoscopic surgery), and postoperative adjuvant therapy types (chemotherapy, radiotherapy, or both) for analysis.

**Results:** In total, 128,162 patients in OpenClaims and 5,009 in the Hospital CDM met the inclusion criteria. In Open Claims, hypertension, hyperlipidemia, and diabetes were the most common diseases preceding the diagnosis of endometrial cancer, present in 91,998 (71.0%), 53,575 (41.4%), and 42,925 (33.1%) patients, respectively. The incidence rate of postmenopausal bleeding was 51.3%. Overall, 66,268 patients received open approach surgery and 61,894 received laparoscopic surgery. The proportion of patients receiving laparoscopic surgery had been increasing from 2003 to 2014; this increase has stopped since 2015. Meanwhile, the number of patients receiving at least 1 type of postoperative adjuvant therapy has risen in the past
decade, from 14.3% in 2003 to 41.6% in 2018, especially for patients receiving a combination of chemotherapy and radiotherapy (3.98% in 2003 and 11.8% in 2018) (Figure 1). Similar trends are observed in Hospital CDM.

Conclusion: This study reveals that hypertension, diabetes, and hyperlipidemia are prevalent in patients with endometrial cancer, and these diseases may play a role in the development of endometrial cancers. Since 2003, the number of patients receiving laparoscopic surgery and postoperative adjuvant therapy has increased. Analysis of clinical data from commercial insurance and hospital record-based databases shows high consistency, suggesting that insurance databases have good prospects for future application.

Fig. 1.

---

732 - Poster Session
Trends and characteristics of fertility-sparing treatment for atypical endometrial hyperplasia and endometrial cancer in Japan: A survey by the gynecologic oncology committee of Japan Society of Obstetrics and Gynecology
Kurume University School of Medicine, Fukuoka, Japan, Tokai University School of Medicine, Kanagawa, Japan, Keio University, School of Medicine, Tokyo, Japan, Chiba University Graduate School of Medicine, Chiba, Japan, Chiba University, Chiba, Japan, Niigata University Graduate School of Medicine, Japan, Niigata, Japan, Tohoku University School of Medicine, Sendai, Japan

Objective: Fertility-sparing treatment is an option for young patients with atypical endometrial hyperplasia (AEH) and endometrial cancer. However, its clinical features and current trends in treatment are relatively unknown in Japan. In this study, we aimed to collect and analyze nationwide data on fertility-sparing treatment for AEH and endometrial cancer patients in Japan. The objective of this study was to examine pathological complete remission (CR) rates and trends in fertility-sparing treatment for young AEH and endometrial cancer patients in Japan.

Method: This study was conducted by the committee on gynecologic oncology of the Japan Society of Obstetrics and Gynecology (JSOG). This retrospective questionnaire-style survey, on fertility-sparing treatment (January 2009 to December
Results: The histology of patients was AEH (n = 165), endometrioid adenocarcinoma (EMCA) grade 1 (n = 225), EMCA grade 2 (n = 9), and atypical polypoid adenomyoma (APA) (n = 7). Fertility-sparing treatment was performed with MPA (87.2%, n = 357) and MPA + metformin (11.6%, n = 47). Among the AEH cases, the pathological CR rate was 89% in MPA 600 mg (n = 97/109), 76.9% in MPA 400 mg (n = 20/26), and 96% in MPA + metformin (n = 24/25). Among EMCA G1 cases, the pathological CR rate was 70.3% in MPA 600 mg (n = 116/165), 70.6% in MPA 400 mg (n = 24/34), and 72.7% in MPA + metformin (n = 16/22). Two hundred sixty patients wished to conceive after confirming pathological CR after treatment. Among these patients, 38.4% (n = 100) conceived, and 33.1% (n = 86) gave birth. Among AEH cases, the recurrence rate was 44.8% in MPA 600 mg (n = 43/96), 30% in MPA 400 mg (n = 6/20), and 45.8% in MPA + metformin (n = 11/24). Among EMCA G1 cases, the recurrence rate was 52.6% in MPA 600 mg (n = 61/116), 37.5% in MPA 400 mg (n = 9/24), and 30.8% in MPA + metformin (n = 4/13).

Conclusion: Current trends and efficacy of fertility-sparing treatment in Japan for AEH and endometrial cancer with various regimens were confirmed by this nationwide retrospective study.

Tissue resident-like CD8 T cells link neo-antigen load to tertiary lymphoid structures in endometrial cancer

J. Lubbers, M. Wazynska, N. van Rooij, M. de Bruyn and H. Nijman, University Medical Center Groningen, Groningen, Netherlands

Objective: Treatment with immune checkpoint inhibitors (ICIs) is associated with unprecedented remission and long-term disease control. However, only a subset of gynecological cancer patients responds to current treatment with ICIs. The response of patients to ICIs has recently been linked to the formation of de novo lymphoid tissue in tumors, the so-called tertiary lymphoid structures (TLSs). My group identified a transcriptionally unique resident memory-like CD8 T cell subset that produces the lymphogenic chemokine CXCL13, an essential factor in lymphoid tissue formation. Within the current study, we sought to analyze the development, characteristics, and therapeutic potential of the resident memory-like CXCL13 CD8 T cell subset in endometrial cancer.

Method: CD8 T cells were isolated from human primary endometrial tumors or the peripheral blood of healthy donors. Peripheral CD8 T cells were activated using anti-CD3/CD28 bead-based stimulation, or T cell receptor (TCR)-specific activation in T cell–tumor cell cocultures. Flow cytometry and mRNA sequencing were used to analyze and compare native and induced resident memory (TRM)-like CD8 T cells.

Results: Four unique TRM-like CD8 T cell subsets were distinguished in endometrial tumors and upon in vitro induction. TRM-like subsets were all characterized by CXCL13 expression, but displayed unique activation and dysfunction signatures. All 4 subsets were functionally impaired upon ex vivo isolation. Nevertheless, tumor infiltration by CXCL13 TRM-like subsets was associated with formation of TLSs and improved outcome. Screening differentially expressed genes against a public library of clinically tested small molecule inhibitor targets identified novel kinase targets in TRM-like CD8 T cells for clinical evaluation.

Conclusion: Tumor-infiltrating TRM-like CD8 T cells are a diverse population of atypical CD8 T cells defined by expression of the chemokine CXCL13. TRM-like CD8 T cells associate with the formation of TLSs and could be targeted by combined ICI and kinase inhibitor therapy.

Natural orifice transluminal endoscopic surgery with sentinel lymph node mapping for endometrial cancer

M.C.V.R. Mendoza and C.L. Lee, aPhilippine General Hospital, Manila, Philippines, bChang Gung Memorial Hospital, Taipei, Taiwan

Objective: In the last few years, there has been a remarkable shift from traditional open surgery to minimally invasive surgery for the management of endometrial cancer especially in disease confined to the uterus. Included in the minimally invasive options is the natural orifice transluminal endoscopic surgery (NOTES) approach with integration of sentinel lymph node (SLN) mapping. This report describes the experience with the largest series of endometrial cancer patients who underwent transvaginal NOTES with SLN mapping using indocyanine green (ICG).
Method: The study included all endometrial cancer patients with clinical stage I disease and endometrioid histology who underwent transvaginal NOTES procedure and SLN mapping with ICG from 2014 to 2019. Seventeen patients underwent NOTES THBSO and SLN mapping, while 1 patient had restaging performed with NOTES cervicectomy and SLN mapping.

Results: There were 18 endometrial cancer patients with stage I disease who underwent transvaginal NOTES procedure and SLN mapping with ICG. The mean patient age was 51.7 years (SD 8.06), and mean BMI was 28.2 kg/m² (SD 5.75). The mean operative time was 258 minutes (SD 70.45), and mean estimated blood loss was 134.4 mL (SD 162.2). The mean decrease from preoperative hemoglobin to postoperative day 1 hemoglobin was 1.5 g/dL. There were no intraoperative or postoperative complications. The patients remained admitted postoperatively with a range of 2 to 6 days (mean postoperative hospital stay 3 days). The overall detection rate was 100% (18/18), and the bilateral detection rate was 89% (16/18). Paraortic SLNs were detected in 6 patients who had positive pelvic SLNs. The mean number of total lymph nodes harvested was 9.2 (range 2–31).

Conclusion: NOTES surgical staging with SLN mapping is a viable option for early-stage endometrial cancer. The report shows patients with FIGO stage IA and IB disease who had successfully undergone staging procedures using the NOTES approach with a 100% overall detection rate of SLNs.
pathologically identified ovarian cancer patients and 8,974 benign patients. Of the ovarian cancer patients, 805 had available survival time. The pretreatment indices were extracted from electronic medical records. First, we assessed the value of the indices to distinguish ovarian cancer patients from benign patients by the t test and stepwise logistic regression. Second, Cox regression was used for survival analysis.

Result: The t test showed that all indices except thrombin time had a significant difference between the ovarian cancer group and the benign group (P < 0.005). Then we input the remaining 11 indices as well as age into the stepwise logistic regression analysis. Eventually, platelet count (OR = 1.009, 95% CI 1.006–1.011, P < 0.0001), platelet distribution width (OR = 1.058, 95% CI 0.993–1.128, P = 0.0800), antithrombin (OR = 0.984, 95% CI 0.974–0.995, P = 0.0031), fibrinogen (OR = 1.207, 95% CI 1.065–1.367, P = 0.0032), and age (OR = 1.078, 95% CI 1.065–1.092, P < 0.0001) were included in the final model as important factors associated with the ovarian cancer. Next, these 5 factors together with histologic type, pathologic grade, and FIGO stage were used for survival analysis. In addition to age and FIGO stage, fibrinogen (HR = 1.254, 95% CI 1.127–1.396, P < 0.0001) was the compelling risk factor of overall survival by the Cox model.

Conclusion: Thrombosis-associated indices were potential predictors for ovarian cancer, among which platelet distribution width, platelet count, antithrombin, and fibrinogen reflected the risk of getting ovarian cancer, and FIB was associated with overall survival of ovarian cancer.

737 - Poster Session
Diagnosis and prognosis prediction of ovarian cancer with feedforward neural network by mining real-world laboratory tests
Y. Gaoa, G. Caii, H. Li, X. Li, K. Song, W. Lv, B. Cui, B. Kong, X. Xie, S. Li, D. Ma and Q. Gao. Tongji Hospital, Tongji Medical College, Huazhong University of Science & Technology, Wuhan, China, City University of Hong Kong, Hong Kong, Hong Kong, Women’s Hospital, Zhejiang University School of Medicine, Zhejiang, China, Qilu Hospital of Shandong University, Jinan, China

Objective: Ovarian cancer remains the most lethal gynecological cancer, mainly because of the lack of an effective screening strategy. We aimed to demonstrate the value of laboratory tests in ovarian cancer detection and prognosis prediction with deep learning in a real-world setting.

Method: In this retrospective, multicohort study, we extracted 435,599 laboratory test results comprising 51 laboratory items from 12,161 patients in electrical medical records among 3 metropolitan hospitals between January 1, 2012, and May 30, 2019. The diagnostic model was trained on data of 5,009 individuals from 2 hospitals with feedforward neural network (FNN), and then tested in an internal and an independent external validation cohort, which contained 1,253 and 5,899 patients, respectively. The performance of the model was evaluated by accuracy, sensitivity, and specificity, and then it was compared with CA1-25. K-modes model was used in the prognosis prediction.

Results: The FNN diagnostic model consisting of 51 laboratory items achieved high accuracy, sensitivity, specificity for the internal validation (0.945, 0.863, 0.962) and for the external validation set (0.912, 0.639, 0.915, respectively) in identifying ovarian cancer. The FNN model exhibited comparable specificity (0.956 vs 0.856, 0.858 vs 0.882) and improved accuracy (0.933 vs 0.841, 0.858 vs 0.785) and sensitivity (0.896 vs 0.811, 0.842 vs 0.318) compared with CA1-25 in detecting patients with ovarian cancer on both validation sets. Also, among early-stage ovarian cancer, the FNN model exhibited improved diagnostic performance in contrast with CA-125 with the accuracy (0.948 vs. 0.811), sensitivity (0.898 vs. 0.412), and specificity (0.956 vs. 0.900) in the combined validation set. Moreover, the combination of the 51 laboratory items was proven to hold potential for recurrence (HR = 1.53, 95% CI 1.15–2.05, P = 0.0035) and survival (HR = 2.25, 95% CI 1.45–3.50, P = 0.0020) prediction in ovarian cancer patients with the K-modes model.

Conclusion: Laboratory tests based on the FNN model hold screening and prognostic potential for ovarian cancer, and this merits further investigation.

738 - Poster Session
The increasing incidence of ovarian epithelial cancer in Taiwan compared to United States: What factors are responsible?
Y.H. Li, J.K. Chan, D.S. Kapp, W.S. Liou and C.I. Liao. Kaohsiung Veterans General Hospital, Kaohsiung, Taiwan, California Pacific and Palo Alto Medical Foundation/Sutter Health Research Institute, San Francisco, CA, USA, Stanford University School of Medicine, Stanford, CA, USA
Objective: The aim of this study was to evaluate the trends of ovarian epithelial cancer incidence in the United States and Taiwan using population-based data.

Method: Cancer registries data were obtained from 2001 to 2015 using United States Cancer Statistics (USCS) and Taiwan Health and Welfare Data Science Center (HWDC) and were adjusted by World (WHO 2000–2025) Standard Million (18 age groups). SEER Stat v8.3.6 and Joinpoint regression programs v4.6.0.0 were used to evaluate the trends in age-adjusted ovarian cancer (ICD-10 = C56) incidence.

Results: From 2001 to 2015, the age-adjusted incidence of ovarian epithelial cancer decreased in the United States with an annual percentage change (APC) of −1.9% (P < 0.05), but increased in Taiwan with an APC of +2.0% (P < 0.05). Of the U.S. patients, whites, blacks, and Asians had a decrease in incidence with APC −2.0% (P < 0.05), −1.3% (P < 0.05), and −0.5% (P > 0.05), respectively. We determined the age group with the greatest rate of ovarian epithelial cancer diagnosis was 80–84 years in the United States (48.8/100,000) and 50–54 years in Taiwan (18.6/100,000). With respect to racial groups in the United States, the age group with the highest rate was 80–84 years for whites (50.3/100,000), 80–84 years for blacks (39.1/100,000), and 80–84 years for Asians (27.6/100,000). See Figure 1.

Conclusion: There was an overall decrease in ovarian epithelial cancer incidence in the United States but an increase in Taiwan. The younger age at presentation in Taiwan may be due to a higher proportion of early-stage and clear cell cancers.

Fig. 1. Age-specific incidence of ovarian epithelial cancer in the US and Taiwan, 2001-2015.
Objective: Recent data on PARP inhibitors suggest that the primary tumor chemosensitivity may play a major role in patient prognosis. The modeled CA-125 kinetic parameter (KELIM), based on the CA-125 kinetics during the first 100 days of adjuvant chemotherapy, is an indicator of the tumor chemosensitivity. It is a predictor of the risk of subsequent platinum-resistant relapse after first-line (Proc ESMO 2019, 1027P). The objective was to assess the relative impact of the tumor chemosensitivity with respect to other prognostic factors on overall survival (OS), and the cure rate, following first-line treatment.

Method: The datasets from 3 large phase III trials in first-line setting (AGO-OVAR 9: carboplatin-paclitaxel (CP) with or without gemcitabine; AGO-OVAR 7: CP with or without topotecan; and ICON 7 trials: CP with or without bevacizumab) were pooled to assess the OS, and the cure rates, of patients according to disease stages (stage I to IV), KELIM, and other prognostic factors using multivariate tests. Cure was defined as no relapse ≥5 years after inclusion.

Results: The data from 2,868 patients were assessable (median follow-up 45 months). The only significant predictors of OS and cure rates were disease stages and KELIM. The prognostic impact of KELIM (categorized by the upper tercile >1.2 or ≤1.2) was limited for stage I–II (5-year OS, 84% vs 80%), but was important for stage III and IV disease (5-year OS, stage III, 48% vs 33%; stage IV, 44% vs 18%). The median OS of patients with stage III–IV disease and favorable KELIM were >45 months (Figure 1). Out of 2,868 patients, 82 patients (2.8%) were cured, including 48 stage I (58%), 32 stage III (39%), and 2 stage IV (2%). Favorable KELIM was found in 60% and 100% of cured stage III and IV, respectively. The 2 independent predictors of the cure probability using the multivariate logistic regression model were disease stage (stage I–II = REF; stage III, OR = 0.18, 0.11–0.30; stage IV, OR = 0.06, 0.01–0.21) and KELIM as a continuous covariate (OR = 2.35, 1.51–3.59).

Conclusion: These data confirm the preponderant role of tumor primary chemosensitivity on patient survival at 5 years and on the likelihood of cure after first-line treatment. Given the impact of platinum sensitivity on PARP inhibitor efficacy, the survival discrepancy in between patients with favorable/unfavorable KELIM may even increase in the future.

Fig. 1.
Objective: Since the advent of transvaginal ultrasound, the detection rate of accessory masses has risen sharply, while the low accuracy of conventional ultrasound often leads to overtreatment. Existing methods for the detection of ovarian cancer are limited in diagnosing early-stage ovarian cancer, which could substantially improve survival. We aimed to develop and validate a deep convolutional neural network (DCNN)-enabled model to improve the diagnostic accuracy of ovarian cancer-based pelvic ultrasound images.

Method: In this study, a total of 592,275 ultrasound images from 107,624 women (4,254 ovarian cancer and 103,370 non-ovarian cancer) were extracted among 10 hospitals between September 2003 and May 2019. The model was developed on 570,930 images (105,079 women) from 8 hospitals, tested in the internal validation set on 13,416 images (1,321 women) from Tongji Hospital, validated on external validation set 1 (1,419 images of 335 women from Jingzhou cohort) and external validation set 2 (6,510 images of 889 women from Xiangyang cohort). The accuracy, sensitivity, specificity, negative predictive value, positive predictive value, and area under the curve (AUC) by receivers operating characteristic analysis were compared with 35 experienced radiologists and CA-125.

Results: The model performed well with an accuracy, sensitivity, and specificity of 0.889, 0.793, and 0.932 for the internal validation set; 0.842, 0.716, and 0.873 for the external validation set 1; and 0.832, 0.699, and 0.863 for the external validation set 2, respectively, in identifying OC. The model exhibited improved accuracy (0.842 vs 0.735, 0.858 vs 0.785), sensitivity (0.750 vs 0.592, 0.842 vs 0.318), specificity (0.863 vs 0.767, 0.806 vs 0.790) compared with the average of radiologists in detecting patients with ovarian cancer for the internal and external validation set 1, respectively. Among early-stage (FIGO stage I–II) ovarian cancer patients, the DCNN model achieved higher specificity (0.836 vs 0.736), sensitivity (0.727 vs 0.624), and AUC (0.831 vs 0.728) than CA-125, respectively. See Figure 1.

Conclusion: DCNN-enabled pelvic ultrasound imaging showed improved performance in identifying patients with ovarian cancer compared with experienced radiologists and CA-125 even in early-stage ovarian cancer. The accurate and early diagnosis of the model merited further investigation.
Role of complete staging surgery and adjuvant chemotherapy in adults with apparent stage I pure immature ovarian teratoma after fertility-sparing surgery: Experience at a tertiary center in China

D. Wang, S. Zhu, C. Jia, D. Cao, M. Wu, K. Shen, J. Yang, L. Pan and Y. Xiang, Peking Union Medical College Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, China

Objective: The standard treatment for young patients with stage I malignant ovarian germ cell tumors, except stage I dysgerminoma and stage IA G1 immature teratoma (IMT), is unilateral salpingo-oophorectomy with complete staging surgery (CSS) followed by platinum-based chemotherapy. However, the role of CSS and adjuvant chemotherapy remains controversial.

Method: Seventy-five patients age >18 years with stage I pure IMT who received fertility-sparing surgery (FSS) between 1986 and 2018 were reviewed retrospectively. FSS was defined as preservation of the uterus and at least 1 adnexa.

Results: Nine patients (12.0%) had recurrent disease during a median follow-up time of 80.2 months (13.7–261.0 months). All patients were successfully salvaged, except for 1 death. Twenty-six (34.7%) patients had received CSS. Fifty-one patients received postoperative adjuvant chemotherapy, while 24 (32.0%) underwent surgery alone, including 15 patients who did not receive adjuvant chemotherapy despite it being indicated by the recommended approach. Four of these patients developed recurrence, but all were salvaged by secondary surgery. Tumor relapse occurred in patients with all grades of IMT (G1, 3/35; G2, 4/25; G3, 2/15). Univariate analysis revealed that CSS, adjuvant chemotherapy, and tumor grade were not associated with 5-year disease-free survival (P = 0.406, P = 0.442, and P = 0.689, respectively). See Table 1.

Conclusion: Adults with stage I pure IMT show excellent overall survival after FSS. Complete staging surgery can thus be omitted in adult patients with stage I pure IMT, and these patients might be spared adjuvant chemotherapy, regardless of grade.
### Table 1.

<table>
<thead>
<tr>
<th>Factors</th>
<th>Disease-free survival</th>
</tr>
</thead>
<tbody>
<tr>
<td>5-year DFS (%)</td>
<td>HR (95% CI)</td>
</tr>
<tr>
<td>Parity</td>
<td></td>
</tr>
</tbody>
</table>
| Nulliparous                   | 89.7                  | 1                  | 0.378  
| Parous                        | 82.4                  | 1.847 (0.459-7.428) | 0.105  
| Initial treatment             |                       |  
| Our clinic                    | 95.6                  | 1                  | 0.146  
| Outside facility              | 79.4                  | 2.968 (0.742-11.871) | 0.406  
| Tumor rupture                 |                       |  
| No                             | 92.8                  | 1                  | 0.406  
| Yes                            | 85.4                  | 3.018 (0.627-14.530) | 0.274  
| Staging operation             |                       |  
| CSS                            | 91.1                  | 1                  | 0.689  
| incomplete                    | 87.8                  | 1.919 (0.399-9.242) | 0.751  
| Lymphadenectomy               |                       |  
| Yes                            | 94.4                  | 1                  | 0.442  
| No                             | 86.8                  | 3.673 (0.459-29.401) | 0.751  
| Omentectomy                   |                       |  
| Yes                            | 92.2                  | 1                  | 0.751  
| No                             | 87.0                  | 2.337 (0.485-11.258) | 0.751  
| Tumor grade                   |                       |  
| G1                             | 94.3                  | 1                  | 0.751  
| G2                             | 84.0                  | 1.889 (0.422-8.446) | 0.751  
| G3                             | 83.0                  | 1.662 (0.277-9.976) | 0.751  
| GP at initial surgery         |                       |  
| No                             | 89.6                  | 1                  | 0.751  
| Yes                            | 85.7                  | 1.288 (0.267-6.200) | 0.751  
| Adjuvant chemotherapy         |                       |  
| No                             | 87.5                  | 1                  | 0.751  
| Yes                            | 89.4                  | 0.602 (0.161-2.240) | 0.751  

---

**742 - Poster Session**  
**Secondary cytoreduction in relapsed serous ovarian cancer: Who really benefits?**  
X. Xie	extsuperscript{a}, S. Tang	extsuperscript{a}, L. Jin	extsuperscript{a}, Y. Shen	extsuperscript{a}, X. Cheng	extsuperscript{a}, W. Lv	extsuperscript{a}, X. Wan	extsuperscript{a} and Z. Chen	extsuperscript{b}.  
	extsuperscript{a}Women's Hospital, Zhejiang University School of Medicine, Hangzhou, China, 	extsuperscript{b}Zhejiang Cancer Hospital, Zhejiang, China

**Objective:** The aim of this study was to determine the potential survival benefit of secondary cytoreductive surgery (SCS) in relapsed serous ovarian cancer (SOC) and to set up a predictive model for the beneficiaries.

**Method:** All patients with platinum-sensitive relapsed SOC at 2 institutions from 2000 to 2017 were identified, and patients who underwent SCS following chemotherapy were compared to patients who received chemotherapy alone after first recurrence. Potential prognostic factors were evaluated in univariate and multivariate analyses. Logistic regression was used to create the model for predicting the beneficiaries of SCS. The receiver operating characteristic (ROC) curve was used to assess the availability of the new model.

**Results:** A total of 222 patients met our eligibility criteria; 77 (34.7%) patients underwent SCS plus chemotherapy (group A) and 145 (65.3%) were treated with chemotherapy alone (group B). On multivariate analysis, ascites <500 ml at primary cytoreductive surgery (CRS) (HR = 1.447, 95% CI 1.006-2.083,  

---

and SCS (HR = 1.791, 95% CI 1.249–2.567, P = 0.002) showed prognostic statistical significance for post-recurrence progression-free survival time (PFS), whereas SCS (HR = 2.406, 95% CI 1.401–4.132, P = 0.001), ≥6 cycles postrecurrence chemotherapy (HR = 1.631, 95% CI 1.046–2.545, P = 0.031), and number and distribution of recurrent lesions (HR = 2.234, 95% CI 1.237–4.033, P = 0.008; HR = 2.137, 95% CI 1.168–3.911, P = 0.014) were independent prognostic factors for overall survival time (OS). A new predictive model was built including the disease-free interval (DFI), and number and distribution of recurrent lesions. The sensitivity and specificity of the model to predict beneficiaries for SCS were 0.929 and 0.635, respectively. See Figure 1.

**Conclusion:** Selecting suitable patients for satisfied SCS is the correct choice for the treatment of recurrent platinum-sensitive SOC. The new predictive model is feasible to select the beneficiaries for SCS.

![ROC curve for the new model (AUC:0.829): number of recurrent tumor sites DFI.](Image)

**Fig. 1.** ROC curve for the new model (AUC:0.829): number of recurrent tumor sites DFI.

---

**743 - Poster Session**  
**Expression of DcR3 in ovarian cancer and clinicopathological implication**  
Y.H. Chang, P.H. Wang and Y.J. Chen. *Taipei Veterans General Hospital, Taipei, Taiwan*

**Objective:** The purpose of this study was to identify DcR3 expression in ovarian cancer and its impact on clinicopathological features and patient outcomes.

**Method:** Clinical samples from women with ovarian cancer were collected from patients who underwent debulking surgery at Taipei Veterans General Hospital. Finally, 100 patients were enrolled in this study. Patients were divided into 2 groups based on DcR3 status. Clinical variables (including platinum status) were compared between groups with Student t test for continuous variables and χ² for categorical variables. Disease-free and overall survival were compared by the method of Kaplan-Meier with the significance of differences determined by log rank test. P < 0.05 was considered statistically significant.
**Results:** Ovarian cancer tissues from 100 women were immunostained for DcR3. DcR3 was detected in 63.6% (63 of 100 patients) of tissues from ovarian cancer patients. The clinical and pathological characteristics of the selected patients were shown. There were no significant differences in age, histology type, ascites, preoperative CA-125 values, optimal debulked status, and platinum response between DcR3-positive and DcR3-negative patients. Advanced-staged patients had more expression of DcR3 ($P = 0.04$). There was no significance in progression-free survival between DcR3-positive and DcR3-negative cases, but DcR3-positive cases had significant shorter overall survival ($P = 0.04$). See Table 1.

**Conclusion:** DcR3 expression in ovarian cancer may have a negative effect on patient outcomes and is worthy of further investigation.

**Table 1.** DcR3 expression status and its association with clinicopathological parameters.

<table>
<thead>
<tr>
<th></th>
<th>DcR3 positive</th>
<th>DcR3 negative</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients (n)</td>
<td>63</td>
<td>36</td>
<td></td>
</tr>
<tr>
<td>Age (years), mean±SD</td>
<td>53.33±13.64</td>
<td>49.61±14.67</td>
<td>0.658</td>
</tr>
<tr>
<td>BMI</td>
<td></td>
<td></td>
<td>0.597</td>
</tr>
<tr>
<td>Normal (&lt;25)</td>
<td>40 (64.5%)</td>
<td>19 (54.3%)</td>
<td></td>
</tr>
<tr>
<td>Overweight (25—29.9)</td>
<td>13 (21%)</td>
<td>10 (28.6%)</td>
<td></td>
</tr>
<tr>
<td>Obese (≥30)</td>
<td>9 (14.5%)</td>
<td>6 (17.1%)</td>
<td></td>
</tr>
<tr>
<td>Stage</td>
<td></td>
<td></td>
<td>0.037*</td>
</tr>
<tr>
<td>I, II</td>
<td>16 (34.04%)</td>
<td>19 (57.6%)</td>
<td></td>
</tr>
<tr>
<td>III, IV</td>
<td>31 (66%)</td>
<td>14 (42.4%)</td>
<td></td>
</tr>
<tr>
<td>Histology</td>
<td></td>
<td></td>
<td>0.887</td>
</tr>
<tr>
<td>Serous</td>
<td>13 (20.6%)</td>
<td>7 (19.4%)</td>
<td></td>
</tr>
<tr>
<td>Non-serous</td>
<td>50 (79.4%)</td>
<td>29 (80.6%)</td>
<td></td>
</tr>
<tr>
<td>Grade</td>
<td></td>
<td></td>
<td>0.740</td>
</tr>
<tr>
<td>1</td>
<td>1 (2.3%)</td>
<td>0 (0%)</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>8 (18.2%)</td>
<td>5 (20.8%)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>35 (79.5%)</td>
<td>19 (79.2%)</td>
<td></td>
</tr>
<tr>
<td>Ascites</td>
<td>52 (82.5%)</td>
<td>29 (80.6%)</td>
<td>0.806</td>
</tr>
<tr>
<td>CA125 (U/ml), mean±SD</td>
<td>2167±3212</td>
<td>1934±3764</td>
<td>0.832</td>
</tr>
<tr>
<td>Debulking</td>
<td></td>
<td></td>
<td>0.667</td>
</tr>
<tr>
<td>Optimal</td>
<td>39 (68.4%)</td>
<td>24 (72.7%)</td>
<td></td>
</tr>
<tr>
<td>Suboptimal</td>
<td>18 (31.6%)</td>
<td>9 (27.3%)</td>
<td></td>
</tr>
<tr>
<td>Platinum response</td>
<td></td>
<td></td>
<td>0.297</td>
</tr>
<tr>
<td>Sensitive</td>
<td>45 (84.9%)</td>
<td>18 (75%)</td>
<td></td>
</tr>
<tr>
<td>Resistant</td>
<td>8 (15.1%)</td>
<td>6 (25%)</td>
<td></td>
</tr>
<tr>
<td>E-cad IHC score, mean±SD</td>
<td>3.02±2.53</td>
<td>2.46±1.93</td>
<td>0.324</td>
</tr>
<tr>
<td>VEGF IHC score, mean±SD</td>
<td>2.69±2.18</td>
<td>2.35±2.42</td>
<td>0.559</td>
</tr>
<tr>
<td>CD44 IHC score, mean±SD</td>
<td>2.02±1.39</td>
<td>2.04±1.52</td>
<td>0.944</td>
</tr>
<tr>
<td>PFS (months), mean</td>
<td>32.97</td>
<td>155.64</td>
<td>0.962</td>
</tr>
<tr>
<td>OS (months), mean</td>
<td>65.4</td>
<td>347.93</td>
<td>0.039*</td>
</tr>
</tbody>
</table>

* means $P < 0.05$
The first study evaluating the distribution of gBRCA1/2 variants within the ovarian cancer cluster region in Japanese ovarian cancer patients


**Objectives** Whether germline BRCA1 (gBRCA1) and BRCA2 (gBRCA2) variants are located within or outside a recently described ovarian cancer cluster region (OCCR) may influence risk variations for ovarian and breast cancers. However, the prevalence of gBRCA1 and gBRCA2 variants within the OCCR has never been evaluated in Japanese ovarian cancer patients. Using the CHARLOTTE study data, we described locations of gBRCA1 and gBRCA2 variants within the OCCR and characteristics of the relevant populations.

**Methods:** The CHARLOTTE study is a cross-sectional study (NCT03229122) involving 63 study sites throughout Japan with FIGO stage I–IV ovarian cancer. gBRCA testing was performed using blood samples. Based on previously reported OCCR (1380–4062 bp for gBRCA1 and between 3249–5681bp and 6645–7471 bp for gBRCA2), distribution of the location of gBRCA1 and gBRCA2 variants was identified, and characteristics of these patients were evaluated.

**Results:** A total of 666 patients were enrolled, and 634 were evaluated. The overall prevalence of gBRCA1 and gBRCA2 variants was 9.9% and 4.7%, respectively. Ovarian cancer patients with gBRCA1 founder variant (L63X) were excluded from the subsequent analysis because this founder variant is known to relate with increases in both breast and ovarian cancer risk. Of the gBRCA1 variants, 59.6% of variants were within and 31.9% were outside the OCCR, and 8.5% were exon deletions. Of gBRCA2 variants, 50.0% of variants were within and 50.0% were outside of the OCCR. Of patients with gBRCA1 variants; 40.7% of patients with variants within the OCCR had a family history of ovarian cancer; the percentage of these patients with variants outside the OCCR was lower (13.3%). Sixty percent of patients with variants outside of the OCCR had a family history of breast cancer; the percentage of these patients with variants within the OCCR was relatively lower (33.3%).

**Conclusion:** Among Japanese ovarian cancer patients, approximately half of the gBRCA1 and gBRCA2 variants were located within the OCCR. Patients with gBRCA1 variants located within the OCCR had a higher frequency of family history of ovarian cancer. The analysis of gBRCA variant position is important, as this information may contribute to more accurate risk assessments of susceptible individuals and early detection of ovarian cancer among gBRCA variants carriers.

Bevacizumab-associated diaphragm rupture in patients with ovarian cancer

Y.J. Song. Pusan National University Yangsan Hospital, Yangsan-si, South Korea

**Objective:** We herein report a case of diaphragm rupture, which is the first reported complication of bevacizumab in ovarian cancer to our knowledge.

**Method:** Bevacizumab is an angiogenesis inhibitor used for adjuvant chemotherapy and maintenance therapy after cytoreductive surgery for advanced ovarian cancer patients. Various adverse effects are encountered in the treatment of bevacizumab, including gastrointestinal perforation, delayed wound healing, proteinuria, hypertension, congestive heart failure, and nasal septal fistula. However, bevacizumab-associated diaphragm rupture is a rare entity.

**Results:** A 54-year-old woman was treated with cytoreductive surgery for advanced ovarian cancer, followed by 6 cycles of paclitaxel and carboplatin combined with 5 cycles of bevacizumab, because the largest diameter of residual disease was 1.5 cm. The response evaluation of adjuvant chemotherapy was complete remission. After 1 cycle of bevacizumab maintenance, she visited the emergency room with uncontrolled epigastric and chest pain. Abdomen-computed tomography revealed diaphragmatic hernia with stomach herniation by diaphragm rupture. Diaphragmatic hernia was repaired by thoracic surgery.

**Conclusion:** Diaphragmatic rupture is a serious complication that may occur during the use of bevacizumab in the treatment of ovarian cancer.
**Objectives:** The main objective of this study was to answer whether performing early preoperative PET-CT scan in patients undergoing neoadjuvant chemotherapy may discriminate their response and prognosis.

**Methods:** A prospective observational study was performed between September 2014 and May 2016. There were exclusively included patients diagnosed with advanced-stage ovarian cancer considered as not eligible for primary debulking surgery according to laparoscopy Fagotti score. These patients were treated with 4 cycles of neoadjuvant chemotherapy with carbotaxole followed by interval debulking and 3 additional cycles of chemotherapy. PET-CT was performed between the initiation of chemotherapy (T0) and first (T1) and fourth (T4) cycle of chemotherapy. Follow-up outcomes of patients were also recorded. Primary outcomes were standardized uptake value (SUV), metabolic tumor volume (MTV), and tumor lesion glycolysis (TLG), which were assessed by 3 different physicians each. Total and percentage modifications of parameters within T0, T1, and T4 were compared between patients with and without recurrence and cancer-related death, while they were also correlated with OS and DFS in a Cox regression analysis.

**Results:** There were 10 patients recruited. All patients managed to have complete excision of the disease. SUVmax, MTV, and TLG were indicated not to present significant interobserver variability within physicians. SUVmax was reduced at 45.9% between T0 and T1 in patients with later cancer-related death versus only 8.0% in survivors (P = 0.05), while the relative mean decrease in absolute units was 6.5 versus 1.17 (P = 0.06). Similarly, TLG between T0 and T1 was reduced at 76.51% versus 33.7% (P = 0.04), while mean TLG decrease was 1,663.8 versus 653.8 units, respectively (P = 0.06). In contrary, patients not presenting recurrence were characterized by significantly higher TLG reduction between T1 and T4 (95.0% for nonrecurrence vs 69.1% for recurrence, P = 0.04), while TLG mean reduction was 1,088 vs 211 units (P = 0.11). All mean values of PET-CT parameters presented a higher reduction between T1 and T4 in patients not presenting recurrence.

**Conclusion:** PET-CT examination preoperatively in advanced-staged ovarian cancer patients may be prognostic. Acute improvement before and after first cycle of chemotherapy may be indicative of an increased biological aggressiveness, while improvement between first and fourth cycle of chemotherapy of a reduced possibility of recurrence.

---

**Objective:** The aim of this study was to describe computed tomographic (CT) and magnetic resonance imaging (MRI) findings of newly established seromucinous ovarian tumors in the revised 2014 WHO classification, according to tumor type with pathological correlation.

**Methods:** We retrospectively reviewed the CT and MR images of 29 patients with seromucinous tumors of ovary for the following factors: size, configuration, signal intensity (SI), staging, and accompanying ovarian endometriosis.

**Results:** The mean age was 45.2 years (range 20–84 years). A total of 32 seromucinous tumors were found on CT or MRI: 17 adenoma (A), 7 borderline (B), and 8 carcinoma (C). The mean size was 11.4 cm (A, 12.6 cm; B, 6.8 cm; and C, 13.3 cm). Adenomas appeared as unilocular (n = 10) or multilocular (n = 7) cystic mass. Borderline tumors (n = 6, 86%) and carcinomas (n = 8, 100%) showed complex cystic and solid mass. The SI of solid portion on T2-weighted images (T2WI) was hyperintense in borderline and hypointense in carcinoma. The seromucinous carcinomas were FIGO stage IA (n = 7, 88%) and stage IC (n = 1). Endometriosis was accompanied with 18 tumors (A, 8, 46%; B, 5, 71%; and C, 5, 63%). See **Figure 1**.

**Conclusion:** The CT and MRI appearance of seromucinous tumors varied according to tumor type. T2WI high SI solid portion was useful for differentiating borderline tumor from carcinoma. Seromucinous tumors were frequently associated with endometriosis.
Clinical characteristics predictive of optimal primary cytoreduction in epithelial ovarian malignancy: A five-year retrospective study in a tertiary government hospital

J.I. Alihuddin. University of the Philippines College of Medicine, Manila, Philippines

Objective: The aim of this study was to determine the clinical characteristics predictive of optimal cytoreduction among women with epithelial ovarian malignancy who underwent primary cytoreductive surgery in a tertiary government hospital.

Method: This retrospective cohort study identified 218 patients with epithelial ovarian cancer who underwent primary cytoreductive surgery in a tertiary government hospital between January 2013 and December 2017. Demographic, imaging, CA-125, and surgicopathologic data were collected. Patient characteristics were compared using $\chi^2$ test or Fisher exact test for categorical variables and independent Student $t$ test for normal continuous variables. Outcome measures included incidence of optimal cytoreduction and factors affecting its occurrence. Descriptive and inferential analysis were performed to estimate odds ratio with 95% confidence interval and $P$ values. Univariate and multivariate logistic regression analysis were conducted.

Results: A total of 145 patients had optimal cytoreduction, while 73 had suboptimal cytoreduction. A simple logistic regression analysis showed that low preoperative, low and mid intraoperative extent of disease, absence of ascites, CA-125 <500 U/ml, size of tumor, stage I and II, and mucinous histologic types were independent predictors of optimal cytoreduction. After adjusting the effects of covariates on multiple logistic regression analysis, mid-preoperative extent of disease and low- or mid-intraoperative extent of disease were associated with more than 900 and 100 times increased odds of optimal cytoreduction ($P < 0.001$).

Conclusion: Preoperative mid-extent of disease and intraoperative low- or mid-extent of disease were statistically significant predictors of optimal cytoreduction.

Multidisciplinary approach to laparoscopic cytoreductive surgery for advanced ovarian cancer with abdominopelvic carcinomatosis

M.C.V.R. Mendoza$^a$ and K.G. Huang$^b$. $^a$Philippine General Hospital, Manila, Philippines, $^b$Chang Gung Memorial Hospital, Taipei, Taiwan
Objective: The surgical management of ovarian cancer is performed traditionally by laparotomy. The role of minimally invasive surgery was exhibited in early-stage disease, assessment of resectability, and second-look surgery. However, laparoscopy in cytoreductive surgery for advanced ovarian cancer has not been established. The aim of this report is to demonstrate the role of the minimally invasive approach in the primary cytoreductive surgical treatment of advanced ovarian cancer.

Method: We present a 38-year-old multiparous woman who presented with a gradually enlarging abdominal mass. Preoperative workup showed bilateral ovarian masses with extensive peritoneal carcinomatosis. The patient underwent laparoscopic cytoreductive surgery (hysterectomy, bilateral salpingo-oophorectomy, peritoneal fluid cytology, anterior and posterior pelvic peritonectomy, bilateral pelvic node dissection, low anterior resection with colo-anal reanastomosis, partial hepatectomy, right subdiaphragmatic peritonectomy, and ablation of liver and subdiaphragmatic peritoneal nodules) performed by a multidisciplinary team of gynecologic oncologists and colorectal and hepatobiliary surgeons.

Results: The estimated blood loss was 350 ml. There were no intraoperative or postoperative complications. The histopathology result showed high-grade serous carcinoma of the bilateral ovaries with metastasis to the omentum, subdiaphragmatic peritoneum, and liver capsule. Final surgicopathologic stage is IIIC. The patient received the first course of adjuvant chemotherapy 11 days postsurgery with no adverse events and was discharged with improved condition.

Conclusion: Minimally invasive cytoreductive surgery for advanced ovarian cancer is a safe and feasible procedure. Laparoscopy allows for better visualization of tumor involvement ensuring complete removal of all visible disease. It allows for faster recovery leading to a shorter interval to chemotherapy initiation.

750 - Poster Session
Radiologic quantitative score in computed tomography to predict primary debulking outcome in advanced ovarian cancer
J. Zuo. Cancer Hospital, Chinese Academy of Medical Sciences, Beijing, China

Objective: The aim of this study was to identify the predicting value of radiologic quantitative score of computed tomography (CT) in primary debulking outcome in advanced epithelial ovarian cancers (EOC).

Method: A total of 360 patients histologic diagnosed of stage IIIIC-IV EOC who underwent primary cytoreductive surgery in our institution were enrolled in this retrospective study. A radiologic quantitative score based on abdomen/pelvis CT with 13 radiologic criteria was proposed and calculated by radiologists on all eligible patients, while the tumor distribution and debulking outcome were also accessed. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall accuracy were calculated for each radiologic criterion with a total score of each patient summed to draw curve-fitting of optimal debulking probability.

Results: Among the enrolled patients, 18% were stage IV and 37.2% (134/360) underwent radical debulking procedures, while 72.7% achieved optimal debulking. The radiologic score index overall accurately identified the disease extent with 85.4% sensitivity, 97.2% specificity, 95.7% PPV, 90.2% NPV, and 92.2% accuracy. The cutoff value of the total score for predicting optimal outcome was set to 10 points, with 86.4% predictive accuracy, 94.4% sensitivity, and 63.4% specificity. Three fitting-curves for optimal debulking probability were generated for all enrolled patients, the standard debulking group, and the expanded-debulking group (Figure 1). The goodness-of-fit test showed that for all patients compared to the standard group, $\chi^2 = 14.65$ ($P = 0.0001$), and for the expanded group compared to the standard group, $\chi^2 = 11.22$ ($P = 0.0008$). In addition, the expanded debulking surgery for cases scored 8–11 points using quantitative radiologic score could increase more than 50% possibility for optimal outcome.

Conclusion: Quantitative radiologic score has reliable sensitivity, specificity, and accuracy in predicting tumor distribution in advanced ovarian cancer. It is feasible to predict the debulking outcome and evaluate the effect of different surgical procedures by this score system.

751 - Poster Session
Effect of chronological age on surgical morbidity in advanced ovarian cancer patients aged 65 years and older
J. Mun², S.J. Park², H.S. Kim² and J.W. Kim². “Seoul National University Hospital, Seoul, South Korea, “Seoul National University College of Medicine, Seoul, South Korea
Objective: Although the standard treatment of ovarian cancer begins with a debulking surgery, especially in advanced stages, gynecologic oncologists tend to prefer less radical surgery for the elderly population because of the fear that surgical morbidity may be relatively high. However, since there is a lack of evidence that morbidity may be high in elderly patients who undergo debulking surgery, we investigated the impact of chronological age older than 65 years on the surgical extent and surgical morbidity of advanced ovarian cancer patients who underwent debulking surgery.

Method: We enrolled patients age 65 years and older who received a primary debulking surgery due to stage IIIC–IVB ovarian cancer from November 2004 to June 2019. All patients were divided into the following four groups: group 1, 65–69 years; group 2, 70–74 years; group 3, 75–79 years; and group 4, 80 years and older. We used the Surgical Complexity Score (SCS) and Memorial Sloan Kettering Cancer Center (MSKCC) Surgical Secondary Events Grading System for evaluating the surgical extent of debulking surgery and severity of surgical complications, respectively.

Results: A total of 120 patients were classified into group 1 (n = 58), group 2 (n = 38), group 3 (n = 17), and group 4 (n = 7) (P = 0.52). Optimal cytoreduction, estimated blood loss, and length of hospitalization were not different among the 4 groups, whereas operative time significantly decreased as age increased. However, SCS did not differ, and both frequency and severity of complications according to the MSKCC Surgical Secondary Events Grading System were also not different among the 4 groups (Table 1).

Conclusion: This study suggests that chronological age may not be the factor affecting surgical extent and complexity and, more importantly, the surgical morbidity of advanced ovarian cancer patients age 65 years and older. Thus, elderly patients can most likely tolerate primary debulking surgery and may be managed identically to other age populations.

Table 1. Surgical characteristics and outcome of patients.

<table>
<thead>
<tr>
<th></th>
<th>Group 1 (n=58, %)</th>
<th>Group 2 (n=38, %)</th>
<th>Group 3 (n=17, %)</th>
<th>Group 4 (n=7, %)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical complexity score</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–4</td>
<td>23 (39.7)</td>
<td>9 (23.7)</td>
<td>8 (47.1)</td>
<td>3 (42.9)</td>
<td></td>
</tr>
<tr>
<td>5–9</td>
<td>19 (32.8)</td>
<td>15 (39.5)</td>
<td>5 (29.4)</td>
<td>2 (28.6)</td>
<td>0.94</td>
</tr>
<tr>
<td>≥ 10</td>
<td>16 (27.6)</td>
<td>14 (36.8)</td>
<td>4 (23.5)</td>
<td>2 (28.6)</td>
<td></td>
</tr>
<tr>
<td>Residual tumor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No gross residual</td>
<td>21 (36.2)</td>
<td>14 (36.8)</td>
<td>7 (41.2)</td>
<td>6 (85.7)</td>
<td></td>
</tr>
<tr>
<td>&lt; 1 cm</td>
<td>16 (27.6)</td>
<td>12 (31.6)</td>
<td>3 (17.6)</td>
<td>0</td>
<td>0.28</td>
</tr>
<tr>
<td>&lt; 2 cm</td>
<td>9 (15.5)</td>
<td>5 (13.2)</td>
<td>3 (17.6)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>≥ 2 cm</td>
<td>12 (20.7)</td>
<td>7 (18.4)</td>
<td>4 (23.5)</td>
<td>1 (14.3)</td>
<td></td>
</tr>
<tr>
<td>Estimated blood loss (ml)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st quartile (&lt;650)</td>
<td>22 (37.9)</td>
<td>11 (28.9)</td>
<td>4 (23.5)</td>
<td>2 (28.6)</td>
<td></td>
</tr>
<tr>
<td>2nd quartile (650 ≤ x &lt;1000)</td>
<td>20 (34.5)</td>
<td>11 (28.9)</td>
<td>4 (23.5)</td>
<td>2 (28.6)</td>
<td>0.09</td>
</tr>
<tr>
<td>3rd quartile (≥1000)</td>
<td>16 (27.6)</td>
<td>16 (42.1)</td>
<td>9 (52.9)</td>
<td>3 (42.9)</td>
<td></td>
</tr>
<tr>
<td>Operative time (mins)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st quartile (&lt;250)</td>
<td>18 (31.0) †</td>
<td>9 (23.7) †</td>
<td>7 (41.2)</td>
<td>6 (85.7) †‡</td>
<td></td>
</tr>
<tr>
<td>2nd quartile (250 ≤ x &lt;360)</td>
<td>19 (32.8) †</td>
<td>14 (36.8) †‡</td>
<td>7 (41.2)</td>
<td>0 †‡</td>
<td>0.03</td>
</tr>
<tr>
<td>3rd quartile (≥360)</td>
<td>21 (36.2) †</td>
<td>15 (39.5) †‡</td>
<td>3 (17.6)</td>
<td>1 (14.3) †‡</td>
<td></td>
</tr>
<tr>
<td>Length of hospitalization (days)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st quartile (&lt;10)</td>
<td>13 (22.4)</td>
<td>12 (31.6)</td>
<td>5 (29.4)</td>
<td>1 (14.3)</td>
<td></td>
</tr>
<tr>
<td>2nd quartile (10 ≤ x &lt;14)</td>
<td>19 (32.8)</td>
<td>7 (18.4)</td>
<td>5 (29.4)</td>
<td>2 (28.6)</td>
<td>0.99</td>
</tr>
<tr>
<td>3rd quartile (14 ≤ x &lt;17)</td>
<td>10 (17.2)</td>
<td>8 (21.1)</td>
<td>5 (29.4)</td>
<td>1 (14.3)</td>
<td></td>
</tr>
<tr>
<td>4th quartile (≥18)</td>
<td>16 (27.6)</td>
<td>11 (28.9)</td>
<td>2 (11.8)</td>
<td>3 (42.9)</td>
<td></td>
</tr>
</tbody>
</table>
† Group 1 and Group 4, P = 0.023
‡ Group 2 and Group 4, P = 0.012

752 - Poster Session
Correlation of constitutive photomorphogenic1(COP1) and p27 tumor suppressor protein expression in ovarian cancer
H.B. Kim. Hallym University Kangnam Sacred Heart Hospital, Seoul, South Korea
Objective: Constitutive photomorphogenic 1 (COP1) is an E3 ubiquitin ligase that regulates important target proteins for cell growth including p27. The tumor suppressor p27 negatively regulates the cell cycle by inhibiting cyclin-dependent kinase. COP1 negatively regulates p27 stability by mediating its nuclear export and degradation. Even if COP1 and p27 are tightly related and have significant roles in tumor progression, the expression patterns and relationship of both proteins in cancer have not yet been studied.

Method: We analyzed the expression patterns and relationship between COP1 and p27 using an ovarian cancer tissue microarray by dual immunofluorescence analysis.

Results: The expression levels of COP1 and p27 proteins were not significantly different between ovarian cancer tissue and normal control tissue. Other clinical data including age, tumor type, tumor grade, and stage were not significantly high (Pearson correlation coefficient 0.79, $P = 8.65 \times 10^{-22}$).

Conclusion: Our results demonstrate that while the expression levels of COP1 and p27 are highly correlated, they are not significantly related to cancer progression in ovarian cancer.

753 - Poster Session
Molecular profiling of atypical endometriosis as premalignant lesions of ovarian cancer
D. Chung, D.B. Chaya, H. Shina, W. Yang, H. Cho, S. Jeon, B. Lee, G.H. Han, E. Lee and J.H. Kim. aYonsei University College of Medicine, Seoul, South Korea, bSoochunhyang Cheonan Hospital, Cheonan, South Korea, cInha University Hospital, Incheon, South Korea.

Objective: Atypical endometriosis has been reported as a precursor that proceeds to endometriosis-associated ovarian cancer (EAOC). However, the molecular transformation mechanism has not yet been fully understood. The aim of the present study is to identify potential novel disease markers emblematic of the progression of high-risk endometriosis to EAOC.

Method: RNA was extracted from 66 formalin-fixed, paraffin-embedded (FFPE) tissues comprising benign endometriosis ($n = 9$), atypical endometriosis ($n = 18$), adjacent endometriosis to EAOC ($n = 10$), and EAOC ($n = 29$). Lesions of endometriosis or EAOC from whole FFPE tissue sections were obtained by laser capture microdissection, and differentially expressed genes were analyzed using RNA sequencing technology.

Results: Differential expression analysis revealed up- or downregulation of 698 genes in atypical endometriosis and 852 genes in adjacent endometriosis to EAOC compared to non-atypical endometriosis, respectively (>2-fold, $P < 0.05$). The 301 genes selected by Venn Diagram analysis are up- or downregulated in both atypical endometriosis and adjacent endometriosis to EAOC compared to non-atypical endometriosis. Gene ontology analysis for 301 genes showed that "transcription, DNA template" was the top term when sorted by the number of genes. It included a lot of zinc finger protein family.

Conclusions: We identified gene alteration between the endometriosis, atypical endometriosis, and adjacent endometriosis to EAOC using RNA sequencing. Further studies of this may be an essential resource to screen for high-risk endometriosis, which can progress to ovarian cancer.

754 - Poster Session
DNA methylome profiling identifies novel methylated genes in serous ovarian cancer patients with platinum resistance
T. Hua, Y. Li and S. Kang. aAffiliated Xing Tai People Hospital of Hebei Medal University, Xingtai, China, bHebei Medical University, Fourth Hospital, Shijiazhuang, China.

Objective: Platinum-based chemotherapy is widely used for a variety of cancers including serous ovarian cancer (SOC). However, platinum resistance is a major contributor to the high mortality of SOC patients. Accumulated evidence has implied that DNA methylation may serve as a potential biomarker for chemotherapy-resistant phenotypic screening; however, the pattern underlying platinum resistance remains unclear.

Method: Reduced representation bisulfite sequencing (RRBS) analysis was performed to identify differences in methylation status between nonresponder and extreme responder SOC patients ($n = 8$ in each group). The Qubit® 3.0 Fluorometer was
used for the quantification of RRBS library. The RRBS library was sequenced on Illumina HiSeq2500 sequencer as 50 bp paired-end reads. RT-qPCR was used to detect the expressions of MSH2, ZIC5, CCNL1, PRDM13, and MGRN1 mRNA in the 16 patients.

**Results:** There were considerable differences in DNA methylome profiling between the nonresponder and extreme responder SOC patients (Figure 1). After screening, 67 valid hyper-/hypo-methylated regions were identified to be located within 67 gene promoter and exon regions (adjusted q ≤ 0.5), which were primarily associated with cell-cell adhesion, B cell activation, and lymphocyte activation according to GO analysis. The differentially methylated regions (DMR) within MSH2, ZIC5, CCNL1, PRDM13, and MGRN1 were identified according to the order of P values from low to high. Spearman correlation analysis revealed a significantly negative connection between methylation level of the 5 genes and their mRNA expressions (r = −0.789, P = 0.021; r = −0.635, P = 0.034; r = −0.712, P = 0.041; r = −0.589, P = 0.038; r = −0.428, P = 0.019, respectively).

**Conclusion:** DNA methylome profiling based on RRBS assay is an effective method for screening aberrantly methylated genes in nonresponder patients, which may serve as a potential epigenetic biomarker for the prediction of platinum resistance.

---

**755 - Poster Session**

**Survivin promotes piperlongumine resistance in ovarian cancer**

X. Yan, L. Gong, X. Chen, P. Ye, H. Zhou, L. Cai and X. Nan. *First Affiliated Hospital of Wenzhou Medical University, Wenzhou, China*

**Objective:** Survivin is regarded as the most robust antiapoptosis protein that has been implicated in both control of cell division and inhibition of apoptosis, and its over-expression in epithelial ovarian cancer (EOC) is associated with chemoresistance and poor survival. In the previous study, we suggested that piperlongumine induced apoptosis and
synergized with cisplatin or paclitaxel in human ovarian cancer cells in vitro. Here, we investigate the functional impacts of piperlongumine on survivin expression in EOC cells and delineate its mechanism of action.

**Method:** Expression and transcriptional level of survivin were detected by Western blotting and Real-Time PCR, respectively. Ovarian cancer cells were transfected by lentivirus transformed with pCDH-Neo-Venus-survivin plasmid to over-express survivin, and the stable cell lines expressing survivin were used for subsequent experiments. MTT assay was utilized to quantify cell proliferation. Nude mice xenograft assay was performed to evaluate the antitumor effects of piperlongumine in vivo.

**Results:** Our experiments demonstrate that piperlongumine rapidly reduces survivin levels in EOC via the ROS-mediated proteasome-dependent pathway in vitro, while concurrently exerting a significant inhibitory effect on the proliferation of EOC cells. Moreover, piperlongumine inhibits EOC cells xenograft tumor growth and downregulates survivin in vivo.

**Conclusion:** Our investigation demonstrates for the first time that piperlongumine induces ovarian cancer apoptosis by inhibiting survivin via the ROS-mediated proteasome-dependent pathway.

---

**756 - Poster Session**

**Impact of extended cycles of chemotherapy on survival outcome in recurrent epithelial ovarian cancer**

W.Y. Hwang¹, S.I. Kim², M. Lee³, K. Kim³, J.H. No⁴, J.W. Kim³, Y.B. Kim³ and D.H. Suh⁴. ¹Seoul National University Bundang Hospital, Seongnam-Si, South Korea, ²Seoul National University Hospital, Seoul, South Korea

**Objective:** The purpose of this study was to determine whether extended cycles of chemotherapy improve survival outcomes in recurrent epithelial ovarian cancer (EOC) patients.

**Method:** Of 722 patients who were newly diagnosed with and treated for EOC between 2005 and 2018, 405 (56.1%) experienced disease recurrence. Excluding patients who were lost to follow-up, enrolled in clinical trials, and under active treatment, a total of 301 patients were retrospectively reviewed. Among them, only those who completed at least 6 cycles of second-line chemotherapy and showed noncomplete remission/nonprogressive disease (assessed by Response Evaluation Criteria in Solid Tumors, RECIST, v1.1 criteria) after 6 cycles were included in this analysis. Survival outcomes were compared between the 2 groups: standard group (6 cycles) versus extended group (>6 cycles).

**Results:** In total, 163 patients were included, and 92 and 71 were assigned to the standard group and extended group, respectively. Age at diagnosis, histology, grade, and stage were not different between the 2 groups. Compared to the standard group, the extended group showed lower proportions of platinum-sensitive recurrence (73.2% vs 90.2%, \( P = 0.004 \)) and secondary debulking surgery (4.2% vs 17.4%, \( P = 0.009 \)). During a median follow-up of 30.1 months (range 5.1–123.8 months), while no difference in overall survival was observed between the 2 groups (\( P = 0.240 \)), the extended group showed significantly poorer progression-free survival than the standard group (median 12.9 vs 14.9 months, \( P = 0.003 \)). However, in multivariate analysis adjusting stage, platinum sensitivity, serum CA-125 levels at the time of first recurrence and after 6 cycles, secondary debulking surgery, residual tumor size on CT scans, and maintenance treatment, extended chemotherapy was not a poor prognostic factor for progression-free survival (adjusted HR = 1.048, 95% CI 0.596–1.841, \( P = 0.871 \)).

**Conclusion:** More than 6 cycles of chemotherapy might not improve survival outcomes in recurrent EOC patients who showed residual disease after 6 cycles of second-line chemotherapy. Further analysis of side effects is needed.

---

**757 - Poster Session**

**Erastin enhances docetaxel efficacy in ovarian cancer by targeting ABCB1 transporter**

X. Yan, X. Chen, L. Cai, X. Nan, J. Chen, X. Chen and H. Zhou. *First Affiliated Hospital of Wenzhou Medical University, Wenzhou, China*

**Objective:** Over-expression of drug efflux transport ABCB1 (P-gp) is one of the main reasons for multidrug resistance (MDR) in cancer cells. Upregulation of ABCB1 accounts for the resistant recurrence in ovarian cancer with poor survival. Erastin is a novel specific small molecule targeting SLC7A11 to induce ferroptosis. In the present study, we explored the novel effect of erastin on MDR mediated by ABCB1 transporter.
**Method:** We treated ovarian cancer cell lines A2780 and A2780/Taxol with erastin or docetaxel, respectively, or in combination; cell viability was valued by MTT assay; cell cycle and apoptosis rate were measured by flow cytometry (FCM); and relative protein levels were detected by Western blot. Fluorescent signals of ABCB1-substrate rhodamine 123 accumulated in cells were observed under fluorescence microscope; the Discovery Studio 2.5 was used to obtain the binding mode of ABCB1 and erastin. Statistical analysis was performed using Student t test.

**Results:** We demonstrated that the combination of erastin with docetaxel synergistically decreased cell viability, promoted cell apoptosis, and induced cell cycle to arrest at G2/M in cancer cells with ABCB1 over-expressing. Mechanistically, erastin potently blocked the drug-efflux activity of ABCB1 to increase the intracellular accumulation of ABCB1-substrate agents without alteration of the expression of ABCB1.

**Conclusion:** Erastin can restore the sensitivity of a variety of ABCB1-substrate chemotherapeutic agents in ABCB1 over-expression cancers indicating that this beneficial combination may offer a potential effective administration for patients with cancers.

---

**758 - Poster Session**

**What influences the long-term survival of advanced high-grade serous ovarian cancer?**

aWomen's Hospital, Zhejiang University School of Medicine, Hangzhou, China, bZhejiang Cancer Hospital, Zhejiang, China

**Objective:** The aim of this study was to identify clinicopathological factors and tumor biological characteristics that contribute to prolonging survival in patients with advanced high-grade serous ovarian carcinoma (HGSOC).

**Method:** In this case control study, we compare short-term (<2 years) and long-term (≥10 years) survivors of stage IIIA-IV high-grade serous ovarian, fallopian tube, or peritoneum cancer at Women's Hospital, School of Medicine, Zhejiang University and Zhejiang Cancer Hospital from January 2004 to December 2016. The possible factors associated with long-term survival were examined by χ² test and logistic regression analysis.

**Results:** A total of 698 medical records with newly diagnosed IIIA-IV high-grade serous ovarian, fallopian tube, or peritoneum carcinoma were reviewed, and 19 (2.7%) long-term survivors along with 101 (14.5%) short-term survivors meeting criteria were identified. Short-term and long-term survivors showed mostly similar clinical factors including age, FIGO stage, preoperative CA-125 level, optimal primary debulking surgery, neoadjuvant chemotherapy, and surgical complexity score. However, long-term survivors showed a trend toward platinum sensitivity and receipt of intraperitoneal chemotherapy during initial treatment, while lesion distributions of the tumor such as bladder serous involvement, colon and small intestine and their mesenteries involvement, and hepatorenal recess involvement were associated with decreased survival. Multivariate logistic regression analysis showed that intraperitoneal chemotherapy and platinum sensitivity were significantly associated with long-term survivors versus controls (P = 0.008, OR = 0.082, 95% CI 0.013–0.512, P = 0.002; OR = 0.037, 95% CI 0.005–0.304), while small intestine and its mesentery involvement was the independent influence factor for short-term survivors (P = 0.009, OR = 6.673, 95% CI 1.596–27.062).

**Conclusion:** For advanced HGSOC, short-term and long-term survivors showed mostly similar clinical situations. Compared to controls, some biological characteristics and lesion distributions of the tumor itself beyond surgery were associated with long-term survival. Gene signatures can be further studied.

---

**759 - Poster Session**

**Diagnosis and management of growing teratoma syndrome after ovarian immature teratoma: A single center experience**

D. Wang, S. Zhu, C. Jia, D. Cao, M. Wu, J. Yang, L. Pan, N. Cheng and Y. Xiang. Peking Union Medical College Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, China

**Objective:** The aim of this study was to evaluate the diagnostic, surgical, and oncological outcomes of patients with growing teratoma syndrome (GTS).
**Method:** Patients diagnosed with ovarian immature teratoma (IMT) between 1980 and 2018 at our hospital were evaluated for the development of GTS. Their clinical characteristics, surgical and pathological data, and oncological outcomes were collected.

**Results:** Between 1980 and 2018, 175 cases of IMT were referred to our hospital. Thirty-five patients subsequently developed GTS with a crude rate of approximately 20%. The median interval between the initial diagnosis of IMT and the first occurrence of GTS was 18.5 months (range 6–78 months). Residual disease \((P < 0.001)\) and gliomatosis peritonei (GP) at initial surgery \((P = 0.023)\) were independent risk factors for GTS development. Fertility-sparing surgery for GTS was performed in 27 patients, and 4 patients achieved 5 singleton pregnancies. The median follow-up time was 73 months (range 11–401 months). Eleven patients developed at least 1 recurrence. Residual disease after GTS surgery was associated with GTS recurrence \((P = 0.001)\). By the end of follow-up, 27 patients were alive without disease and the other 8 patients were alive with disease. See **Table 1**.

**Conclusion:** The presence of residual disease and GP at initial surgery are risk factors for GTS. Complete surgical resection is the cornerstone for treatment of GTS. The presence of residual disease after surgery for GTS is a risk factor for GTS recurrence. Fertility-sparing surgery should be performed because spontaneous pregnancy is possible. The overall prognosis of GTS is excellent.

**Table 1.** Univariate and multivariate analysis of risk factors that predict development of GTS

<table>
<thead>
<tr>
<th>Clinical factors</th>
<th>Univariate</th>
<th>Multivariate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Entire cohort</td>
<td>Number of GTS</td>
</tr>
<tr>
<td>FIGO stage</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-II</td>
<td>155</td>
<td>26 (16.8%)</td>
</tr>
<tr>
<td>III-IV</td>
<td>20</td>
<td>9 (45.0%)</td>
</tr>
<tr>
<td>Residual disease at initial surgery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>144</td>
<td>16 (11.1%)</td>
</tr>
<tr>
<td>Yes</td>
<td>31</td>
<td>19 (61.3%)</td>
</tr>
<tr>
<td>Presence of GP at initial surgery</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>139</td>
<td>21 (15.1%)</td>
</tr>
<tr>
<td>Yes</td>
<td>36</td>
<td>14 (38.9%)</td>
</tr>
<tr>
<td>Tumor grade</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>69</td>
<td>13 (18.8%)</td>
</tr>
<tr>
<td>High</td>
<td>106</td>
<td>22 (20.8%)</td>
</tr>
<tr>
<td>Histology</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pure IMT</td>
<td>158</td>
<td>31 (19.6%)</td>
</tr>
<tr>
<td>Mixed GCT</td>
<td>17</td>
<td>4 (23.5%)</td>
</tr>
</tbody>
</table>

**760 - Poster Session**

**Fibroblasts-secreted collagen type I alpha 1 drives a metastasis-promoting microenvironment in ovarian cancer**

M. Li and W. Lu. Women’s Hospital, Zhejiang University School of Medicine, Zhejiang, China

**Objective:** Ovarian cancer is the most lethal gynecologic malignancy because of its propensity for wide peritoneal metastasis. Fibroblasts, as the dominant component of the tumor microenvironment, are crucial for tumor progression. Therefore, exploring the mechanism in the cross-talk between fibroblasts and ovarian cancer cells may provide more effective therapeutic targets for the treatment of ovarian cancer.

**Method:** Differentially expressed proteins were compared between ovarian cancer ascites and normal peritoneal fluids using liquid chromatography-mass spectrometry label-free quantitative proteomics. ELISA was conducted to detect fibroblast-secreted COL1A1 expression in ascites and cellular supernatant. CCK-8 and transwell were performed to observe COL1A1...
influence on ovarian cancer cells malignant behavior. SiRNA transfection, inhibition assay, qPCR, Western blotting, and immunofluorescence were employed to reveal the mechanism by which COL1A1 modulates the metastasis properties of ovarian cancer cells. SKOV3 orthotopic xenograft model was established to investigate COL1A1 influence on xenograft metastases. All data were presented as means ± S.E.M. and analyzed using GraphPad Prism 8.0 software.

**Results:** We found that COL1A1 was notably elevated in ascites from human epithelial ovarian cancer patients, and was mainly secreted from fibroblasts. Human COL1A1 recombinant protein promoted migration and invasion of ovarian cancer cells, but had no effect on proliferation. Intraperitoneal injection of COL1A1 accelerated the growth and intraperitoneal dissemination of ovarian cancer xenograft in SCID-Beige mice. Further, COL1A1 activated the PI3K/AKT signaling pathway through the membrane surface receptor integrinβ1. Knockdown or blocking the integrin β1 reversed COL1A1-induced migration and invasion in ovarian cancer cells. Moreover, supernatant from ovarian cancer cells in turn promoted COL1A1 secretion of fibroblasts, thus forming an interacting loop between ovarian cancer cells and fibroblasts.

**Conclusion:** Our findings suggest that fibroblasts secrete COL1A1 and facilitate ovarian cancer metastasis by activating the integrinβ1/AKT signaling pathway, and ovarian cancer cells oppositely promote COL1A1 secretion of fibroblasts, thus forming a metastasis-promoting microenvironment. COL1A1 may be a predictive biomarker and has potential therapeutic value in ovarian cancer patients.

---

**761 - Poster Session**

**Intraperitoneal chemotherapy as first-line treatment of newly diagnosed advanced epithelial ovarian cancer: Two centers’ data in China**

X. Xie, Y. Shen, S. Tang, X. Cheng, W. Lv, X. Wan and Z. Chen. *Women’s Hospital, Zhejiang University School of Medicine, Hangzhou, China, Zhejiang Cancer Hospital, Zhejiang, China*

**Objective:** The purpose of this study was to evaluate whether the modified intraperitoneal plus intravenous chemotherapy (IP/IV) regimen as first-line treatment of advanced epithelial ovarian cancer (EOC) in China can be well tolerated or confer any potential benefit on survival.

**Method:** This was a multicenter retrospective case control study in women with newly diagnosed stage III–IV EOC who underwent optimal cytoreductive surgery (CRS) (<1 cm) followed by IP/IV or intravenous chemotherapy (IV) from January 2007 to December 2017 at Women’s Hospital, School of Medicine, Zhejiang University and Zhejiang Cancer Hospital. The toxicities and outcomes of patients who received IP/IV were compared with those of patients who received IV. Pearson χ² test was adopted to evaluate for variables associated with IP/IV completion and toxicity. Kaplan-Meier survival analysis and Cox regression multivariate analysis models were performed to compare progression-free survival (PFS) and overall survival (OS).

**Results:** A total of 463 patients with stage III–IV EOC were eligible for analysis including 85 patients treated with paclitaxel 135 mg/m² intravenously plus cisplatin 75 mg/m² intraperitoneally repeated every 3 weeks (IP/IV group), and 378 patients treated with conventional 3-weekly TC (paclitaxel 135 mg/m² over 3h plus carboplatin, AUC = 5) intravenous chemotherapy (IV group). All the patients in the IP/IV group received an average of 5.8 times of IP/IV. The incidence of grade 3 or 4 neutropenia and thrombocytopenia did not significantly differ between the IP/IV and IV groups. Cox regression multivariate analysis at the 5% significance level showed that R0 primary CRS was the only factor related to progression-free survival (PFS) (\( P < 0.001 \)) and OS (\( P = 0.006 \)). But before and after substratification according to R0 primary CRS status, there was no significant difference in PFS or OS between the IP/IV and IV cohorts.

**Conclusion:** The efficacy of IP/IV is mainly coming from the intraperitoneal drug dose intensity and cumulative dose, but we still need to find and validate high-efficiency and low-toxic IP chemotherapy regimens. The intravenous carboplatin plus paclitaxel regimen remains the clinical gold standard for first-line treatment of advanced EOC.

---

**762 - Poster Session**

**Clinical, socioeconomic characteristics, treatment and reproductive outcomes of patients with gestational trophoblastic neoplasia at a tertiary care hospital in India**

Objective: Gestational trophoblastic neoplasia (GTN) is a rare disease. The primary objective of the study was to evaluate disease-free survival (DFS), and the secondary objective was to analyze clinical and socioeconomic characteristics, chemotherapy response, reproductive outcome, and overall survival (OS).

Method: This was a single-institution retrospective study in a tertiary care cancer center in India. All patients diagnosed with GTN from January 2009 to December 2014 at our hospital were evaluated. Data were retrieved from case files and electronic medical records. The data were analyzed using SPSS v23.0. DFS and OS were estimated by the Kaplan–Meier method.

Results: A total of 153 patients were diagnosed with GTN during this period, of which 136 (89%) were from a socioeconomically challenged background. The median age of the patients was 28 years (range 18–54 years). The median β hCG was 53726 IU/ml (range 18–10440587). These data were analyzed for 143 patients after excluding 10 patients lost to follow-up immediately after diagnosis. The median duration of follow-up was 63 months. Sixty-two (43%) patients were low risk and 79 (55%) were high risk, while data were not available for 2 patients. Among the low-risk patients, 55 (89%) received first-line single-agent methotrexate and 38 (69%) patients achieved remission. Among those with high risk, 6 patients received induction chemotherapy (cisplatin and etoposide). Forty-two out of 54 (78%) achieved remission with first-line EMACO. Five patients needed angiembolisation and another 5 radiotherapy for control of bleeding. There were 12 deaths (8%), of which 1 was due to toxicity, 4 to acute bleeding, and 7 to disease progression. At 5 years, DFS was 88% (95% CI 82%–94%) and OS was 90% (95% CI 85%–96%). Thirty (21%) patients had undergone hysterectomy, of which 23 were done at a peripheral hospital and 12 were due to bleeding. In the rest within the data available, 74 (70%) resumed menstruation; 40 conceived, of which there were 8 abortions, 3 molar pregnancy, and 22 successful pregnancy outcomes.

Conclusion: Most GTN patients were socioeconomically challenged and had high-risk disease. The outcomes were acceptable although a lot of work still needs to be done.

763 - Poster Session
Demographic and clinical differences between whites versus Asians presenting with uterine sarcoma
S.Y. Yang⁎, H.W. Tsai⁎, J.K. Chan⁎, D.S. Kapp⁎ and C.I. Liaoa. ⁊Kaohsiung Veterans General Hospital, Kaohsiung, Taiwan, ⁊California Pacific and Palo Alto Medical Foundation/Sutter Health Research Institute, San Francisco, CA, USA, ⁊Stanford University School of Medicine, Stanford, CA, USA

Objective: The aim of this study was to evaluate the proportions and trends of uterine sarcoma incidence in the United States and Taiwan using population-based data.

Method: Cancer registries data were obtained from 2001 to 2015 using United States Cancer Statistics (USCS) and Taiwan Health and Welfare Data Science Center (HWDC) and adjusted by World (WHO 2000–2025) Standard Million (18 age groups). SEER Stat 8.3.6 and Joinpoint regression programs v4.6.0.0 were used to evaluate the trends in age-adjusted uterine mesenchymal cancer (ICD-10 = C54 & C55) incidence expressed per 100,000 women.

Results: From 2001 to 2015, the age-adjusted incidence of uterine sarcoma in the United States did not change obviously with annual percentage change (APC) +0.4% (P > 0.05); however the incidence increased in Taiwan with APC +2.5% (P < 0.05). Of the U.S. patients, blacks and Asians had an increase in incidence with APC +1.8% (P < 0.05) and +2.1% (P < 0.05), except whites kept stable with APC −0.2% (P > 0.05). We determined the age group at the greatest risk diagnosis and showed the 50–54 years in the United States (2.6/100,000) and 45–49 years old in Taiwan (2.7/100,000). Of the U.S. patients, the age group with the highest risk was 50–54 years for whites (2.4/100,000), 60–64 years for blacks (4.6/100,000), and 50–54 years for Asians (2.4/100,000). See Figure 1.

Conclusion: The incidence of uterine sarcoma in the United States did not obviously change but increased in Taiwan. Patients in Taiwan present with younger age (45–49 years). Given the younger age at presentation, a more reliable test and imaging is warranted to identify those risks and avoid minimally invasive procedures with morcellation.
Vaginal melanoma: A case managed by laparoscopic type III pelvic exenteration achieving tumour-free margins and preserving organ structure and function


Objective: Melanoma of the female genital tract is a rare malignancy. Primary surgical excision is the preferred treatment modality if clear surgical margins can be achieved. Vulvo-vaginal melanoma presents the surgical challenge of striving for adequate tumor excision whilst aiming to preserve bladder, bowel, and sexual function where possible.

Method: We present a case of vaginal melanoma managed by laparoscopic type III pelvic exenteration, achieving clear surgical margins while also preserving considerable organ structure and function.

Results: A 69-year-old female presented with a bleeding, pigmented lesion of the genital tract. Incisional biopsy diagnosed vaginal melanoma. Examination revealed a 3-cm pigmented lesion involving the lower two-thirds of vagina, 2 cm from the anal verge. A further lesion was noted within the upper one-third of vagina. Cystoscopy identified urethral and bladder base involvement, correlating with stage IV disease. Imaging excluded lymphatic and distant metastatic disease. Multidisciplinary discussion recommended primary surgery, and the patient was counselled appropriately. Total laparoscopic hysterectomy, bilateral salpingo-oophorectomy, total vaginectomy, and partial vulvectomy (clitoral-sparing) were undertaken and removed en-bloc per vagina (see Figure 1). Trans-perineal total urethrectomy, partial cystectomy, and suprapubic catheter insertion were performed. The vulva was reconstructed by fashioning a bilateral lotus flap. Operating time was 6 hours, and no intraoperative complications occurred. Final histopathology confirmed clear surgical margins.

Conclusion: This case demonstrated the application of laparoscopic and transperineal approaches to achieve adequate resection of locally advanced stage IV vaginal melanoma when standard wide local resection alone would not achieve sufficient margins, thus making primary surgery possible. Such routes also avoided the morbidity of open surgery. This case considered the impact of extensive vulvo-vaginal surgery on physical function, sparing organs not involved. Vulval
reconstruction was performed with psychological well-being in mind, aiming to minimize the disfigurement and negative impact on body image that can be associated with such surgery.

![Image](image1.png)

**Fig. 1.**

---

765 - Poster Session

**Vulvo-vaginal melanoma: Advances and consensus in UK practice**


**Objective:** Vulvo-vaginal melanoma is rare—with 170 cases recorded by Public Health England 2010–2013. This explains the paucity of data to guide patient care, instead relying on extrapolation of evidence pertaining to cutaneous melanomas of other sites. The resulting uncertainty and variation in practice between centers became the driving force behind establishing consensus within the United Kingdom when treating this rare malignancy.

**Method:** A melanoma focus group was formed, comprising representatives from many disciplines including gynecologic oncology, dermatology, histopathology, colorectal, urology, and plastic surgery. Through review of available literature, combined with expert opinion, a new U.K. guideline for the management of vulvo-vaginal mucosal melanoma was published in May 2018.

**Results:** Suspicious pigmented lesions of the female genital tract should be referred via cancer pathways to either gynecology oncology or dermatology. Suspicious features include itching, bleeding, and irregularity. For small lesions, excisional biopsy is appropriate, with incisional biopsy of larger lesions. Local staging comprises vulval/vaginal examination and palpation of groin nodes, complemented by MRI and cystoscopy. CT-thorax/abdomen/pelvis should assess for lymphadenopathy and metastatic disease, with CT-PET and MRI/CT brain recommended in advanced cases. Staging is according to the TMN system. All patients should be tested for BRAF, c-KIT, NRAS, GNAQ, and GNA11 mutations. Surgery in a centralized unit with expertise is treatment of choice, with the importance of patient selection and counselling highlighted. As radicality of surgery does not improve survival, surgical margins of >1 mm are deemed sufficient, aiming to preserve structure and function where possible. Lymphadenectomy is reserved for suspicious nodes, with no routine role for sentinel lymph nodes. Positive margins require
re-excision, and adjuvant treatment should be individualized. Post-treatment surveillance is recommended at 3 monthly intervals for 3 years, followed by 6 monthly, and then annually thereafter, with incorporation of serial pelvic, groin, and brain imaging.

**Conclusion:** This new U.K. guidance provides clinicians with an agreed-upon framework for managing this rare malignancy ensuring standardization and optimization of care throughout the United Kingdom.

---

**766 - Poster Session**

**A case of Bartholin’s gland malignancy: A rare diagnosis**


**Objective:** Bartholin’s gland carcinoma is rare. It may arise from the duct or gland proper and thus may be a squamous cell carcinoma (SCC) or adenocarcinoma. Delays in treatment are not uncommon because of misdiagnosis as a cyst or abscess. Bartholin’s gland cancers have a poorer prognosis than SCC vulva, and thus timely and appropriate treatment is key.

**Method:** We present a case of Bartholin’s gland carcinoma in a postmenopausal patient, considering the diagnosis and management.

**Results:** A 64-year-old woman presented with a vaginal swelling, but otherwise asymptomatic. On examination, a 4-cm fixed Bartholin’s gland tumor was palpated, not breaching the vagina or rectum. There were no clinically detectable groin nodes. MRI was suspicious of a primary Bartholin’s gland carcinoma. A staging CT thorax/abdomen/pelvis and CT-PET excluded metastatic disease, but identified an enlarged avid inguinal node. The patient was discussed via MDT. Given the rarity of the suspected diagnosis and potential morbidity associated with groin node dissection (GND), 2-step surgery was recommended. Extensive preoperative counselling covered potential for bowel resection, flap reconstruction, and future impact on bowel/bladder and sexual function. The risk of lymphoedema was discussed. Uncomplicated wide local excision and primary wound closure were performed. There were no complications. Histopathology confirmed SCC of the Bartholin’s gland. Two weeks later, the patient underwent bilateral GND (see **Figure 1**). Intraoperatively a bulky right inguinal node was noted, correlating with imaging. There were no complications. Histopathology confirmed a positive inguinal lymph node. The patient was referred to oncology for adjuvant treatment.

**Conclusion:** This case highlights a rare malignancy and the need for vigilance for Bartholin’s carcinoma in postmenopausal women presenting with a gland swelling. Unlike in SCC vulva where histopathology can be obtained preoperatively, a Bartholin’s carcinoma is not easily amenable to biopsy without breach of the tumor capsule. We have demonstrated a 2-step surgical approach, securing the histopathological diagnosis first on total excision, prior to undertaking GND, justifying the additional patient morbidity GND represents without significantly delaying treatment.
**Recurrent vaginal intraepithelial neoplasia after hysterectomy for the treatment of cervical intraepithelial neoplasia**

**Objective:** Recurrent vaginal intraepithelial neoplasia (VaIN) is not a life-threatening condition, but worrisome enough to affect quality of life. The purpose of this study is to identify risk factors for recurrent VaIN1+ lesions and to evaluate the efficacy of laser vaporization in patients who underwent hysterectomy for treatment of cervical intraepithelial neoplasia (CIN).

**Method:** Medical records of 374 women who underwent hysterectomy for the treatment of CIN lesions were retrospectively reviewed. Patient characteristics and results of vaginal examinations including Pap smear, human papillomavirus (HPV), and punch biopsy were collected. Recurrence was defined as VaIN1+ diagnosis by punch biopsy at vaginal stump. Variables were compared between recurrence (+) and (−) using uni- and multivariate analyses. Time to subsequent recurrence was compared between laser vaporization (+) and (−) using survival analysis.

**Results:** Of 374 patients, 36 (9.6%) had VaIN1+ during median follow-up of 32 months (0–193 months): 13 (3.5%) VaIN1, 6 (1.6%) VaIN2, 15 (4.0%) VaIN3, and 2 (0.5%) invasive cancer. Age ≥51 years ($P = 0.001$) and resection margin (+) with CIN2+ ($P < 0.001$) showed significant association with VaIN1+ after hysterectomy. However, parity, HPV, minimally invasive surgery, and high-grade lesion had no significant association with VaIN1+ after hysterectomy. Multivariate regression analysis showed that age ≥51 years was the only independent risk factor for recurrent VaIN1+ (HR = 2.9, 95% CI 1.3–6.8, $P = 0.012$). Of 36 patients with VaIN1+ at vaginal stump, 22 (57.9%) were treated by laser vaporization, and 13 (34.2%) were observed without treatment. VaIN1+ at vaginal stump treated by laser vaporization had less subsequent recurrence ($P = 0.021$) and longer time to subsequent recurrence than observation (mean time to subsequent recurrence (128.7 months, 95% CI 101.4–156.0, vs 41.8, 95% CI 15.7–67.9, $P = 0.003$).

**Conclusion:** Patients 51 years and older who underwent hysterectomy for the treatment of CINs might be most at risk of VaIN at vaginal stump. Laser vaporization can reduce the subsequent recurrence of VaIN.
**Objectives:** The aim of this study was to determine the frequency of compliance and loss to follow-up among women screened for cervical cancer in urban and rural communities in the Ilemela District of Northern Tanzania.

**Method:** The study population consisted of nonpregnant women ≥18 years with a history of current and/or past sexual activity who were VIA screened and treated with cryotherapy at a university-sponsored mass screening in July 2018 and 2019. These data were analyzed by \( \chi^2 \) and logistic regression in R, with statistical significance \( P < 0.05 \).

**Results:** A total of 1,282 women were screened during July 2018 and July 2019. In 2018, 29.3% of women (\( n = 270 \)) who presented to the screening should have followed up in 1 year given their results. In 2019, only 11.3% of women (\( n = 52 \)) had previously attended a cervical cancer screen-and-treat. Nineteen percent (\( n = 10 \)) of these women previously went to the urban site, while the rest went to the rural site (37%, \( n = 19 \)) or another site (44%, \( n = 23 \)). Therefore, the minimum loss to follow-up was 89.3% among women possibly screened at university-sponsored clinics in 2018. Overall, 84.2% (\( n = 48 \)) of women followed up appropriately based on their year of last screening, prior VIA result, and HIV status. Eighty-five percent (\( n = 44 \)) of women were VIA screened in 2019, and 6% (\( n = 3 \)) of these women had lesions suspicious for cancer, while 4% (\( n = 2 \)) were VIA+ and treated with cryotherapy. Nineteen percent (\( n = 10 \)) of women were known to be HIV+, and 1 was diagnosed with HIV at the 2019 program. Seven percent (\( n = 4 \)) of women had new HIV or VIA results that changed their follow-up timeline. Overall, 10.5% (\( n = 4 \)) of women previously treated in 2018 had abnormal VIA results again in 2019, and all were treated with cryotherapy.

**Conclusion:** VIA screening for cervical cancer is accepted and feasible in the communities studied, but compliance with serial screening schedules is problematic. Barriers that have an impact on loss to follow-up need to be characterized. Moving forward, an ongoing partnership with Bugando Medical Centre will facilitate the development of robust patient navigation systems and community education to improve patient follow-up.

---

**769 - Poster Session**

**Epidemiologic characteristics of cervical cancer in young women in Korea**

S. Pyeon\(^a\), J.M. Song\(^a\), Y. Bang\(^a\) and J.M. Lee\(^b\). \(^a\)Kyung Hee University Hospital at Gangdong, Seoul, South Korea, \(^b\)Kyung Hee University Hospital, Seoul, South Korea

**Objective:** Cervical cancer is the fourth most common cancer among women. Especially in developing countries, it is the leading cause of death. The GDP of the Republic of Korea is the tenth largest in the world and regarded as a developed country. Since the cervical cancer screening program was started, the age-standardized rate (ASR) of cervical cancer has decreased from 18.6 per 100,000 women in 1999 to 10.8 per 100,000 women in 2016. In 2016, the screening program was expanded to women in their 20s. We analyze the effect of this expansion on the prevalence of cervical cancer and emphasize the significance of screening test.

**Method:** The Korea Central Cancer Registry (KCCR) has been in operation since 1980; it is a hospital-based program for collecting data from about 200 hospitals. The KCCR had reported the cancer statistics annually, and the last announced data were from 2016. The data included incidence rates, prevalence rate, and survival rates by site, age, and region.

**Results:** Annual cervical cancer cases have been declining steadily, from 3,992 in 2010 to 3,564 in 2016, and it is the seventh most common of female cancers. However, by age group, the incidence in the 15–34 years group was 5.7 per 100,000, ranking third after thyroid and breast cancers. The age-specific incidence rates in women in their 20s had declined from 7.8 per 100,000 in 2010 to 5.4 per 100,000 in 2015, but increased to 7.4 per 100,000 in 2016. See Figure 1.

**Conclusion:** The first year of screening for cervical cancer in women in their 20s was 2016. Although the increase in the diagnosis was noted by the screening in this year, it caused bias that seemed to indicate an increased rate of incidence. The national immunization program has included human papillomavirus vaccination since 2016. Therefore, further evaluation of the effect of both screening and vaccination is needed.
Villoglandular adenocarcinoma of the cervix: A retrospective review of 60 cases

X. Yan, X. Chen, P. Ye, J. Chen, X. Nan, H. Zhao and K. Zhou. First Affiliated Hospital of Wenzhou Medical University, Wenzhou, China

Objective: The objective of the study was to analyze the clinicopathologic features and prognosis of patients with villoglandular adenocarcinoma (VGA) of the cervix. Management of this variant of cervical adenocarcinoma is discussed.

Method: A retrospective review of clinical records including patient characteristics, surgical procedure, pathology, and prognosis was performed in patients with VGA between 2005 and 2019 from multiple centers.

Results: A total of 60 cases were included. The median patient age was 43.8 years (range 27–68 years). The most common presenting symptoms were cervical contact bleeding and increased vaginal discharge. A human papillomavirus (HPV) test was positive in 19 of 21 patients. HPV16 and HPV18 were positive in 10 and 5 patients, respectively. Two patients were positive for multiple infections including HPV16. The concordance rate between preoperative cervical biopsy and postoperative pathological diagnosis of VGA was 36.1%. In the cohort of 55 patients who underwent radical hysterectomy (2009 FIGO stage IA2 = 2, IB1 = 37, IB2 = 10, IIA1 = 5, and IIA2 = 1), 5 patients underwent simple hysterectomy (2009 FIGO stage IA2 = 2, IB1 = 3). 45 patients had pelvic lymphadenectomy, and 14 patients reserved 1/both ovaries. Twenty-six patients accepted postoperative adjuvant treatment. The follow-up ranged from 5 to 155 months with a median of 57 months, except for 8 patients lost to follow-up. During the follow-up period, no death or recurrence occurred in any of the patients. Specifically, 1 patient delivered a healthy baby at 36 weeks of gestation prior to treatment with neoadjuvant chemotherapy (NACT) followed by radical hysterectomy.

Conclusion: This study confirmed that VGA is a type of cervical adenocarcinoma with a favorable prognosis. Further studies are warranted to determine the most appropriate or more conservative surgical approach for the disease.

Knowledge is power? Pap smear habits of female OB/GYNs compared to other female physicians

G. Hershkovitz, Y. Ochshorn, Y. Raz, N. Michaan, I. Laskov, E. Fiszer and D. Grisaru. Lis Maternity Hospital - Tel Aviv Sourasky Medical Center, Tel Aviv, Israel

Objective: Cervical cancer incidence in Israeli Jewish women is consistently lower than that in many other developed countries and has been stable for 2 decades. Cervical cancer screening using the Pap test in Israel is funded, but there is no national screening program and the proportion of women tested is lower than that reported by the OECD. The aim of this
study was to evaluate whether knowledge affects compliance, thus encouraging the implementation of public education programs.

**Method:** Female physicians working in the Tel Aviv Sourasky Medical Center answered anonymous questionnaires regarding their knowledge of the Pap test, cervical cancer-related factors, and self-performance status.

**Results:** Forty-two female obstetrician/gynecologists and 57 female physicians of other specialties volunteered to participate in our study. Female obstetrician/gynecologists knew more about the purpose of Pap smear (100% vs 82%, \( P = 0.004 \)) and WHO recommendations of PAP test’s frequency (88% vs 39%, \( P < 0.001 \)) and age for first Pap test (71% vs 12%, \( P < 0.001 \)), but longer time has passed since their last Pap test (4 years vs 2.6 years, \( P = 0.031 \)), and they were vaccinated for HPV at lower rates than other physicians (23% vs 46%, \( P = 0.04 \)). Surprisingly, condom use was more frequent among other physicians compared to the obstetrician/gynecologists group (40% vs 13%, \( P = 0.005 \)), and they were younger at first Pap test (22 years vs 26 years, \( P = 0.003 \)).

**Conclusion:** Female obstetrician/gynecologists’ knowledge of the importance of Pap test, their accessibility to Pap smear services, and their daily encounter with cervical cancer patients do not affect their compliance for Pap smear performance.

---

**772 - Poster Session**

**Impact of adherence to sedlis criteria for postoperative adjuvant radiotherapy in lymph node-negative cervical cancer**

T.H. Kim. *SMG-SNU Boramae Medical Center, Seoul, South Korea*

**Objective:** The NCCN guideline recommends adjuvant radiotherapy based on the Sedlis criteria developed from the GOG 92 trial. The purpose of this study was to investigate adherence to Sedlis criteria in radical hysterectomy patients without any high-risk factors and to analyze the recurrence rate of patients who did not receive adjuvant radiotherapy.

**Method:** We included 133 patients with 2009 FIGO stage IB1–IIA2 disease receiving radical hysterectomy and pelvic lymph node dissection (PLND) without any adjuvant treatment between 2010 and 2017. Patients having any high-risk factors including positive lymph node, positive resection margin, and parametrial involvement on pathologic report were excluded. Treating physicians consisted of 8 gynecologic oncologists from 2 institutions. Sedlis criteria adherence rate and recurrence-free survival (RFS) were estimated.

**Results:** Most patients were stage IB1 (117 patients, 88.0%). Abdominal radical hysterectomy (ARH) and minimally invasive surgery radical hysterectomy (MISRH) were performed in 39 and 94 patients, respectively. Thirty patients (22.6%) met the Sedlis criteria with combination of intermediate risk factors. The Sedlis criteria adherence rate differed significantly according to treating physicians (18.8%~100%). Three-year RFS was significantly different according to whether the Sedlis criteria were met (93.9% vs 61.0%, \( P < 0.001 \)). The RFS difference remained in ARH and MISRH groups. In patients who did not meet the criteria, there was no recurrence in 28 ARH patients, while 7 in 75 MISRH patients had recurrence (\( P = 0.098 \)). In multivariate analysis adjusting stage, conization, and histology, only the Sedlis criteria were the independent prognostic factors for recurrence (HR = 6.3, 95% CI 2.3–17.6).

**Conclusion:** Adherence to the Sedlis criteria varies by treating physicians. Adeherence to the Sedlis criteria should be emphasized regardless of the mode of surgery.

---

**773 - Poster Session**

**Neoadjuvant chemotherapy followed by radical surgery versus concurrent chemoradiotherapy in patients with FIGO stage IIB cervical cancer**

T. Junying, H. Jin, L. Jinjin, O. Xiping, L. Pujun, G. Xue, Z. Qian, P. Tingting and P. Hongfei. *The First Affiliated Hospital of Chongqing Medical University, Chongqing, China*

**Objective:** The aim of this study was to compare the long-term survival of patients with FIGO stage IIB cervical cancer treated with neoadjuvant chemotherapy followed by radical hysterectomy (NACT + RS) with the survival of those treated with concurrent chemoradiotherapy (CCRT).
Method: A retrospective analysis was conducted on a cohort of 58 patients with FIGO stage IIB cervical cancer treated with NACT + RS (n = 58) from January 2013 to October 2016 in the First Affiliated Hospital of Chongqing Medical University, China. Patients were followed up for 36 to 80 months. The primary outcome was disease-free survival (DFS), defined as survival without relapse or death related to cancer. Secondary outcomes included overall survival and complications. The DFS and overall survival were compared with a randomized controlled trial from India that analyzed the survival of those treated with concurrent chemoradiotherapy (CCRT).

Results: The 5-year DFS rates of the NACT + RS and CCRT groups were 82.6% and 79.3%, respectively (HR = 1.18, 95% CI 0.54–2.55, P = 0.85). The overall survival rates of NACT + RS and CCRT groups were 87.2% (IIB) and 74.7% (IB2, IIA, IIB), respectively (HR = 2.11, 95% CI 0.94–4.64, P = 0.64).

Conclusion: This retrospective study suggests that survival results with NACT + RS and with CCRT for patients with FIGO stage IIB cervical cancer are comparable. NACT + RS could be an alternative treatment strategy for patients with FIGO stage IIB cervical cancer.

774 - Poster Session
The pattern and treatment of recurrence in the initial learning period of laparoscopic radical hysterectomy/trachelectomy for cervical cancer
H. Yang, Fudan University Shanghai Cancer Center, Shanghai, China

Objective: The aim of this study was to investigate the pattern of disease recurrence and identify the clinicopathologic prognostic factors for patients with early cervical carcinoma treated with laparoscopic radical hysterectomy (LRH)/trachelectomy (LRT) in the initial learning period, and explore the therapy of recurrence.

Method: We retrospectively reviewed 161 patients with FIGO 2018 stages IA2–IIA2) cervical cancer who underwent LRH/LRT between November 2011 and December 2017. The oncologic outcomes, postrecurrence treatment, and follow-up results were analyzed for all patients.

Results: The median follow-up time was 32.7 months. Among patients with disease recurrence, there were 11 (64.7%) local recurrences, 3 (17.6%) distal metastasizes, and 2 (11.8%) disseminated recurrences both local and distal. Eight patients (47.1%) had multiple site recurrences. The estimated 3-year disease-free survival rate was 88.2%, and 5-year overall survival rate was 97.7%. FIGO 2018 stage >IB1 (P = 0.013, HR = 6.121, 95% CI 0.035–0.679) was the only independent unfavorable prognostic factor related to DFS. Individualized chemoradiotherapy for local recurrences and R0 cytoreduction surgery for unique recurrence sites/multisite on pelvic are available.

Conclusion: LRH/LRT and lymphadenectomy for cervical cancer appears to increase distance and multiple site recurrence within the peritoneum. Some patterns of recurrences may be unique. They should be approached cautiously, especially for patients with FIGO 2018 stage >IB1 in the initial learning period. Multidisciplinary therapy, including surgery, can be used to treat recurrent patients.

775 - Poster Session
Prognostic factors related with poor outcomes in patients with locally advanced cervical cancer
D. Cantu de León, R. Ramirez, L.N. Gallardo-Alvarado, D. Perez-Montiel, M. Perez Quintanilla and S. Del Real. Instituto Nacional de Cancerología de México, Mexico, DF, Mexico, Instituto Nacional de Perinatología, Mexico, DF, Mexico, Hospital General de Saltillo, Saltillo, CU, Mexico

Objective: The aim of this study was to evaluate different clinical features as prognostic factors in terms of disease-free survival (DFS) and overall survival (OS) in a retrospective cohort of patients with locally advanced cervical cancer (LACC).

Method: This was a retrospective analysis from records of patients with LACC treated with concurrent chemoradiation and brachytherapy from 2005 to 2014. PNI was calculated according to the following method: 10 × serum albumin (g/L) + 0.005 × lymphocyte count (per mm). And we calculated the ratio of NL, PL, and ML. Univariate Cox proportional hazards analyses were performed on continuous data—leukocyte, neutrophils, lymphocyte, platelet counts, PLR, NLR, MLR, and PNI. The cutoff value was calculated by ROC analyses, with Youden index and defined as 38.0 for PNI, <2.6 for NLR, <270 for PLR, and <3.0 for LMR.
We used Kaplan-Meier method and compared with log rank test to perform bivariate analysis and Cox regression for multivariate analysis.

Results: From 1,954 patients with LACC, a total of 1,137 records were included in these analysis (patients who completed standard treatment and had at least 3 cycles of concomitant chemotherapy). Clinical stages were IB2 96 (8.4%), IIA 45 (4.0%), IIB 661 (58.1%), III 308 (27.1%), and IVA 27 (2.4%), of which 1,009 (88.7%) had squamous cell carcinoma, 109 (9.6%) adenocarcinoma, and 19 (1.7%) adenosquamous carcinoma. Thirty (2.6%) were well differentiated, 821 (72.2%) moderately differentiated, and 627 (25.2%) poorly differentiated tumors. We found differences between clinical stage in DFS and OS ($P = 0.002$ and $P = 0.00$); well-differentiated tumors had OS of 97% at 5 years, which was statistically significant when compared with other grades ($P = 0.032$). Poor prognosis in terms of DFS and OS were significantly different between patients with high NLR (RR = 1.68, 95% CI 1.5–1.97, $P = 0.002$) and low PNI (RR = 1.44, 95% CI 1.07–1.93, $P = 0.008$). We found no differences in DFS and OS between histologies.

Conclusion: Histology grade and clinical stage are robust factors associated with poor prognosis. PNI and NLR were independent factors associated with a poor survival; we found significant inverse correlation between these 2 variables.

776 - Poster Session
Locally advanced cervical cancer: Are there differences between young and geriatric patients?
D. Cantú de Leóna, L.N. Gallardo-Alvaradoa, R. Ramírez, D. Perez-Montiel, M. Perez Quintanillab and S. Del Real c
aInstituto Nacional de Cancerología de México, Mexico, DF, Mexico, bInstituto Nacional de Perinatologia, Mexico, DF, Mexico, cHospital General de Saltillo, Saltillo, CU, Mexico

Objective: The purpose of this study was to compare the response to treatment, disease-free survival (DFS), and overall survival (OS) among young versus geriatric patients diagnosed with locally advanced cervical cancer (LACC) treated with CCR.

Method: This is a retrospective study that analyzed 266 patients younger than 40 years and 203 patients older than 65 years (geriatric) with LACC treated with CCR from 2005 to 2014. A descriptive, comparative, and survival analysis was conducted.

Results: A total of 469 records were obtained; there were no differences between histologies. The predominant histology in both groups was squamous carcinoma, 88% in young patients and 93.6% in the geriatric group. One hundred and twelve (90.3%) of the group of geriatric patients were illiterate compared to only 4.5% ($n = 12$) of the young patients. Sixty-five (24.4%) young patients and 27 (13.3%) geriatric patients did not reach complete response to treatment ($P = 0.003$). Forty-six percent of young patients required transfusions before or during treatment, and only 16% of geriatric patients received transfusions ($P = 0.000$). Recurrences were documented in 58 (28.7%) and 51 (29.9%) young and geriatrics patients, respectively, with no differences in DFS. Mean OS was 127 months for young and 138 for geriatric ($P = 0.037$) patients.

Conclusion: Statistically significant differences were found in response to treatment and OS, with no impact on OS. Prospective studies that include more patients are needed.

777 - Poster Session
Profiling of key integration sites from normal cells to cervical cancer by chronological sequencing of cervical samples
Y. Meng and P. Wu. Tongji Hospital, Tongji Medical College, Huazhong University of Science & Technology, Wuhan, China

Objective: As HPV persistence is established as a requirement for the development of cervical cancer, serial sampling and viral integration detection of women who later develop cervical precancer may provide a biologic ground for the development of cervical cancer.

Method: We performed high-throughput viral integration detection for 85 chronological samples from 42 cervical cancer patients. All samples were taken from Tongji hospital, Wuhan, and Qilu Hospital, Jinan, China, between 2005 and 2017. The inclusion criteria of this study were (1) patients with an HPV-positive normal cervical sample and HPV-positive CIN sample; (2) obtained from consenting patients; and (3) having adequate and sufficiently high-quality DNA (quantity ≥3 µg, concentration ≥20 ng/µL, and an apparent main band upon electrophoresis) for next-generation sequencing.
**Results:** By conducting high-throughput viral integration detection, we identified a total of 323 integration sites in 41 cervical intraepithelial neoplasias and 44 HPV-positive normal cervical samples. We discovered several hot spots including *CCAT1*, *KLF5*, and *CCDC106*. We also identified the consistent viral integration sites existing both in cervical intraepithelial neoplasias and HPV-positive normal cervical samples, as well as the integration sites detected in only 1 stage.

**Conclusion:** In summary, we report a genome-wide analysis of HPV integration in cervical intraepithelial neoplasias and HPV-positive normal cervical samples and identify the key integration sites of cervical cancer development. Our data provide insights into HPV integration-driven cervical carcinogenesis.

---

**778 - Poster Session**

**Comparison of laparoscopic and open radical hysterectomy in cervical cancer patients with tumor size ≤2cm**

X. Yan, X. Chen, N. Zhao, P. Ye, J. Chen, X. Nan, H. Zhou, K. Zhou, Y. Zhang, J. Xue and H. Zhao. First Affiliated Hospital of Wenzhou Medical University, Wenzhou, China

**Objective:** There is recent evidence that demonstrates worse oncologic outcomes associated with minimally invasive radical hysterectomy when compared to open radical hysterectomy. The aim of our study was to retrospectively evaluate the oncological outcomes between laparoscopic and open radical hysterectomy in stage IB1 (FIGO 2009) cervical cancer patients with tumor size ≤2 cm.

**Method:** A retrospective review of medical records was performed to identify patients with FIGO 2009 stage IB1, tumor size ≤2 cm cervical cancer who underwent laparoscopic surgery or open surgery from January 2010 to December 2018 from 3 separate centers. Concurrent comparison between the laparoscopic and open cohorts was made for survival outcomes.

**Results:** A total of 325 cervical cancer patients were included; 129 patients underwent laparoscopic surgery, and 196 patients had open surgery. The median follow-up times were 51.8 months (range 2–115) for laparoscopic surgery and 49.5 months (range 3–108) for open surgery. Patients in the laparoscopic group had significantly worse disease-free survival than those in the open group (5-year survival rate 90.4% vs 97.7%, P = 0.016). There was no significant difference in overall survival between groups (5-year survival rate 99.4% vs 96.9%, P = 0.33). The Cox proportional hazards regression analysis indicated that laparoscopic surgery was associated with lower disease-free survival compared to open surgery (adjusted HR = 13.274, 95% CI 2.49–70.71, P = 0.002). In patients with nonsquamous cell carcinoma or with grade II–III, laparoscopic surgery both had a significantly worse disease-free survival compared to the open surgery group (5-year survival rate, 74.0% vs 100.0%, P = 0.01; 88.8% vs 98.0%, P = 0.018, respectively).

**Conclusion:** Laparoscopic radical hysterectomy was associated with worse disease-free survival for stage IB1 (FIGO 2009) cervical cancer patients with tumor size ≤2 cm compared to open radical hysterectomy. Further studies may shed additional light on the impact of minimally invasive surgery in this low-risk patient population.

---

**779 - Poster Session**

**What is the best treatment for older patients with invasive cervical carcinoma?**


**Objective:** With the aging of Japan’s population, a therapeutic strategy that is effective and acceptable to older patients is necessary. The purpose of this study is to determine a suitable treatment for older patients with invasive cervical carcinoma.

**Method:** The medical records of women age >75 years with invasive cervical carcinoma treated with definitive external beam radiation therapy (EBRT) from January 2005 to December 2016 were reviewed retrospectively.

**Results:** Of 120 patients with invasive cervical carcinoma, 115 (95%) received EBRT. Forty-one patients (34.2%) received EBRT concurrent with weekly platinum-based chemotherapy (CRT), and 101 patients (84.2%) received definitive EBRT and brachytherapy. The median disease-free survival was 26 months, and overall survival was 39 months. As an acute complication of EBRT, grade 3 anorexia was observed in 11 patients (9.2%), grade 3 or 4 hematologic toxicities manifested as neutropenia in 18 patients (15%), anemia in 9 patients (7.5%), and thrombocytopenia in 3 patients (2.5%). Half of the patients who received CRT were observed with more than grade 3 acute complications. As a late complication of EBRT, grade 3 enterocolitis was observed in 11 patients (9.2%), and grade 3 pelvic fractures in 7 patients (5.8%). Clinical stage (I–II vs III–
IV), histological type (squamous cell carcinoma or not), lymph node metastasis, and performance of brachytherapy were significant prognostic factors in the univariate analysis. The histological type was the only significant prognostic factor in the multivariate analysis.

**Conclusion:** Definitive EBRT and brachytherapy is a preferable and safe treatment for invasive cervical carcinoma in women age >75 years. Combined chemotherapy is not only related to the prognosis but also invasive for elderly patients.

---

**780 - Poster Session**  
**Hands-on cervical cancer prevention training courses for low-resource settings**  

The University of Texas MD Anderson Cancer Center, Houston, TX, USA.  
Chulalongkorn University, Bangkok, Thailand.  
Rice University, Houston, TX, USA.  
Hospital Central de Maputo, Maputo, Mozambique.  
Irmandade Santa Casa de Misericordia/UFCSPA/Porto Alegre, Porto Alegre, Brazil

**Objective:** In 2018, there were approximately 570,000 new cases of cervical cancer worldwide. More than 85% of cases occurred in low- and middle-income countries, primarily because of poor access to screening and a limited number of medical providers trained to diagnose and treat cervical precancerous lesions. Our objective was to provide locally held, hands-on training courses to medical providers in these countries.

**Method:** The courses included didactic lectures and hands-on training stations using low-cost simulation models developed by Rice University. The hands-on training included visual inspection with acetic acid (VIA), thermal ablation, cryotherapy, colposcopy, cervical biopsy, endocervical curettage, and loop electrosurgical excision procedure (LEEP). Pre- and post-course knowledge and confidence levels were evaluated.

**Results:** From February 2017 to November 2019, we held 12 hands-on training courses in 6 cities across 5 countries (El Salvador, Mozambique, Trinidad and Tobago, Lesotho, and Malawi). Overall, there were 506 participants. The average number of participants per course was 42 (range 19–92). The participants included doctors, nurses, and midwives. The course duration varied from 1 to 3 days. Eighty-two percent of participants completed the evaluation forms. The mean scores for knowledge showed a 29% improvement (pre, 6.3/10; post, 8.1/10). The mean scores for confidence showed a 17% improvement (pre, 3.0/5.0; post, 3.5/5.0). There were no significant differences in scores between courses.

**Conclusion:** Our locally held hands-on cervical cancer prevention training courses showed improvement in provider knowledge and confidence to perform cervical cancer prevention procedures. These courses are part of a larger strategy to build local capacity for cervical cancer screening, diagnosis, and treatment in low- and middle-income countries. This training is coupled with ongoing telementoring using Project ECHO (Extension for Community Healthcare Outcomes) to ensure sustainability.

---

**781 - Poster Session**  
**Electrical bioimpedance spectroscopy based multi-electrode screening probe for the identification of cervical intraepithelial neoplasia (CIN)**  
D.C. Park.  
St. Vincent’s Hospital, College of Medicine, The Catholic University of Korea, Suwon, South Korea

**Objective:** The aim of this work is to introduce a noninvasive and easily operable multielectrode screening probe device for the identification of cervical dysplasia based on the impedance spectroscopy of cervical tissues.

**Method:** A multielectrode screening probe is designed to calibrate the impedance spectroscopy of cervical tissues. Twenty-eight multifrequency voltages are collected through the 2 concentric array electrodes via sensitivity-optimized current-voltage protocol aided by a localization energy concentration method. They measure the frequency-dependent behavior of cervical cancer tissue and normal tissue. Both numerical simulations and experiments are carried out to validate the performance of the proposed multielectrode probe in the identification of cervical dysplasia.

**Results:** Based on the numerical simulation and experimental results, the resistivity of normal cells significantly depend on the frequency compared with the resistivity of CIN cells. See Figure 1.
Conclusion: The impedance of cervical tissues varies with respect to frequency, which provides a cheap and noninvasive screening method for the identification of cervical cancer. Future work is currently being undertaken to clinically promote the probe.

![Graph showing impedance variation](image)

**Ratio**

\[
\text{Ratio} = \frac{Z(f(n)) - Z[\text{ref. } f(n)]}{Z[\text{ref. } f(n)]} = \frac{Z(f(n)) - Z_{100 \text{ kHz}}}{Z_{100 \text{ kHz}}}
\]

\(f(n) = [0.625, 1, 5, 10, 50, 100 \text{ kHz}]\)

**Fig. 1.** The difference in the change of the electrical property between the cervical tissue in normal dysplasia. The new diagnostic device had 72% sensitivity and 72.2% specificity in the pilot study.

![Graph showing ROC curve](image)

- Sensitivity: 72%
- Specificity: 72.2%
- AUC (area under the curve): 0.80

---

**782 - Poster Session**

**Genetic testing procedures of BRCA1/2 mutation and their disparities: A national survey**

H. Wu\(^a\), B. Xu\(^b\), Q. Gao\(^c\), X. Zhou\(^d\), J. Shao\(^e\), Z. Liang\(^f\) and D. Ma\(^g\).

\(^a\)Peking Union Medical College Hospital, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, China, \(^b\)National Cancer Center/Cancer Hospital, Chinese Academy of Medical Sciences (CAMS) and Peking Union Medical College (PUMC), Beijing, China, \(^c\)Tongji Hospital, Tongji Medical College Huazhong University of Science & Technology, Beijing, China, \(^d\)Fudan University Shanghai Cancer Center; Department of Oncology, Shanghai Medical College; Institute of Pathology, Fudan University, Shanghai, China, \(^e\)Sun Yat-Sen University Cancer Center, State Key Laboratory of Oncology in South China, Collaborative Innovation Center for Cancer Medicine, Guangzhou, China, \(^f\)Molecular Pathology Research Center, Peking Union Medical College Hospital, Chinese Academy of Medical Science and Peking Union Medical College, Beijing, China, \(^g\)Tongji Hospital, Tongji Medical College Huazhong University of Science & Technology, Wuhan, China

**Objective:** Although BRCA testing is required for treatment decision in ovarian and breast cancer, no survey data are currently available in China to identify the capability of BRCA testing. Thus, we identified discrepancies in BRCA1 and BRCA2 testing procedures in different laboratories across China.

**Method:** This survey was conducted using a website to assess the BRCA1 and BRCA2 testing landscape in China. All survey information was distributed to participating laboratories through the study website. The survey consisted of 5 main components that provided information on laboratory, BRCA1 and BRCA2 detection, germline BRCA1 and BRCA2 detection, tumor tissue BRCA1 and BRCA2 detection, and variant interpretation. Data were presented as frequencies and percentages.

**Results:** A total of 62 genetic testing laboratories completed the survey. Illumina was the most commonly used next-generation sequencing (NGS) platform (61.2%) followed by Thermo Fisher (24.1%). All laboratories were capable of carrying out BRCA1 and BRCA2 testing.
out germline \textit{BRCA1} and \textit{BRCA2} genetic testing, except for 1, while only 80.6\% of the laboratories had the facility to carry out tumor \textit{BRCA1} and \textit{BRCA2} genetic testing. Panel design and sequencing parameters varied greatly among various laboratories. Of all laboratories, 46.8\% missed detecting changes in intronic regions due to probe design; LGRs were not detected in about 40\% of the laboratories. It was seen that 12\% of laboratories that carried out tumor \textit{BRCA1} and \textit{BRCA2} testing did not perform quality control of tumor cell content. There were differences in interpretation guidelines used by the laboratories. American College of Medical Genetics guidelines were mostly referenced for data interpretation (90.3\%) followed by Chinese expert consensus (70.9\%). The variant of uncertain significance (VUS) rate was estimated by only 41.9\% of laboratories and based on different methodologies. A majority (83.87\%) of the laboratories did not share data with public databases; however, they are willing to share data with national institutions if possible. Quality scores of 28 (for germline \textit{BRCA}) and 20 (for tumor \textit{BRCA}) laboratories are presented in Figure 1a and Figure 1b.

**Conclusion:** Even though there is a huge need for \textit{BRCA} testing, there is no unified standard for it. Mandatory quality control and specific guidelines are needed in China to ensure quality assurance in \textit{BRCA1} and \textit{BRCA2} genetic testing laboratories.

---

**783 - Poster Session**

**Thermodynamic parameters of blood plasma proteins in women with breast tumors**

N. Kotrikadze\textsuperscript{a}, M. Alibegashvili\textsuperscript{a}, L. Ramishvili\textsuperscript{a}, I. Nakashidze\textsuperscript{a}, T. Tevdoradze\textsuperscript{a}, M. Gordeziani\textsuperscript{a}, M. Zibzibadze\textsuperscript{a}, A. Khazaradze\textsuperscript{a}, B. Sepiashvili\textsuperscript{a} and S. Ahmad\textsuperscript{a}. \textsuperscript{a}Ivane Javakhishvili Tbilisi State University, Faculty of Exact and Natural Sciences, Tbilisi, Georgia, \textsuperscript{b}Batumi Shota Rustaveli State University, Faculty of Natural Science and Health Care, Batumi, Georgia, \textsuperscript{c}AdventHealth Cancer Institute, Orlando, FL, USA

**Objective:** The study of blood plasma proteins in oncological patients carries a potential diagnostic significance. It is well established that some quantitative, as well as qualitative, alterations of plasma proteins take place in blood of patients with mammary gland tumors. Hence, the aim of the study was to investigate the thermodynamic parameters of blood plasma proteins in women with breast tumors during the menopausal period.

**Method:** Blood plasma specimens from menopausal patients (50–65 years) with benign (fibroadenoma) and malignant breast tumors (breast cancer) were studied. The method of differential scanning microcalorimetry (DSMC) was applied to investigate the thermodynamic parameters of blood plasma (\( n = 20 \) in each group).

**Results:** The thermograms of the control group showed a major peak near 62–63°C, which corresponds to the melting temperature of native plasma albumin. The major peak was shifted to higher temperature in cases of benign tumor that was observed at 65–66°C on the thermogram. Besides, a small shoulder arose at 70–71°C. Calorimetric assay of blood plasma in case of breast cancer showed dramatic differences from normal thermogram of control group. The major peak shifted to a higher temperature range appearing at 74–75°C. Furthermore, new peaks were observed in the range of 57–58°C and 87–88°C, and a new shoulder was observed at 68–69°C compared to the control and breast benign tumor thermograms. The most interesting observation was the appearance of the 87–88°C peak on the thermogram of breast cancer, which may be caused by the significant increase of thermostable proteins in the acute phase fraction (such as orosomucoid, \( \alpha_1 \)-antitrypsin, haptoglobin, C-reactive protein, and various modified forms of other proteins).
**Conclusion:** The differences observed on the blood plasma thermograms of patients with breast tumors enabled the differentiation of benign and malignant breast tumors using the DSMC method. Our findings may be useful in the differential diagnostic value of the method for mammary gland tumors.

---

**784 - Poster Session**  
**Efficacy and safety of pegteograstim and pegfilgrastim on chemotherapy-induced neutropenia in ovary cancer patients**  
M.K. Kim. *Sunnybrook Cancer Centre/University of Toronto, Changwon-Si, South Korea*

**Objective:** Febrile neutropenia is a deadly situation during chemotherapy. Granulocyte-colony-stimulating factor (G-CSF) is used to prevent febrile neutropenia associated with myelosuppression. Pegfilgrastim, a pegylated form of filgrastim, has an increased half-life. Pegteograstim is a novel recombination human G-CSF of another form of pegylated filgrastim. Women with ovarian carcinoma who are treated with paclitaxel/carboplatin with those drugs were investigated to evaluate efficacy and safety of pegteograstim and pegfilgrastim.

**Method:** A minimum of 24 hours after chemotherapy, pegteograstim or pegfilgrastim was given as a single subcutaneous injection of 6 mg during each chemotherapy cycle. We evaluated to absolute neutrophil count (ANC) change and febrile neutropenia incidence.

**Results:** We found 30 of pegteostim cases and 12 pegfilgrastim. Median ANC between pegteostim was 2,960. Pegfilgrastim was 2,396. After pegteograstim, ANC was elevated to 13,847 from 2,960 (difference was 10,887) in case of pegteograstim. In pegfilgrastim, ANC increased to 1,2933 (difference was 10,537). There was no febrile neutropenia in both cases. Safety profiles of 2 groups did not differ significantly.

**Conclusion:** Pegteograstim and pegfilgrastim have similar efficacy and safety profile in the reduction of chemotherapy-induced neutropenia in ovarian cancer patients who were undergoing chemotherapy with chance of myelosuppression.

---

**785 - Poster Session**  
**Effectiveness of intravenous iron in gynecologic cancer-associated anemia**  
M.K. Kim. *Sunnybrook Cancer Centre/University of Toronto, Changwon-Si, South Korea*

**Objective:** Anemia control is associated with quality of life in gynecologic cancer patients. This study evaluated the effect of intravenous iron, ferric carboxymaltose, in a group of gynecologic cancer patients.

**Method:** In this retrospective study, we identified ovary/endometrial and cervical cancer patients who were receiving ferric maltose and had a baseline and follow-up hemoglobin (Hb) levels including complete blood count (CBC) besides RBC transfusion and oral iron supplementation.

**Results:** We found 116 cancer cases of ferric carboxymaltose infusion (5 peritoneal, 41 cervical, 9 endometrial, and 61 ovary). Among them, 5 cases received transfusion, oral iron, and intravenous ferric carboxymaltose; median Hb change was 1.42 (8.26–9.68), and median hematocrit (Hct) change was 4.26 (24.2–28.46). Twenty-three cases were chosen for transfusion and intravenous ferric carboxymaltose; median Hb change was 1.04 (8.60–9.64), and median Hct change was 5.08 (23.96–29.04). Forty-seven cases were intravenous ferric carboxymaltose and oral iron supplementation; median Hb change was 0.45 (8.25–8.70), and median Hct change was 2.01 (26.69–28.7). forty-one cases received intravenous ferric carboxymaltose only; median Hb change was 0.33 (8.85–9.13), and median Hct change was 2.12 (27.74–29.86).

**Conclusion:** Intravenous administration of iron in gynecologic cancer patients leads to a moderate increase in Hb and Hct.

---

**787 - Poster Session**  
**Prediction model of ovarian cancer progression using chemo-resistant related genes variation via TCGA database analysis**  
Z. Zheng and X. Wu. *Fudan University Shanghai Cancer Center, Shanghai, China*
Objective: Ovarian cancer is one of the leading causes of gynecological cancer death. Platinum-based chemotherapy plays an important role in treatment of ovarian cancer, but chemoresistance is one obstacle to treatment failure. The aim of this study was to establish a prediction model of ovarian cancer progression using chemoresistant related genes variation via analysis of The Cancer Genome Atlas (TCGA) database.

Method: Gene transcription, single nucleotide polymorphism, and copy number variations of patients with ovarian cancer were collected from the TCGA database. Platinum-resistant gene variation was identified by support vector machine (SVM) classification. The prediction model of ovarian cancer progression based on platinum-resistant gene variation was established by L1-LASSO and Cox proportional hazards regression model.

Results: An SVM classification model based on 10 gene variations was identified to be associated with platinum resistance. The AUC area of this model was 0.971, with sensitivity = 1 and specificity = 0.839. Eight of these 10 genes were used to establish a progressive model by Cox proportional hazards regression. The prognosis score is $(-0.42542) \times \exp\text{GJA8} + (0.430375) \times \exp\text{PNLDC1} + (-0.20707) \times \exp\text{SLC5A1} + (1.169891) \times \exp\text{VSTM2L} + (1.195075) \times \exp\text{CACNA1C} + (-1.64918) \times \exp\text{SEZ6L} + (0.442726) \times \exp\text{GDF3} + (-1.78725) \times \exp\text{SYNM}$. The high-risk group predicted by these models showed a shorter overall survival time ($38.56 \pm 21.31, n = 115$) than the low-risk group ($n = 115, 47.30 \pm 26.11, P < 0.001$).

Conclusion: A prediction model of ovarian cancer progression using chemoresistant related genes variation via TCGA database analysis is feasible, but needs to be verified in future studies.

---

788 - Poster Session

Socioeconomic factors related to treatment response in locally advanced cervical cancer

L.N. Gallardo-Alvarado and D. Cantu de León. Instituto Nacional de Cancerología de México, México, DF, Mexico

Objective: The aim of this study was to evaluate the association between socioeconomic factors and outcomes after primary treatment in locally advanced cervical cancer (LACC).

Method: We enrolled 1,865 women with LACC from 2005 to 2017 in a descriptive and comparative analysis of treatment response.

Results: Median age was 51 (19–87) years and BMI 27.5 without differences between clinical stages; 93.5% received concurrent chemoradiotherapy followed by brachytherapy, and the other 6.5% received only radiotherapy or did not complete the treatment. Eighty percent of patients were classified as low and very low income; we did not find differences between income and the type of initial treatment and outcome. The educational level was inversely correlated with clinical stage at diagnosis, with statistically significant differences between stages III or more when between 26% and 31% were illiterate and between 24% and 31% had not finished elementary school, compared with only 10%–20% of illiterate patients in stages IB2 and II ($P = 0.004$). Illiterate patients have more risk to noncomplete treatment, 38.5% versus 11.5% of patients who at least completed elementary school ($P = 0.00$). See Table 1.

Conclusion: According to the literature, the lower socioeconomic actor women appear to have poorer survival. In our data, the differences are related to the stage of disease at diagnosis and the probability to abandon the treatment. In an institution such as ours, where most individuals have low or very low incomes, other factors seem to have a higher impact on prognosis, such as clinical stage, and are more important in LACC.

<table>
<thead>
<tr>
<th>Clinical stage</th>
<th>Complete response</th>
<th>Partial response or persistent disease</th>
<th>Progression disease</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>IB2</td>
<td>166 (93.2)</td>
<td>5 (2.8)</td>
<td>7 (3.9)</td>
<td></td>
</tr>
<tr>
<td>IIA</td>
<td>87 (87.9)</td>
<td>5 (5.1)</td>
<td>7 (7.1)</td>
<td></td>
</tr>
<tr>
<td>IIB</td>
<td>896 (87)</td>
<td>69 (6.7)</td>
<td>65 (6.3)</td>
<td></td>
</tr>
<tr>
<td>IIIA</td>
<td>41 (78.9%)</td>
<td>4 (7.7)</td>
<td>7 (13.5)</td>
<td></td>
</tr>
<tr>
<td>IIIIB</td>
<td>297 (67.2)</td>
<td>77 (17.4)</td>
<td>68 (15.4)</td>
<td>0.02</td>
</tr>
<tr>
<td>IVA</td>
<td>28 (46.7)</td>
<td>24 (40)</td>
<td>8 (13.3)</td>
<td>0.00</td>
</tr>
</tbody>
</table>
**790 - Poster Session**  
Gynecologic oncology program in Grenada  
J.A. Cosina and S.P. Bowens. aHartford Healthcare Cancer Institute at The Hospital of Central Connecticut, New Britain, CT, USA, bMedstar Washington Hospital Center, Washington, DC, USA

**Objective:** There is a paucity of data for U.S.-based gynecologic oncologists providing overseas volunteer services. I developed a consultative service in gynecologic oncology in Grenada, West Indies. Here we report the details of the services provided and patient outcomes.

**Method:** At the invitation of the Ministry of Health, I visited Grenada in May 2006 to provide inpatient and outpatient consultative services in gynecologic oncology. Following the success of this initial trip, I began regular visits every 6 months to provide consultations and surgical services for patients with gynecologic malignancies or complicated gynecologic conditions. Additional services included pathology and radiology review and remote consultations between trips. Grenada has a medical oncologist and can provide chemotherapy treatments. Radiation oncology is not available. Postoperative care is provided by local gynecologists and general surgeons. Approval was obtained from the St. George's University Institutional Review Board (IRB) in 2014. Data were collected from hospital and outpatient records retrospectively for patients seen prior to IRB approval and prospectively thereafter. There were significant lapses in available data given lack of follow-up as well as inconsistent medical recordkeeping.

**Results:** I have made 29 trips between May 2006 and May 2019. There were 383 patients seen and 307 surgical procedures performed. The most common malignancy was cervical cancer (n = 74) followed by uterine (n = 65) and ovarian (n = 27). The most common non-oncologic diagnoses were uterine fibroids (n = 38), endometriosis (n = 19), or both (n = 8). The most commonly performed surgical procedures included TAH with or without BSO with or without staging (n = 131) followed by radical hysterectomy (n = 55). A total of 167 patients were treated for a gynecologic malignancy. Of these, 45 were lost to follow-up. Mean follow-up of 117 patients for whom data are available is 26.9 months (range 0–132). At last follow-up, 76 patients were NED, 22 died, and 24 were alive with disease.

**Conclusion:** Despite numerous logistical challenges, a successful gynecologic oncology program can be created in a developing country with limited resources. Integration with local care providers is essential to ongoing success. Excellent ontological outcomes can be obtained via a collaborative long-term relationship.

---

**791 - Poster Session**  
Overcoming data collection challenges for breast and cervical cancer in a resource poor setting: Postwar cancer registration in Liberia  
D. Alelea, M. Lieberb, S. Slewionc, A. Dottinod, S.W. Camanorc and A.M. Beddoeb. aJFK Memorial Hospital, Monrovia, Liberia, bIcahn School of Medicine at Mount Sinai, New York, NY, USA, cJFK Medical Center, Monrovia, Montserrado, Liberia, dNYC Department of Health, New York, NY, USA

**Objective:** Breast and cervical cancers are the most common cancers affecting women in Liberia. The lack of pathology limits efforts to determine the exact burden of disease and public health awareness and prevention strategies.

**Method:** This is a retrospective review of FNAs done between January and December 2018. All patients presenting for evaluation of breast and cervical lesions are reported.

**Results:** A total of 478 FNAs were performed, and cancer was diagnosed in 128 patients (26.7%). The majority of patients evaluated (316, 66.1%) were female. The most common reason for referral of women was for evaluation of a breast mass in 135 women (42.7%). A diagnosis of breast cancer was made in 51 of these women (37.7%) and fibroadenoma in 28 women (20.7%). A number of breast lesions were suspicious for carcinoma. The most common histologic type of breast cancer was ductal cell carcinoma. Of the 135 female patients, 13 (4.1%) were referred for evaluation with a cervical lesion. Cancer was diagnosed in all 13 patients. The most common histologic type was squamous cell cancer.

**Conclusion:** FNA is a low-cost and efficient method that is underutilized in low-resource settings to diagnose cancers. The number of unsatisfactory FNAs obtained from breast lesions, and the lack of immunohistochemistry, underscores the need for development of full anatomic pathology services in Liberia.
Objective: Until 2019 Ireland offered only girls of school age the quadrivalent human papillomavirus (HPV) vaccine. However, in late 2019 the vaccine schedule was extended to include males. In 2019 there was also an increase in vaccine uptake with uptake among school girls at 70%, from a low of 50% in 2017 and 2018. Despite this, uptake is still not at desired levels. We know that knowledge aids in vaccine acceptability, and so we aimed to assess women’s knowledge of HPV and the vaccine. We also aimed to assess where women gained their knowledge and whether they found the vaccine to be acceptable for both men and women.

Method: This was a questionnaire-based study, which took place over a 6-month period in an Irish general hospital. A sample of 100 women attending our gynecology clinic were asked to anonymously complete a 22-question questionnaire. Participants were included if older than 18 years, female, and capable of giving consent. This questionnaire was based on similar, validated questionnaires. Full ethical approval was granted by the local ethics board.

Results: We collected results from \( n = 100 \) women. Over one fourth \( (n = 26) \) had never heard of the HPV vaccine. Of these, none knew the risk factors for contracting HPV nor the diseases caused by HPV. Of this subgroup all women responded “I don’t know” when asked whether they think boys and girls should receive the vaccine. Of women who had heard of the vaccine \( (n = 74) \), 85% believed girls should receive the vaccine, while only 56% believed boys should. When asked where they had heard of the vaccine, most answered “the news” \( (n = 32) \), followed by “social media” and family (both \( n = 26 \)), finally followed by general physician or health care professional \( (n = 24) \). Of the subgroup who quoted “social media” as their source of education, 57% were between 25 and 39 years.

Conclusion: Our study highlights the ongoing lack of knowledge surrounding HPV and the HPV vaccine within this community. It also highlights the importance of knowledge for vaccine acceptability, highlighted by vaccination being considered less acceptable for males. This is perhaps owing to the lack of education toward this gender and may affect uptake of the vaccine within this subgroup. As such, we suggest further education is needed, particularly directed toward males. Finally, we highlighted the diversity of information sources and note that health care professionals are not the primary source. In order to improve vaccine awareness and subsequently uptake, we suggest changing the way health care professionals share information.