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Scientific Plenary V: The Farr Nezhat Surgical Innovation Session
Tuesday, March 14, 2017
Moderators: Paola A. Gehrig, MD*, University of North Carolina at Chapel Hill, Chapel Hill, NC, USA*
Farr R. Nezhat, MD, FACOG, FACS*, Weill Cornell Medical College, New York, NY, USA*
William Edward Winter III, MD*, Legacy Medical Group - Gynecologic Oncology, Lake Oswego, OR, USA*

21 - Scientific Plenary
Uterine transposition
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The Surgical film presents the case of a 26 yo patient with rectal cancer. In the first part of the video, the technique for dissecting the uterus and placing it at the level of the umbilicus is presented. In the second part, the uterus is repositioned after chemorradiation of the pelvis. The follow-up is also presented.

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22 - Scientific Plenary
Incidence of surgical site infection after implementation of a reduction bundle in gynecologic cancer patients undergoing colon surgery at a comprehensive cancer center
M.B. Schiavone[a], L.A. Moukarzel[b], K. Leong[a], Q. Zhou[a], A. Iasonos[a], K. Long Roche[a], M.M. Leitao[a], D.S. Chi[a], N.R. Abu-Rustum[a] and O. Zivanovic[a]. [a]*Memorial Sloan Kettering Cancer Center, New York, NY, USA,* [b]*Johns Hopkins School of Medicine, Baltimore, MD, USA*

Objective: Surgical site infections (SSIs) are substantial causes of morbidity, prolonged hospitalization, cost, and death in patients undergoing colorectal procedures. The aim of our study was to investigate the incidence of SSI before and after the implementation of an SSI reduction bundle in gynecologic cancer patients undergoing colon surgery at a comprehensive cancer center.

Method: We identified all gynecologic cancer patients who underwent colon resection between 2014 and 2016, during which time a service-wide SSI reduction bundle was introduced as part of a quality improvement project. Interventions in the SSI reduction bundle included preoperative oral antibiotics with optional mechanical bowel preparation, skin preparation with antibacterial solution, and the use of a separate surgical closing tray. SSI rates within a 30-day postoperative window were assessed. Various clinicopathologic data were abstracted. Appropriate statistical tests were used.

Results: A total of 233 patients were identified, of whom 115 had undergone colon surgery prior to (PRE) and 118 after (POST) the implementation of the SSI reduction bundle. There were no statistically significant differences in age, BMI, ASA score, incidence of diabetes, smoking, or type of malignancy between the groups. The most frequent type of colon surgery was low anterior resection in both cohorts (PRE 59/115, 51%; POST 53/118, 45%; $P = 0.1$). Emergency operations accounted for 23 (20%) of 115 PRE cases and 15 (13%) of 118 POST cases ($P = 0.2$). There were no differences in rates of stoma formation or hysterectomy, as well as wound classification between groups. Incidence of SSI within 30 days of surgery was 43/115 (37%) in the PRE and 14/118 (12%) in the POST cohorts ($P \leq 0.001$). Presence of wound dehiscence was noted in 30/115 (26%) PRE and 2/118 (2%) POST patients ($P \leq 0.001$). In patients whose operation time was longer than 360 minutes, 30-day SSI rates were 37% and 12% for PRE and POST groups, respectively ($P \leq 0.001$). For patients with an estimated blood loss greater than 500 cc, SSI rates were 44% and 15%, respectively ($P \leq 0.001$).

Conclusion: The implementation of an SSI reduction bundle was associated with a significant reduction in 30-day SSI rates in gynecologic cancer patients undergoing colon surgery. In addition, the SSI reduction bundle remained effective in patients undergoing longer operations and in patients with increased blood loss.

Focused Plenary I: Ace of Database: Making Sense of Data
Tuesday, March 14, 2017
Moderators: Saketh R. Guntupalli, MD*, University of Colorado Denver, Aurora, CO, USA*
Elisabeth Jenefer Diver, MD, *Massachusetts General Hospital, Boston, MA, USA*

23 - Focused Plenary

Clinical behavior of low grade serous ovarian carcinoma: An analysis of 714 patients from the Ovarian Cancer Association Consortium (OCAC)

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Objective: Evidence to date suggests limited benefit of chemotherapy in women with low-grade serous ovarian carcinoma (LGSC); however, this has not been comprehensively studied in a large number of well-characterized cases. The mitogen-activated kinase (MAPK) pathway is most frequently mutated in these tumors. We set to examine a large dataset of patients through the Ovarian Cancer Association Consortium network with the primary objective of identifying patients' response to systemic chemotherapy.

Method: A comprehensive retrospective cohort analysis of 714 patients with LGSC was undertaken. All patients had central pathology review. Of those, 687 had accessible datasets and were included in the final analysis. Univariable (UVA) and multivariable (MVA) analyses of progression-free (PFS) and overall survival (OS) using the Cox PH model were performed, and Kalpan-Meier survival curves were generated.

Results: The median age at diagnosis was 54 years. The stage distribution was 158 (24%) stage I, 62 (9%) stage II, 401 (60%) stage III, and 45 (7%) stage IV. A total of 382 patients had complete surgical outcome data. Of those, 202 patients had no residual visible disease at the conclusion of surgery and 180 patients had visible residual disease. Complete chemotherapy data were available for 439 patients. There were 170 patients treated with first-line platinum-based chemotherapy and 269 not treated with adjuvant chemotherapy. The median follow-up was 4.9 years. Median OS was 8.9 years (7.7–10.3, $P < 0.001$). The 3- and 5-year OS probabilities were 80% and 66%, respectively. MVA controlling for age, stage, residual disease, and adjuvant platinum-based chemotherapy indicate a statistically significant OS difference related to stage (stage I vs stage III, HR = 2.31, 1.28–4.18, $P < 0.006$) and residual disease (HR = 2.53, 1.69–3.77, $P < 0.001$). First-line platinum-based treatment was not associated with significant survival advantage in this cohort (HR = 1.05, 0.76–1.46, $P = 0.766$).

Conclusion: This multicenter analysis indicates that surgical completion to no residual disease provides a survival advantage in patients with LGSC. Adjuvant platinum-based therapy was not associated with improved OS. Targeted therapies to the MAPK pathway and hormone-based therapy may be considered in these patients. Further subgroup and genomic analyses are planned to examine genomic alterations that may predict systemic response.

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24 - Focused Plenary

Patterns of use and outcomes of adjuvant chemotherapy and radiation for early-stage uterine papillary serous carcinoma

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Objective: Early-stage uterine papillary serous carcinoma (UPSC) has a poor prognosis. Adjuvant radiation and chemotherapy are often utilized, but the effect on outcomes is based on small studies. We examined the use of chemotherapy (CT), vaginal brachytherapy (VBT), and external beam radiotherapy (EBRT) with early-stage UPSC and analyzed the association between these interventions and survival.

Method: We identified women with stage I-II UPSC recorded in the National Cancer Data Base from 1998 to 2012 who underwent primary surgical treatment. Use of CT, VBT, and EBRT was examined. Cox proportional hazards models were used to examine the independent associations of treatment on survival. A propensity score analysis was performed to minimize the impact of confounders on the outcomes of interest.

Results: We identified 7,325 patients including 4,547 (62%) stage IA, 1,071 (14.6%) stage IB, and 1,328 (18.1%) stage II patients. Overall, 37.9% received CT; 17.7% received EBRT; and 19.6% received VBT. CT use increased from 9.5% in 1998 to 56.3 % in 2012 and VBT increased from 6.8% to 29.2%, while EBRT decreased from 19.1% to 11.8%. In a multivariable model, CT use (HR = 0.76, 95% CI 0.67–0.86) and VBT (HR = 0.67, 95% CI 0.57–0.78) were associated with decreased mortality. When stratified by use of CT, VBT remained associated with improved survival in women who did and did not receive CT. There was no statistically significant association between EBRT and survival. The beneficial effects of CT remained in sensitivity analyses limiting the cohort to only patients who underwent nodal staging. A propensity score analysis also suggested that VBT was associated with improved survival, but there was no association between EBRT and survival.

Conclusion: In early-stage UPSC, use of CT and VBT is increasing. CT and VBT are associated with improved survival. There appears to be little benefit in the addition of EBRT over VBT.

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25 - Focused Plenary
Surgical readmission and survival in women with ovarian cancer: Are short term quality metrics incentivizing decreased long term survival?
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Objective: Health systems are increasingly being incentivized to decrease postoperative readmissions. It is unknown whether incentives to decrease postoperative readmission are aligned with goals of improved long-term survival. Our objective was to determine the association between treatment with neoadjuvant chemotherapy (NACT) or primary debulking surgery (PDS) and readmission after surgical hospitalization as well as overall survival among women with stage III epithelial ovarian cancer (EOC).

Method: We identified incident cases of stage III EOC treated with both chemotherapy and surgery in the National Cancer Data Base (NCDB) from 2006 to 2012. A further inclusion criterion was undergoing surgery at the facility reporting to the NCDB. Readmission was defined as readmission to the reporting facility within 30 days of surgery. Readmissions were categorized as planned or unplanned per the NCDB. Log binomial models were used to estimate risk ratios and 95% confidence intervals. Survival analysis was performed using Cox proportional hazards models.

Results: We identified 26,595 women with stage III EOC who underwent treatment with both chemotherapy and surgery. Of these, 15.5% (n = 4,172) were treated with NACT and 11.3% (n = 3,052) were readmitted to the same hospital within 30 days of surgery; 57% (n = 1,742) were unplanned. NACT was associated with a 37% reduction in the risk of unplanned readmission (RR 0.63, 95% CI 0.54–0.74) and a 48% reduction in the risk of any readmission (RR 0.52, 95% CI 0.46–0.59) compared to PDS with adjustment for age, race, insurance, Charlson comorbidity score and histology. However, in the same population, receipt of NACT was also associated with a 36% increase in the rate of death from all causes (HR 1.36, 95% CI 1.29–1.42) with adjustment for the same factors.

Conclusions: Women with stage III EOC who received NACT experienced decreased rates of readmission after surgical hospitalization compared to those receiving PDS. However, in the same cohort, the women treated with NACT also experienced decreased overall survival. While selection bias may account for some of the observed differences in survival, the current focus on short-term hospital-wide quality metrics, such as postoperative readmission, may be creating incentives inconsistent with long-term goals, such as improved survival.

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26 - Focused Plenary
Knocking out stress: A systems-based identification of optimal drug combinations to improve ovarian cancer outcomes
R.L. Dood[a], A.S. Nagaraja [a], Y.A. Lyons[a], J.M. Hansen[a], R.A. Previs[a], D.B. Jackson[b], R.L. Coleman[a] and A.K. Sood[a]. [a]*The University of Texas MD Anderson Cancer Center, Houston, TX, USA,* [b]*Molecular Health GmbH, Heidelberg, Germany*

Objective: Stress and inflammation promote growth of many cancer types. However, mechanisms and optimal strategies for blocking such effects have not been fully defined. Here, we analyzed large-scale datasets to identify optimal drug combinations and tested them in an ovarian cancer mouse model.

Method:The Federal Adverse Event Reporting System (FADRS) database was accessed using EFFECT software (Molecular Health, Helsinki, Germany), which organizes event reports by drugs involved and outcome (death, hospitalization, and the like). Among reports involving ovarian cancer, mortality was compared across beta-blocker and nonsteroidal antiinflammatory drug (NSAID) classes. We then tested the effects of the identified drugs propranolol (beta-blocker) and etodolac (COX-2 inhibitor), in combination and individually, in a syngeneic ovarian cancer model using immune-competent C57BL/6 mice injected intraperitoneally with ID-8 cells who underwent daily restraint stress. Treatment comparisons were made using ANOVA, linear regression for tests of interaction, and 2-sided α-adjusted tests for pairwise comparisons, all using STATA 12.0 with $\alpha = 0.05$.

Results: The FAERS database identified 9,234 ovarian cancer reports, indicating death in 20.9%. In univariable analyses, both beta-blockers and COX inhibitors were associated with a statistically significantly lower mortality ($P < 0.001$). In multivariable ANOVA models, beta-blockers, COX-2, and nonselective COX inhibitors all had statistically significant reduction in mortality. A statistically significant interaction was found between beta-blockers and both nonselective COX and selective COX-2 inhibitors

suggesting synergy. Syngeneic mouse model results are reported in Table 1. Statistically significant differences were seen in all outcomes across treatment groups. In pairwise comparisons, all treatments were statistically superior to control except etodolac's effect on ascites. Etodolac with propranolol over propranolol alone was statistically significantly improved only in decreasing the number of tumor nodules but not in other outcomes.

Conclusion: These data represent the first systems-based identification of an effective combination of COX inhibition and beta-blockade in ovarian cancer. Further in vivo studies will guide development of clinical strategies identified here to maximize ovarian cancer outcomes.

Table 1. Mean tumor measurements by treatment group.

	Control* **(n=10)** ***mean ± s.e.***	**Propranolol (n=9†)** ***mean ± s.e.***	**Etodolac (n=9†)** ***mean ± s.e.***	**Propranolol + Etodolac (n=10)** ***mean ± s.e.***
Tumor weight (g)	0.65 ± 0.07	0.37 ± 0.03	0.41 ± 0.05	0.20 ± 0.02
Ascites volume (mL)	3.60 ± 0.50	1.44 ± 0.26	2.89 ± 0.46	0.75 ± 0.20
No. of tumor nodules	45.40 ± 6.21	35.67 ± 1.82	44 ± 5.10	17 ± 2.60
No. of tumor sites	4.3 ± 0.21	3.11 ± 0.26	3.33 ± 0.24	2.50 ± 0.24

*One moribund control was sacrificed early on day 25. †One mouse each in the propranolol only and etodolac only groups was lost in handling on day 8 leaving 9 mice for analysis.

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27 - Focused Plenary

Preoperatively predicting non-home discharge after surgery for gynecologic malignancy

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Objective: Returning home after surgery is recognized by The Joint Commission as a quality metric. In addition, considerable expense is incurred when a patient is not discharged home. Identifying patients prior to surgery who have a high likelihood of non-home discharge could facilitate candid discussion about expectations for recovery, early discharge planning, and hospital resource allocation. The objective of this study was to develop a preoperative risk-scoring model to predict non-home discharge after surgery for gynecologic malignancy.

Method: A retrospective cohort study was performed using a regional data registry. Women who had surgery involving hysterectomy for gynecologic malignancy from January 2013 through April 2015 were identified. Discharge status was determined by trained clinical data abstractors. Women discharged with home health care services were included in the home discharge group. A multivariable model was developed to create a nomogram (Fig. 1) to assign a risk score.

Results: Non-home discharge occurred in 3.1% of 2,134 women. The proportion of non-home discharges did not differ by cancer diagnosis (uterine 3.5%, ovarian 2.2%, and cervical 1.6%, $P = 0.2$). Skilled nursing facilities were the most common non-home destination (68.2%), followed by inpatient rehabilitation (19.7%). Women discharged to a facility had a longer hospital length of stay (10 vs 3 days, $P < 0.0001$). Among patients with comorbidities (hypertension, diabetes, coronary artery disease, COPD/dyspnea, arrhythmia, and history of DVT/PE), non-home discharge was more common in women with 1 (aOR 3.4, $P = 0.03$) or ≥2 of these comorbidities (aOR 5.1, $P = 0.003$) compared to having none. Non-home discharge was more common after laparotomy (aOR 6.7, $P < 0.0001$) than laparoscopy, and in those aged ≥70 years (aOR 3.4, $P < 0.0001$), American Society of Anesthesiologists (ASA) class ≥3 (aOR 4.5, $P = 0.0004$), and with partial or total dependent functional status (aOR 8.7, $P < 0.0001$). The final model C-statistic was 0.89.

Conclusion: Non-home discharge after surgery involving hysterectomy for gynecologic malignancy was predicted with high accuracy in this retrospective analysis. Once externally validated, this nomogram can be used to manage patient expectations about discharge destination and to coordinate postacute care.

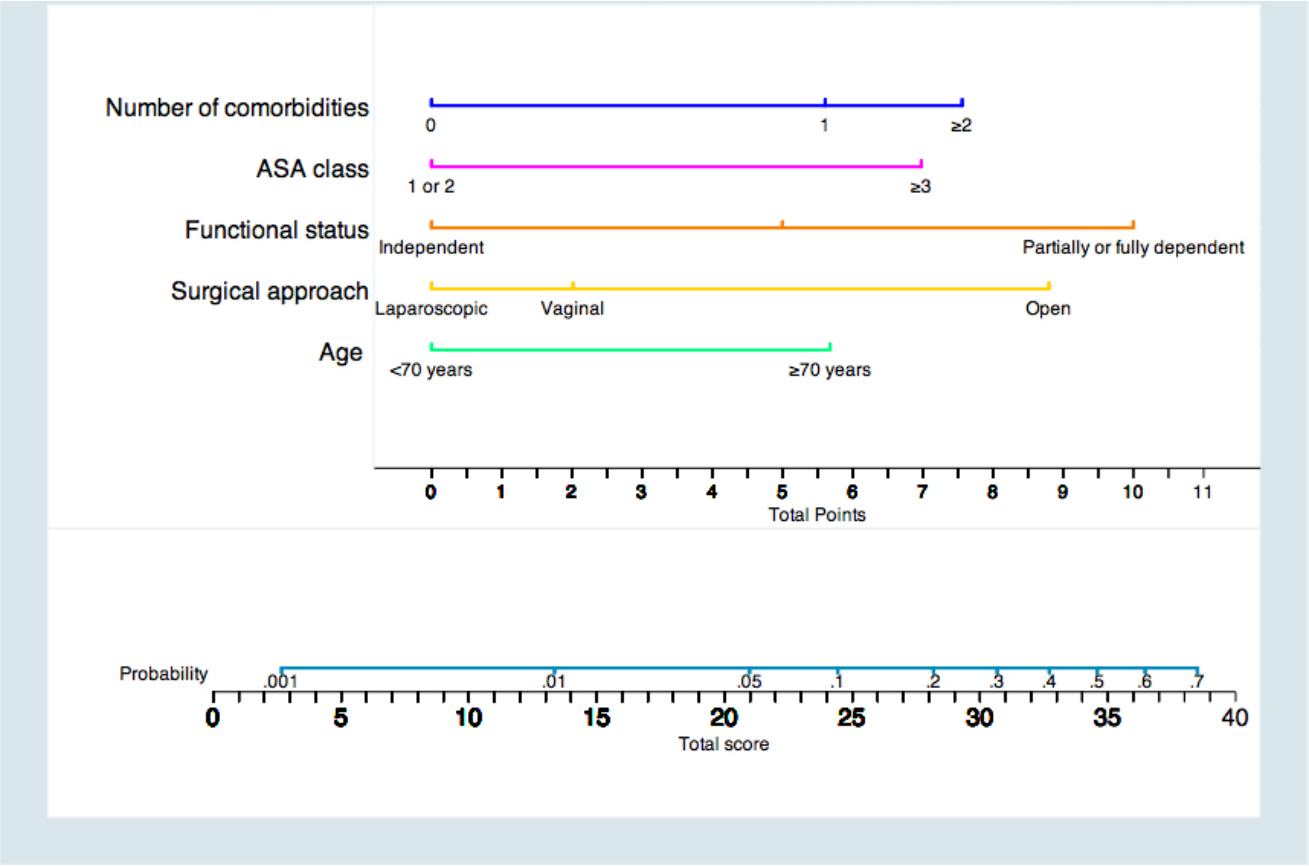

Fig. 1. Nomogram for non-home discharge after surgery for gynecologic malignancy.

Focused Plenary II: Improving Surgical Outcomes
Tuesday, March 14, 2017
Moderators: Marcela G. del Carmen, MD, MPH, *Massachusetts General Hospital/Harvard University, Boston, MA, USA*
James Nicklin, MBBS, *University of Queensland, Herston, Australia*

28 - Focused Plenary
A randomized controlled trial comparing the efficacy of perioperative celecoxib versus ketorolac for perioperative pain control
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Objective: To compare postoperative pain control scores and narcotic use following robotic hysterectomy in patients receiving scheduled perioperative Celecoxib versus Ketorolac.

Method: A total of 138 patients undergoing robotic hysterectomy were compared. All patients received scheduled preoperative and postoperative Tylenol (975 mg PO q 8 hours) and Gabapentin (100 mg PO q 8 hours) as well as postoperative intravenous and oral narcotics as needed. Seventy patients were randomized to receive scheduled Ketorolac during surgery (15 mg IV q 6 hours) and 68 patients to receive Celecoxib prior to surgery (400 mg PO) as well as scheduled Celecoxib postoperatively (200 mg PO BID). Patients in the Celecoxib arm continued Celecoxib for 7 days postoperatively (200 mg PO BID). Pain scores were measured using the visual analog scale every 2 hours for the first 24 hours or until discharge. Postoperative narcotic use was measured for the first 24 hours following surgery or until time of discharge. All patients were seen within 2 weeks postoperatively and given a questionnaire regarding outpatient narcotic use and return to activities of daily living (ADLs). SPSS software was used for statistical analysis. All discrete variables were analyzed using χ^2 analysis and independent variables using an independent t test.

Results: There were no significant differences in age, body mass index, diagnosis, procedures performed, number of port sites, operative time, or length of stay between the two arms. No differences were seen in pain scores or narcotic or antiemetic usage prior to discharge from the hospital. Perioperative complications and days to return to ADLs did not differ between the two groups. There was 1 readmission, for postoperative fever, in a patient randomized to Ketorolac. Patients who received

Celecoxib required fewer oral narcotics following discharge (6.0 ± 3.6 vs 8.1 ± 4.0, $P = 0.001$) and stopped taking oral narcotics earlier (3.8 ± 2.6 days vs 5.7 ± 2.8 days, $P < 0.001$) following discharge. (See Tables 1–4.)

Conclusion: Celecoxib prior to surgery and continued for 7 days postoperatively is safe and reduces outpatient narcotic use compared to scheduled postoperative Ketorolac. Utilization of Celecoxib for postoperative pain control may allow for reduced narcotic doses and reduce narcotic-prescribing practices in this patient population.

Table 1. Demographic Data.

	Toradol (n = 70)	Celebrex (n = 68)	P Value
Age (years)	56.3 ± 11.3	55.1 ± 14.4	0.3
Body Mass Index	31.8 ± 8.6	31.7 ± 8.1	0.49
Preoperative Diagnosis			0.17
Malignancy (Cervix/uterus)	21	15	
Premalignancy (CIN/Hyperplasia)	14	15	
Leiomyoma	8	4	
Pelvic Pain	11	8	
DUB	3	8	
Adnexal Mass	10	12	
Genetic Predisposition to Malignancy	3	4	
Surgical Pathology			0.11
Malignant Pathology	22	15	
Benign Pathology	48	53	
Procedure			0.11
Robotic Hysterectomy +/- BSO, cysto	22	15	
Robotic Hysterectomy +/- BSO, LND, cysto	48	53	
Operative Time (minutes)	105 ± 32	104 ± 34	0.42
Port Sites	4.3 ± 0.5	4.2 ± 0.4	0.15
Length of Stay (hours)			
Total time in hospital	16.3 ± 8.3	17.6 ± 9.2	0.19
Time in hospital after surgery	11.6 ± 8.1	11.9 ± 7.6	0.41

Table 2. Immediate Postoperative Pain Scores and Analgesic Use in the First 24 hours Following Surgery.

	Toradol (n = 70)	Celebrex (n = 68)	P Value
Pain Score (average)	2.7 ± 1.9	2.4 ± 1.6	0.21
Dilaudid (mg)	0.7 ± 1.0	0.8 ± 1.0	0.35
Morphine (mg)	0.5 ± 2.1	0.4 ± 1.6	0.39
Oxycodone (mg)	4.0 ± 6.9	5.4 ± 9.0	0.15
Zofran (mg)	1.5 ± 1.9	1.3 ± 2.2	0.32

Table 3. Perioperative Complications.

	Toradol (n = 70)	Celebrex (n = 68)	P Value
Total Complications	6	8	0.32
Anemia	0	2	0.08
Uncontrolled Pain	2	3	0.31
Intraoperative Injury	0	1	0.15
Patient Desire to Stay	2	1	0.16
Inability to void	2	0	0.08

Table 4. Postoperative Outpatient Narcotic Usage and Return to ADLs Following Discharge.

	Toradol (n = 70)	Celebrex (n = 68)	P Value
Days Until able to complete ADLs	2.4 ± 0.8	2.2 ± 0.9	0.14
Mean days requiring narcotic use	5.7 ± 2.8	3.8 ± 2.6	<0.001
Mean number of oral narcotics used after discharge	8.1 ± 4.0	6.0 ± 3.6	0.001

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29 - Focused Plenary

Liposomal bupivacaine and preoperative acetaminophen: Useful in minimally invasive surgery too?

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Objectives To determine whether preoperative intravenous acetaminophen (IA) and local infiltration of liposomal bupivacaine (LB) at the time of port-site closure significantly improve postoperative pain control and reduce narcotic requirements following robotic hysterectomy and surgical staging for uterine malignancy.

Method: A retrospective analysis was performed including all patients undergoing robotic hysterectomy and staging for uterine malignancy at a single institution from 2012 to 2016 (n = 243). This cohort was divided into patients receiving 1 gram of preoperative IA and local LB at the time of port-site closure (intervention, n = 111) and patients receiving no adjunctive intervention (control, n = 104). Demographic data including age, body mass index (BMI), diagnosis of chronic pain syndromes, and preoperative narcotic utilization were collected and compared between cohorts. Primary outcomes included patient-reported pain scores and inpatient narcotic utilization. Secondary outcomes included length of stay (LOS) and the amount of narcotic prescriptions filled within 30 days of surgery. Opioid utilization was measured using morphine milligram equivalents.

Results: In the intervention cohort, significant reductions in narcotic utilization were seen in both PACU (P = 0.012) and inpatient (P = 0.014) settings. Patients in the intervention cohort were also discharged an average of 2.4 hours earlier (P < 0.005) and filled significantly fewer narcotic prescriptions postoperatively (P = 0.009). No significant differences in patient-reported pain scores, age, BMI, diagnosis of chronic pain syndromes, smoking status, or amount of narcotics filled in the year prior to surgery were found between cohorts.

Conclusion: While addition of local LB and preoperative IA did not reduce patient-reported pain scores, it did significantly reduce narcotic consumption in both PACU and inpatient settings as well as postdischarge narcotic requirements and LOS in patients undergoing robotic hysterectomy and surgical staging for uterine malignancy, demonstrating utility in enhancing recovery even after minimally invasive surgery.

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30 - Focused Plenary

A cost-utility analysis of sentinel lymph node mapping, selective lymphadenectomy, and routine lymphadenectomy in the management of low-risk endometrial carcinoma

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Objective: To evaluate the cost-utility of 3 lymphadenectomy (LND) strategies in the management of low-risk endometrial carcinoma (EC).

Method: A decision analysis model compared 3 LND strategies in women undergoing minimally invasive surgery (MIS) for low-risk EC: (1) routine LND in all patients; (2) selective LND based on intraoperative frozen section (Mayo criteria), in which approximately 60% of patients undergo LND; and (3) sentinel lymph node (SLN) mapping based on the Memorial Sloan Kettering algorithm. In the SLN algorithm, 15% of patients map unilaterally, requiring a contralateral side-specific LND, and 5% don't map, requiring a bilateral LND. Costs and outcomes were obtained from published literature and Medicare reimbursement rates (Table 1). Cost categories consisted of hospital, physician, operating room, pathology (including ultrastaging), and lymphedema treatment. Effectiveness was defined as 3-year disease-specific survival adjusted for the impact of lymphedema (utility = 0.8) on quality of life. Incremental cost-effectiveness ratios (ICERs) per quality-adjusted life years (QALYs) gained were calculated. QALYs and costs (adjusted to 2016 dollars) were discounted at an annual 3% rate. Multiple deterministic sensitivity analyses were performed.

Results: For the estimated 40,000 women undergoing surgery for low-risk EC each year in the United States, the annual cost of routine LND, selective LND, and SLN is $722 million, $681 million, and $656 million, respectively. In the base case scenario, routine LND had a cost of $18,041 and an effectiveness of 2.79 QALYs. Selective LND had a cost of $17,036 and an effectiveness of 2.81 QALYs, while SLN had a cost of $16,401 and an effectiveness of 2.87 QALYs. With a difference of $1,005 and 0.02 QALYs, selective LND was both less costly and more effective than routine LND, dominating it. However, with the lowest cost and highest effectiveness, SLN dominated the other modalities and was the most cost-effective strategy. No ICER could be determined. These findings were robust to multiple 1- and 2-way sensitivity analyses varying the rates of lymphedema and LND, surgical approach (open or MIS), lymphedema utility, and costs.

Conclusion: Compared to routine and selective LND, SLN had the lowest costs and highest quality-adjusted survival in this analysis, making it the most cost-effective strategy in the management of low-risk EC.

Table 1: Clinical parameters and costs.

Parameter/Cost category	**Base case estimate**	**Range for sensitivity analysis**
Risk of lymphedema		
LND	20%	10 – 30%
SLN	5%	0 – 10%
Weighted SLN *	7%	0 – 13%
No LND	0%	0 – 5%
Lymphedema utility	0.8	0.7 – 0.95
% of pts who undergo LND in selective LND arm	60%	50 – 75%
3-year disease-specific survival †		
Routine LND arm	100%	95% – 100%
Selective LND arm	98.8%	95% – 100%
SLN arm	100%	95% – 100%
Operating room time (additional minutes needed)		
Frozen section	20 min	15 – 25 min
LND	30 min	30 – 60 min
SLN	20 min	15 – 30 min
Weighted SLN *	22 min	17 – 34 min
Hospital fee	$11,697	
Surgeon fee		
Hysterectomy/BSO	$916	
Hysterectomy/BSO + LND	$1,878	
Hysterectomy/BSO + SLN	$1,581	
Weighted Hysterectomy/BSO + SLN *	$1,621	
Anesthesiologist fee	$592	
Pathology fee		
Hysterectomy/BSO + LND	$1,517	
Selective LN Arm		
Hysterectomy/BSO + Frozen section + No LND	$678	
Hysterectomy/BSO + Frozen section + LND	$1,614	
Hysterectomy/BSO + SLN (including ultrastaging)	$1,312	
Weighted Hysterectomy/BSO + SLN *	$1,340	
Operating room cost/min	$30	$30 – 60
Lymphedema treatment cost/year	$2,500	$2,500 – 5,000

LND: lymphadenectomy; SLN: Sentinel lymph node mapping
* Weighted SLN adjusts for the fact that 80% of pts map bilaterally, 15% map unilaterally and require a contralateral side-specific LND, and 5% do not map and require a bilateral LND
† Eriksson et al, *Gynecol Oncol* 2016

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31 - Focused Plenary

Overcoming stress effects: A prospective feasibility trial of beta-blockers with upfront ovarian cancer therapy

P.H. Thaker[a], L.M. Kuroki[a,b], W. Hu[c], I. Zighelboim[d], L.M. Ramondetta[c], A.R. Hagemann[a], L.S. Massad[a], M.A. Powell[a], D.G. Mutch[a] and A.K. Sood[c]. *[a]Washington University School of Medicine in St. Louis, St. Louis, MO, USA, [b]St Louis, MO, USA, [c]The University of Texas MD Anderson Cancer Center, Houston, TX, USA, [d]St. Luke's Cancer Care Associates, Bethlehem, PA, USA*

Objective: Nonselective beta-blockers (NSBB) have been shown to inhibit angiogenic factors in preclinical models of ovarian cancer and are associated with reduced risk of death in retrospective studies. Here, we carried out a prospective study adding a NSBB perioperatively to standard chemotherapy in patients with presumed ovarian, fallopian tube, or primary peritoneal (EOC) cancers.

Method: Following institutional review board approval, patients with suspected EOC were approached in clinic and started on propranolol 40 mg PO BID for 48–72 hours preoperatively. After intraoperative confirmation of EOC, patients were restarted on propranolol when tolerating oral intake in the hospital and with appropriate blood pressure and heart rate hold parameters. The propranolol was given with the treating physician's choice of standard chemotherapy for 6 cycles and then weaned off after completion of chemotherapy. Primary endpoints were to determine the tolerability and serum levels of angiogenic cytokines at defined time points pre- and post-treatment (after cycles 3 and 6) with beta-blockers.

Results: Of 84 enrolled patients suspected to have EOC, 35 (42%) patients had confirmed EOC and continued taking propranolol. Reasons for study withdrawal included transfer of care to outside providers (n = 7, 20%), insomnia (n = 1), decline of adjuvant chemotherapy (n = 1), and complications of intraperitoneal (IP) chemotherapy (n = 1). Hence, 25 were evaluable for the objectives. Three patients (12%) required dose reductions of propranolol (n = 1, 30 mg; n = 2, 20 mg) with the first cycle of chemotherapy due to hypotension, and 1 patient received 4 cycles of intravenous (IV) chemotherapy. Twenty-four patients were able to complete propranolol concurrently with 6 cycles of IP (n = 13), dose-dense IV (n = 7),and every 3-week IV chemotherapy (n = 5). Four patients received bevacizumab. Over a 5-year follow-up period, 8 patients have not recurred to date and 8 have died. Multiplex analysis of 23 cytokines was carried out. Compared to baseline blood samples, substantial reductions in circulating proangiogenic molecules (e.g., VEGF, MCP-1, IL-6, and IL-8; $P < 0.01$) was noted.

Conclusion: Adding a NSBB to IP or IV chemotherapy in EOC patients is safe and warrants further investigation in a randomized clinical trial.

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32 - Focused Plenary

Choosing Wisely: Decreasing the incidence of perioperative blood transfusions in gynecologic oncology

L.S. Prescott, J.S. Taylor, C.A. Marten, M.F. Munsell, K. Myers, L.A. Meyer, P.T. Ramirez, C.F. Levenback, D.C. Bodurka and K.M. Schmeler. *The University of Texas MD Anderson Cancer Center, Houston, TX, USA*

Objective: To evaluate the efficacy of a transfusion reduction initiative for patients undergoing gynecologic surgery.

Method: We implemented a multimodality initiative to align transfusion practices with the American Society of Hematology's Choosing Wisely campaign and decrease our transfusion rate by 25%. Our intervention included educational outreach targeting trainees, nurse practitioners, nursing leadership, and faculty about the determents of transfusion and best transfusion practices. Baseline transfusion rates were determined for all abdominal, vaginal, and vulva surgical cases from April 1, 2014, to June 30, 2014. Data for the postintervention period from August 15, 2015, to May 16, 2016, were captured prospectively. Demographic, perioperative variables and transfusion rates were compared between the baseline and postintervention cohorts using the Fisher exact and Mann-Whitney tests. The primary outcome was transfusion rate within 72 hours of surgery.

Results: We identified 985 cases, 269 in the baseline and 716 in the postimplementation cohort. The baseline cohort was noted to have a statistically, but not clinically, significant lower median preoperative hemoglobin (12.3 vs 12.5 g/dL, P = 0.035). Otherwise, there were no differences in clinical characteristics, estimated blood loss, surgical time, surgical approach, or proportion of cases with malignancy between the two cohorts. The overall transfusion rate decreased from 23.8% to 11.3%,

with a relative risk reduction (RRR) of 53% ($P < 0.001$). The overall laparotomy transfusion rate decreased from 47% to 23% (RRR 52%, $P < 0.001$). The number of occurrences in which more than 1 unit was ordered at a time decreased from 34/50 (68%) to 14/38 (37%) ($P = 0.005$). There were no differences in 30-day mortality, cardiac, or venous thromboembolism events between the cohorts. In the multivariate analysis, after adjusting for key clinical and perioperative factors, our intervention was associated with a significant decrease in transfusion (OR = 0.25, 95% CI 0.13–0.45). Assuming a cost/unit of blood at $274, this intervention led to a cost savings of $56,718.

Conclusion: Implementation of a transfusion reduction initiative resulted in substantial reductions in perioperative transfusions and costs without significant changes in morbidity or mortality.

Focused Plenary III: Blinding Me with Science
Tuesday, March 14, 2017
Moderators: Stephanie Gaillard, MD, PhD*, Duke University Medical Center, Durham, NC, USA*
Gillian Monica Thomas, MD*, Sunnybrook Odette Cancer Center, Toronto, ON, Canada*

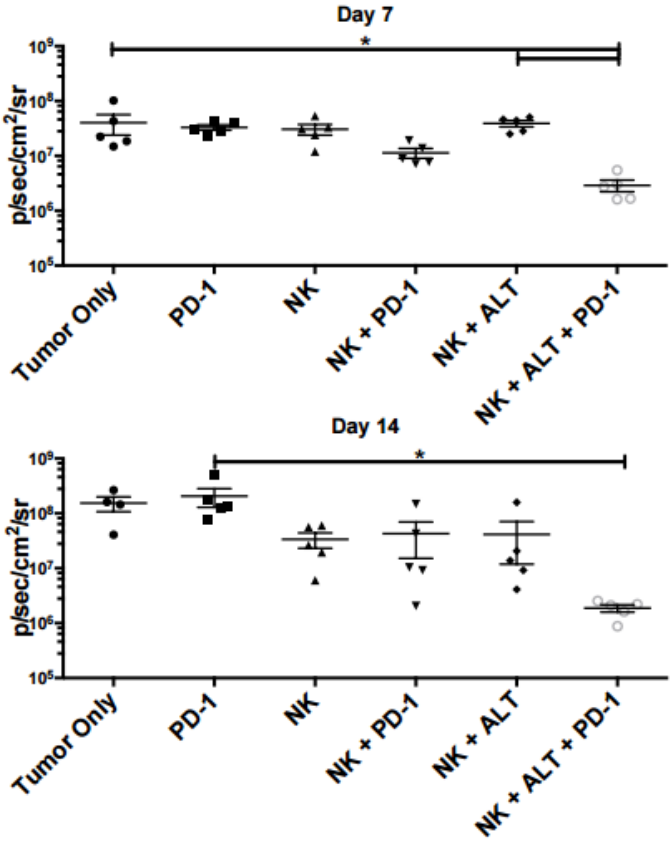
33 - Focused Plenary
Combination therapy with IL-15 superagonist (ALT-803) and PD-1 blockade enhances human NK cell immunotherapy against ovarian cancer
M.A. Geller[a], L.A. Bendzick[a], C. Ryan[b], S. Chu[b], A. Lenvik[b], A.P.N. Skubitz[a], K.L.M. Boylan[a], R. Isaksson Vogel[a], J. Miller[b] and M. Felices[b]. [a]*University of Minnesota, Minneapolis, MN, USA,* [b]*University of Minnesota Cancer Center, Minneapolis, MN, USA*

Objective: NK cells represent a powerful immunotherapeutic target because they lyse tumors directly, do not require differentiation, and can elicit potent inflammatory responses. NK cells derived from ovarian cancer ascites function poorly. The objective of these studies was to use an IL-15 superagonist molecule, ALT-803, in combination with a checkpoint inhibitor to enhance the function of both normal and ovarian cancer patient-derived NK cells.

Method: NK cell function from normal donor peripheral blood mononuclear cells and ovarian cancer patient ascites was assessed using flow cytometry and chromium release assays ±ALT-803 stimulation and a PD-1 inhibitor (pembrolizumab). To evaluate the ability of intraperitoneally delivered ALT-803 to enhance NK cell function in vivo against ovarian cancer, we used a MA148-luciferase positive ovarian cancer NSG xenogeneic mouse model with transferred human NK cells.

Results: ALT-803 potently enhanced NK cell functionality against all ovarian cancer cell lines with significant increases seen in CD107a (3.4- to 8.2-fold), IFNg (5.6- to 6.4- fold), and TNFα (4.1- to 8.7-fold). Function was also rescued in NK cells derived from the ascites of ovarian cancer patients. In our xenogeneic model of ovarian cancer, only animals treated with ALT-803 and human NK cells showed significant decrease in ovarian cancer tumor burden. Furthermore, human NK cells from the peritoneal cavity at day 32 were functional ex vivo, indicating that ALT-803 maintains NK cells in the NSG mice. In addition, IFNg, produced at higher levels in ALT-803-treated NK cells, readily induced PD-L1 on all ovarian cancer lines tested. To counter this inhibitory signaling, we tested PD-1 blockade using pembrolizumab. In vitro data indicated that cotreatment with ALT-803 and pembrolizumab significantly induced activation and function of normal and patient-derived NK cells. Cotreatment within our xenogeneic model demonstrated control of tumor burden, outperforming single-line therapy (see Fig. 1).

Conclusion: ALT-803 enhances NK cell cytotoxicity against ovarian cancer in vitro and in vivo and importantly is able to rescue functionality of ascites-derived NK cells from ovarian cancer patients. These findings suggest that the combination of ALT-803 and pembrolizumab has the potential to enhance immunotherapeutic approaches for the treatment of ovarian cancer.



MA148luc tumor was established, 2 days later mice were conditioned, followed by addition of NK cells (1 million calculated from a CD3/CD19 depleted product) in the noted groups. Keytruda (noted as PD-1 in the graph) and/or ALT-803 were injected IP (2x/week) were noted (Ketruda = 100 ug/injection, ALT-803 = 50 ug/Kg/ injection). Mice were injected with Luciferin and imaged at d7 (top) and d14 (bottom).

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34 - Focused Plenary

Less is more: Macrophage depletion after adaptive resistance improves anti-VEGF therapy

Y.A. Lyons[a], S. Pradeep[a], J.M. Hansen[a], R.L. Dood[a], S. Wu[a], M.J. Wagner[b], R.A. Previs[a], W. Hu[a], R.L. Coleman[a] and A.K. Sood[a]. [a]*The University of Texas MD Anderson Cancer Center, Houston, TX, USA,* [b]*The University of Texas, MD Anderson Cancer Center, Houston, TX, USA*

Objective: Antiangiogenesis therapy has shown clinical benefit in patients with high-grade serous ovarian cancer (HGSC), but adaptive resistance rapidly emerges. Thus, approaches to overcome such resistance are needed. Here, we systematically assessed immune cell populations enriched during adaptive resistance and identified novel therapeutic avenues.

Method: A series of in vitro and in vivo (immune-competent and nude mice) experiments were carried out. Animals were treated with an anti-VEGF antibody continuously until resistance emerged, at which point full immune profiling was performed. Based on these results, efficacy of AC708 (CSF1R inhibitor to target tumor-associated macrophages) was tested in the adaptive-resistance models. F4/80 antibody was used as a macrophage marker.

Results: On the basis of full immune profiling, we detected significantly increased macrophage infiltration in tumors with anti-VEGF antibody resistance compared to tumors from sensitive mice ($P < 0.0001$). Given the dominant role of CSF1R in macrophage function and overexpression of CSF1R in HGSC, we added AC708 following emergence of adaptive resistance to anti-VEGF antibody. Mice treated with AC708 after anti-VEGF antibody resistance had complete tumor resolution upon completion of the experiment, while those that did not receive AC708 still had abundant tumor. To mimic treatment with the AURELIA regimen, we next treated mice with anti-VEGF antibody and paclitaxel until resistance emerged, and then AC708 was

added. The addition of AC708 restored response to antiangiogenesis therapy, resulting in 82% lower tumor burden compared to treatment with anti-VEGF antibody and paclitaxel alone ($P < 0.0001$), and a substantial decrease in macrophages ($P < 0.0004$).

Conclusion: The addition of CS1R inhibitor to anti-VEGF therapy and taxane chemotherapy results in robust antitumor effects. A randomized clinical trial to confirm these findings has been activated. The REDIRECT (RandomizEd Induction DIscontinuation TRial of EmaCTuzumab) trial will randomize patients to continue weekly paclitaxel and biweekly bevacizumab with or without a CSF1R inhibitor (emactuzumab) following an induction phase.

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35 - Focused Plenary

Birinapant sensitizes platinum-resistant carcinomas with high levels of cIAP to carboplatin therapy

V. La[a], R. Fujikawa[b], D.M. Janzen[b], L. Bainvoll[b], M. Nunez[b] and S. Memarzadeh[b]. [a]*David Geffen School of Medicine at UCLA, Los Angeles, CA, USA,* [b]*University of California, Los Angeles, Los Angeles, CA, USA*

Objective: Platinum drugs are the front-line therapy in many carcinomas including high-grade serous cancers (HGSCs). Response is often favorable but diminishes with recurrence of disease. Standard of care prohibits platinum readministration to patients with platinum-resistant disease. Instead, nonplatinum agents are administered with poor outcomes. We asked whether the addition of birinapant, a drug that degrades inhibitor of apoptosis proteins (cIAP), to carboplatin could eradicate platinum-resistant carcinomas. The frequency of carcinomas sensitive to this combination therapy and biomarkers that predict this response were also explored.

Method: Survival of mice bearing intraperitoneal tumors established from 1 of 2 human HGSC platinum-resistant cell lines (S8 or S9-GODL) receiving birinapant, carboplatin, vehicle, or birinapant and carboplatin (cotherapy) was compared. Using an in vitro organoid assay, sensitivity to cotherapy was assessed in 5 platinum-resistant primary HGSCs and 12-platinum resistant non-HGSC cell lines. Levels of cIAP protein measured by Western blot were correlated with cotherapy response.

Results: Survival of mice bearing S9-GODL HGSC tumors, predicted to be cotherapy sensitive using the in vitro organoid assay, was significantly improved when birinapant and carboplatin were coadministered (Fig. 1A). Conversely, cotherapy did not affect outcome of mice bearing S8-GODL HGSC tumors, predicted to be cotherapy resistant in vitro (Fig. 1A). Approximately half of platinum-resistant carcinomas tested were cotherapy sensitive (Fig. 1B). Using semiquantitative Western blot, a level of ≥22 ng of cIAP in 20 μg of tumor lysate accurately segregated cotherapy-sensitive versus -resistant samples (Fig. 1C). Percentage of cIAP positive cells measured by IHC was 13-fold higher in cotherapy-sensitive versus -resistant tumors.

Conclusion: Platinum drugs can be an effective therapy for platinum-resistant carcinomas as long as they are combined with an agent that targets mechanisms exploited by cancer cells to evade platinum cytotoxicity. The efficacy of birinapant and carboplatin cotherapy will be tested in an upcoming FDA-approved clinical trial (NCT02756130) aimed at treating patients with HGSC tumors predicted to be cotherapy sensitive using our in vitro organoid assay.

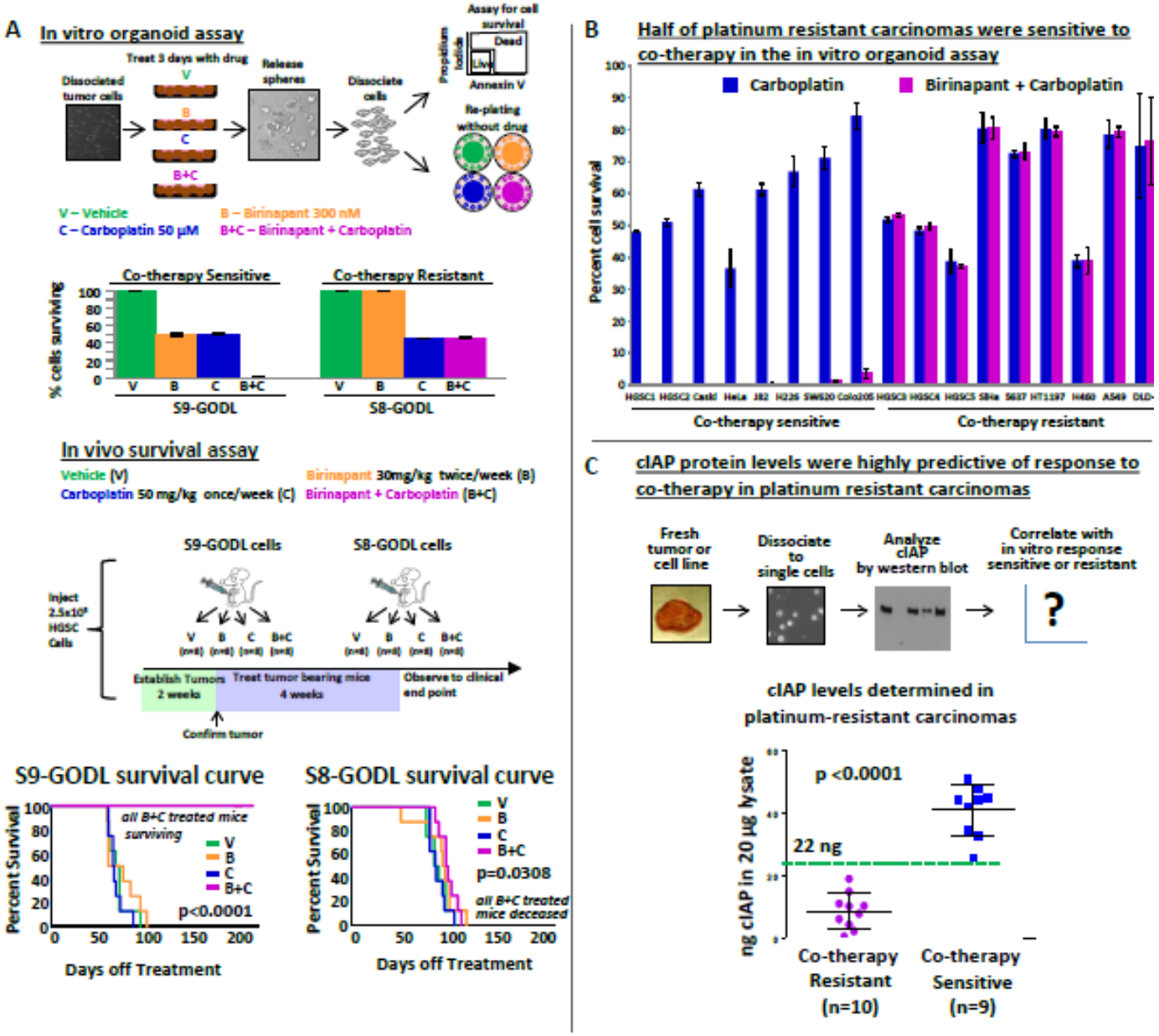

Figure 1. Carboplatin can successfully be used to treat platinum resistant carcinomas when a targeted platinum sensitizing agent such as birinapant is added to the therapeutic regimen. (A) The sensitivity of S9-GODL and S8-GODL platinum resistant HGSC cell lines to carboplatin and birinapant co-therapy was tested using the in vitro organoid assay. Based on this assay S9-GODL cells were co-therapy sensitive while S8-GODL cells were co-therapy resistant. 33 NSG mice were injected IP with one of the two platinum resistant cell lines and once tumor establishment was confirmed, mice were treated with vehicle (V), birinapant (B), carboplatin (C) or co-therapy (B+C) (n=8/cohort). Co-therapy significantly extended overall survival of mice bearing S9-GODL tumors compared to any other treatment group. All S9-GODL co-therapy treated mice are alive (now >240 days off therapy), while all mono-therapy treated mice have died within 100 days ($p<0.0001$). In contrast, co-therapy had no survival benefit in mice bearing S8-GODL tumors. Findings demonstrate that the in vitro organoid assay was highly predictive of response seen in vivo. Results also suggest that platinum resistant cancers can be effectively re-treated with platinum in combination with a tailored sensitizing agent. **(B)** Approximately half of randomly selected platinum resistant carcinomas tested were sensitive to co-therapy regardless of tissue of origin (HGSC1&2, primary high grade serous cancers; CaSki & HeLa, cervical cancer; J82, bladder cancer; H226, lung cancer; SW620 & Colo205, colon cancer). **(C)** Expression levels of cIAP proteins, measured using semi-quantitative western blot, were correlated with response to co-therapy. Tumors sensitive to co-therapy expressed ≥22ng cIAP, while co-therapy resistant tumors expressed <22ng cIAP ($p<0.0001$). S9-GODL tumor cells had cIAP levels above the 22 ng threshold (42ng) while S8-GODL cells had cIAP levels bellow the 22 ng threshold (2.2 ng).

36 - Focused Plenary

Treatment with carboplatin and taxane chemotherapy increases T-cell receptor (TCR) clonality in high-grade serous ovarian cancer (HGSOC)

K. LaVigne[a], P. Cybulska[a], T. Walther[a], R.O. Emerson[b], M. Vignali[b], K.J. Park[a], D.A. Levine[c], D.S. Chi[a], O. Zivanovic[a] and A.E. Snyder Charen[a]. [a]*Memorial Sloan Kettering Cancer Center, New York, NY, USA,* [b]*Adaptive Biotechnologies, Seattle, WA, USA,* [c]*New York University School of Medicine, New York, NY, USA*

Objective: Elevated levels of tumor-infiltrating lymphocytes (TIL) are associated with a better prognosis in high-grade serous ovarian cancer. High TIL proportion with elevated TCR clonality is associated with increased likelihood of response to checkpoint blockade immunotherapy. The objective of this study was to determine how treatment with carboplatin and taxane chemotherapy alters the intratumoral TCR repertoire in HGSOC.

Method: Forty-eight paired tumors were identified from patients with HGSOC. Formalin-fixed paraffin embedded samples were acquired prior to neoadjuvant chemotherapy (NACT) and at interval debulking surgery. Forty-four paired samples yielded data for analysis. Sequencing of the TCRβ region of CDR3 was performed using the immunoSeq assay (Adaptive Biotechnologies).

Results: The median number of cells analyzed was 6,401 (90–587,466); median T-cell count was 4,009 (3–124,737). T-cell clonality was significantly higher in post-treatment samples (median 0.15, range 0.05–0.29) than pretreatment (0.1, range 0.001–0.37, $P < 0.0001$, Mann-Whitney). T-cell infiltrate proportion was similar at both time points (pretreatment median 0.08, range 0.003–1.19, vs post-treatment median 0.09, range 0.006–0.58, $P = .79$, Mann Whitney). Subset analysis of samples from the same site at biopsy and resection demonstrated a similar increase in clonality post-treatment. However, T-cell infiltrate was also higher post-treatment (median 0.18, range 0.05–0.56, vs 0.07, range 0.01–0.58, $P = 0.04$, Mann Whitney). Higher clonality was associated with a nonsignificant improvement in PFS ($P = 0.06$, log rank).

Conclusion: Treatment with carboplatin and taxane chemotherapy increased T-cell clonality without increasing T-cell infiltration in this cohort, to our knowledge the largest published cohort of patient-matched samples prior to and after NACT. Within the site-matched subgroup, an increase in T-cell infiltration was noted. These findings provide rationale for the study of checkpoint blockade after NAXT.

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37 - Focused Plenary

Reversal of obesity-driven aggressiveness of endometrial cancer by metformin

S.A. Sullivan[a], A.M. Tran[a], L.H. Clark[a], N.W. Bateman[b], B.L. Hood[b], T.P. Conrads[b], D. Lee[c], C. Zhou[a], L. Makowski[a] and V.L. Bae-Jump[a]. [a]*University of North Carolina at Chapel Hill, Chapel Hill, NC, USA,* [b]*Gynecologic Cancer Center of Excellence, Annandale, VA, USA,* [c]*Omic Insight, LCC, Durham, NC, USA*

Objective: We assessed the metabolic antitumorigenic effects of metformin in a genetically engineered mouse model of endometrioid endometrial cancer (EC) under obese and lean conditions.

Method: $LKB1^{fl/fl}p53^{fl/fl}$ mice were fed a control low-fat diet (LFD, 10% calories from fat) versus a high-fat diet (HFD, 60% calories from fat) to mimic diet-induced obesity, starting at 3 weeks of age ($n = 10$ mice/group). AdCre was injected at 6 weeks of age to induce invasive EC. Mice were treated with placebo or metformin (200 mg/kg/day, oral) following tumor onset for 4 weeks ($n = 10$ mice/group). Global, unbiased proteomics and metabolomics were used to identify (1) differences between endometrial tumors in lean and obese mice and (2) the obesity-dependent effects of metformin in the endometrial tumors.

Results: Body weight was increased in the obese versus lean mice (32.8 gm vs 24.0 gm, $P = 0.033$). Tumors in HFD-fed mice (obese ECs) were more than double the size of those in LFD-fed mice (lean ECs) (2.1 gm vs 0.79 gm, $P = 0.040$). Metabolomic profiling revealed significant differences between obese and lean ECs. Proteomic analysis found that obese versus lean ECs had increased capacity for lipid and protein biosynthesis as evidenced by increases in apolipoproteins/lipases and proteases/ribosomal subunits, respectively. This corresponded to increases in lipids, amino acids, and dipeptides in obese ECs, as revealed by metabolomic profiling. Metformin inhibited tumor growth in both the obese and lean mice. However, metformin-induced decreases in tumor volume in HFD-fed mice were significantly greater than in LFD-fed mice (85% vs 61%, $P = 0.033$). Proteomic and metabolomic profiling of the endometrial tumors treated with placebo or metformin revealed that metformin reversed the obesity-driven upregulation of lipid biosynthesis, resulting in lipid degradation and oxidation.

Conclusion: The obese state promoted tumor aggressiveness in the $LKB1^{fl/fl}p53^{fl/fl}$ mouse model of endometrioid EC. Importantly, metformin had increased efficacy against EC in obese versus lean mice and reversed the detrimental metabolic

effects of obesity in the endometrial tumors. We hypothesize that the unique metabolic milieu underlies metformin's improved efficacy in treating ECs that develop in an obese host environment.

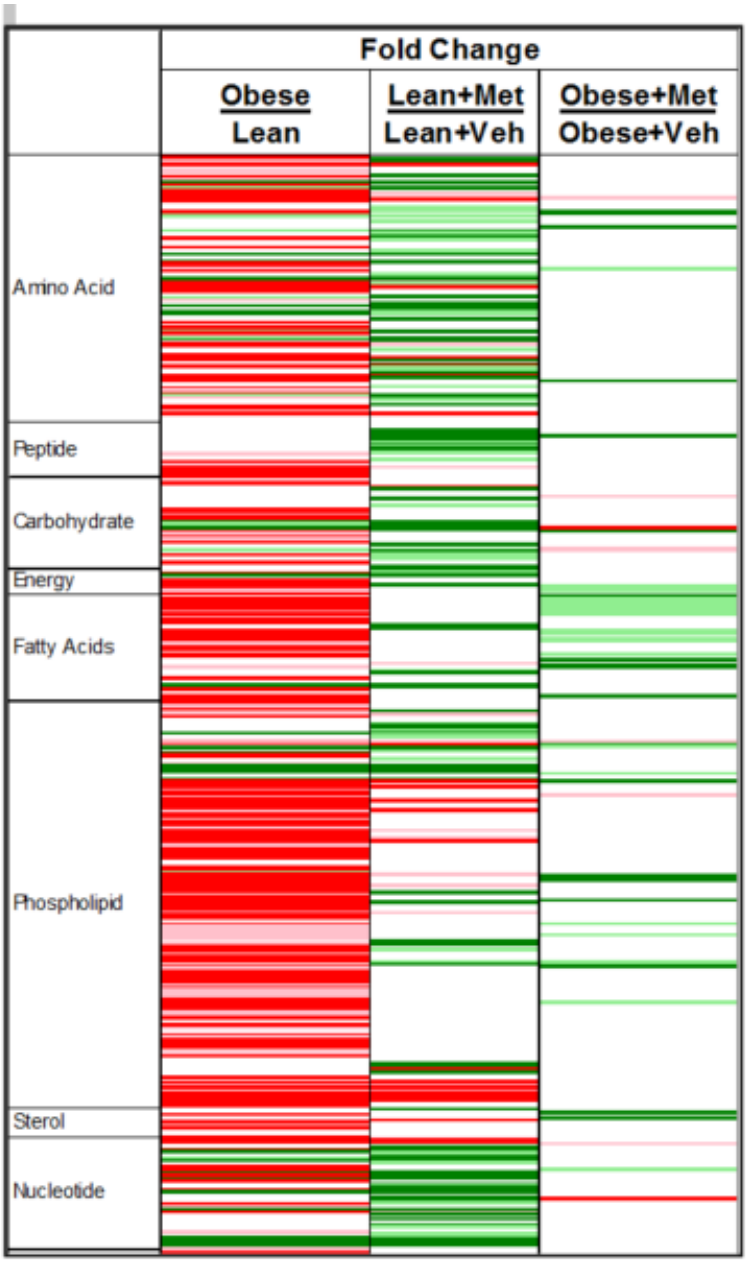

Fig. 1. Comparison of metabolic changes with obesity and metformin treatment in the endometrial tumors from LKB1$^{fl/fl}$p53$^{fl/fl}$ mice ($P < 0.05$). Red=ratio > 1, Green=ratio < 1.

Education Forum VIII: Payment Reform, Now & Later
Tuesday, March 14, 2017
Moderators: David Cohn, MD, *The Ohio State University, Columbus, OH, USA*
Laura Havrilesky, MD, *Duke University School of Medicine, USA*

38 - Education Forum
Development of an alternative payment model (APM) for endometrial cancer: Opportunities to reduce cost and improve quality
J.D. Wright[a], L.J. Havrilesky[b], D.E. Cohn[c], Y. Huang[a], L.W. Rice[d], C.L. Brown[e], E.M. Ko[f] and R.D. Alvarez[g]. [a]*Columbia University College of Physicians and Surgeons, New York, NY, USA,* [b]*Duke University Medical Center, Durham, NC, USA,* [c]*The Ohio State University, Columbus, OH, USA,* [d]*University of Wisconsin School of Medicine and Public Health, Madison, WI, USA,* [e]*Memorial Sloan*

Kettering Cancer Center, New York, NY, USA, [f]University of Pennsylvania, Philadelphia, PA, USA, [g]The Vanderbilt-Ingram Cancer Center, Nashville, TN, USA

Objectives: The Medicare Access and Children's Health Insurance Program Reauthorization Act (MACRA) calls for the development of alternative payment models (APMs) for diseases and procedures. The goal of APMs is to structure reimbursements to incorporate total costs of care across providers and facilities while at the same time improving quality. We piloted development of an APM for primary surgery in early-stage endometrial cancer to identify opportunities to reduce cost and improve quality.

Methods: The MarketScan database was used to identify women with endometrial cancer who underwent hysterectomy from 2009 to 2013. Reimbursements from 30 days preoperatively until 60 days postoperatively were captured. Patients were stratified by route of hysterectomy, and reimbursements were categorized into 1 of 8 cost centers: laboratory, radiology, surgical facility, physician's procedural cost, emergency department visits/readmissions, skilled nursing/home health, other physician costs, and other. A decision analysis model was developed to estimate the changes in cost that could be achieved by altering each cost center.

Results: A total of 29,558 women were identified. The mean cost of an episode of care was $30,641 (standard deviation = $19,841). The most important modifiable factors driving cost were route of hysterectomy, length of stay, and emergency department visits/readmissions. The mean cost of abdominal hysterectomy ($35,357) was greater than either robotic-assisted ($28,538) or laparoscopic ($27,433) hysterectomy. Likewise, costs increased for each additional day of hospitalization at the time of surgery regardless of the route of surgery. Overall, readmissions occurred in 7.6% of patients and had a median cost of $12,286, while emergency department visits were required in 11.7% with a median cost of $3,745. Readmissions and emergency department visits were more frequent after abdominal hysterectomy. Utilizing these baseline data, a model of optimized care in which the rate of minimally invasive surgery was increased by 5% (from 65% to 70%), length of stay was reduced by 10%, and emerency department visits/readmissions were reduced by 10% lowered the average case cost by $980 (3.2%).

Conclusions: The current care of women with endometrial cancer in the United States demonstrates several opportunities to reduce cost and improve quality. Modest alterations in the way endometrial cancer care is rendered can result in cost savings.

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39 - Education Forum

Utilizing public and commercial payer sources to develop endometrial cancer alternate payment models to bridge provider and payer cost sharing

E.M. Ko[a], L.J. Havrilesky[b], D.E. Cohn[c], Y. Huang[d], R.D. Alvarez[e], L.W. Rice[f], C.L. Brown[g] and J.D. Wright[d]. *[a]University of Pennsylvania, Philadelphia, PA, USA, [b]Duke University Medical Center, Durham, NC, USA, [c]The Ohio State University, Columbus, OH, USA, [d]Columbia University College of Physicians and Surgeons, New York, NY, USA, [e]University of Alabama at Birmingham, Birmingham, AL, USA, [f]University of Wisconsin School of Medicine and Public Health, Madison, WI, USA, [g]Memorial Sloan Kettering Cancer Center, New York, NY, USA*

Objectives: To design a surgical alternative payment model (APM) for endometrial cancer (EC), national practice patterns and associated reimbursement costs were compared between public and commercial payer sources.

Methods: 2013 Medicare and 2009–2013 MarketScan databases were used to identify EC hysterectomy cases. Only cases with full carrier files (including all in- and outpatient care) were included (Medicare, *n* = 377; MarketScan, *n* = 29,558). All reimbursements including in- and outpatient-related physician, facility, testing, procedures, and emergency department visits/readmissions were captured from 30 to 60 days pre- and postoperatively. Surgeries included abdominal (ABD), laparoscopic (LSC), robotic (ROB), and vaginal (VAG). Descriptive comparisons were performed. A decision analysis model was developed to inform the modifiable components that influence overall cost for EC surgery.

Results: Total reimbursement for an episode of EC surgery was approximately $10,000 less for Medicare ($18,936, standard deviation [SD] = $10,983) compared to MarketScan ($30,641, SD = $19,841). Medicare had fewer ABD cases than MarketScan. Mean costs were greatest for ABD cases for both Medicare ($25,553) and MarketScan ($35,357), followed by ROB and LSC. (See Fig. 1.) The costs of emergency deparmtent visits/readmissions were greater for Medicare than for MarketScan ($2,460 and $1,740, respectively) and highest for ABD cases ($3,898 and $2,371, respectively). By extrapolating to equivalent sample sizes for Medicare and MarketScan, overall costs were found to be significantly greater for MarletScan ($p < 0.001$). When cost centers were compared, Meducare had a larger proportion of cost attributed to outpatient expenditures than MarketScan (Fig. 1). There was a cost savings of $389/case in Medicare compared with $792/case in MarketScan, if we increased LSC/ROB surgery by 5% (from baseline 65%) and reduced emergency department visits/readmissions by 10%. This results in annual cost savings of $3,769,410 for Medicare and $4,681,512 for MarletScan, based on total EC surgical cases reimbursed per payor per year.

Conclusions: Reimbursements for the surgical management of EC in the United States vary by public versus commercial payers. Development of APMs should account for these differences when defining benchmarks, measuring outcomes, and identifying opportunities for cost savings while improving quality of care. Increasing minimally invasive surgery and reducing emergency department visits/readmissions may result in more than $4 million of cost savings per year.

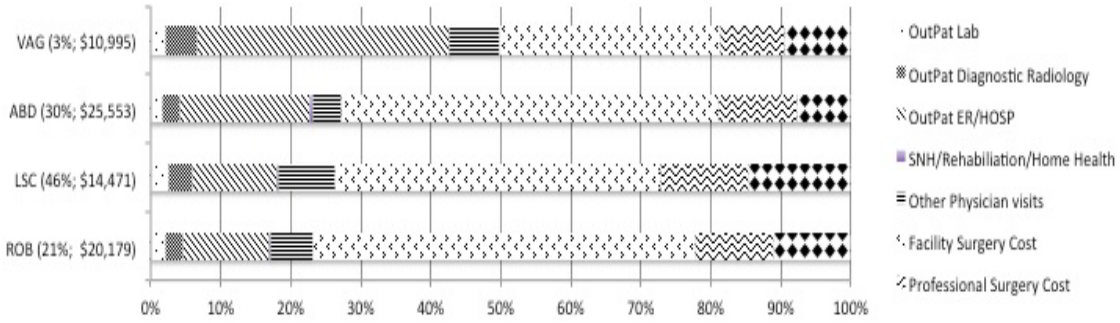

Fig. 1a. Medicare Reimbursement by Cost Center.

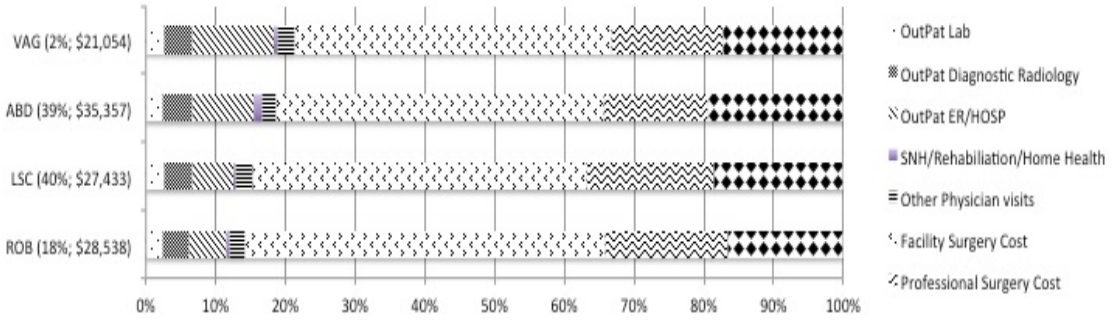

Fig1b. Marketscan Reimbursement by Cost Center.

Education Forum X: Palliative Care and End of Life Solutions
Tuesday, March 14, 2017
Moderator: Cecelia Boardman, MD, *HCA, Richmond, VA, USA*

40 - Education Forum
The effect of a multidisciplinary palliative care initiative on end-of-life care in gynecologic oncology patients
M.M. Mullen, L.M. Divine, B. Porcelli, I. Wilkinson-Ryan, M. Dans, L.S. Massad, M.A. Powell, D.G. Mutch, A.R. Hagemann and P.H. Thaker. *Washington University School of Medicine in St. Louis, St. Louis, MO, USA*

Objectives: Both hospice and palliative care (PC) are underused in cancer care. In 2014, our service promoted an initiative that required PC consultation to enroll hospitalized patients into inpatient hospice care. We sought to evaluate the effect of this initiative on hospice enrollment and end-of-life care in gynecologic oncology (GO) patients.

Methods: After Institutional Review Board approval, retrospective chart review of GO patients who died 1 year pre- and post-implementation of the PC initiative at a single National Cancer Institute cancer center (01/2013–12/2014) was performed. Patient demographics, admission and procedural history, anti-cancer therapy, and end-of-life care were collected. Data were analyzed using χ^2 and Student's t tests.

Results: A total of 308 patients were identified. Median age of death was 63 years (range, 17 to 91). Most patients were white (78.2%), were married (47.4%), and had ovarian (35.7%) or uterine cancer (35.4%). Between 2013 and 2014 (PC policy implementation), there were increased PC consultations ($p = 0.012$), increased hospice enrollment from 40% to 61% ($p = 0.292$), and fewer procedures in the last 30 days of life ($p = 0.010$). Notably, over the same time period, the rate of patients enrolled on inpatient hospice doubled from 12.5% to 25.7% ($p = 0.02$) and time from inpatient hospice enrollment to death increased from an average of 1.9 days to 6.0 days ($p = 0.02$). Similarly, the time from outpatient hospice enrollment to death increased from an average of 26.2 days to 35.4 days ($p = 0.18$). PC consultation was associated with a doubling of outpatient

and inpatient hospice enrollment: 65 of 163 patients (40%) who were not seen by the palliative service versus 116 of 145 (80%) patients who were seen by the palliative service enrolled in hospice ($p < 0.001$).

Conclusions: An integrated PC and inpatient hospice program is associated with increased PC consults, increased rates of both inpatient and outpatient hospice utilization, increased time on hospice, fewer procedures in the last 30 days of life, and improved documented goals of care discussions. Despite improvements, women are still electing hospice later than is optimal. Efforts to move toward earlier PC interventions in a patient's oncologic care could further improve utilization and optimize end-of-life patient care.