Abstract Book

Society of Surgical Oncology SSO 2021 – International Conference on Surgical Cancer Care

Virtual Meeting
March 18-19, 2021

Electronic supplement to
Annals of Surgical Oncology
An Oncology Journal for Surgeons

SSO2021
INTERNATIONAL CONFERENCE
ON **SURGICAL CANCER CARE**®

MARCH 18-19, 2021

Annals of Surgical Oncology
An Oncology Journal for Surgeons

The Official Journal of the Society of Surgical Oncology

Abstract Book

Society of Surgical Oncology
SSO 2021 – International Conference on Surgical Cancer Care
Virtual Meeting
March 18 – 19, 2021

CONTENTS

Volume 20, Supplement 1, February 2021

This supplement was not sponsored by outside commercial interests.

Session Titles and Abstract Contents

Session Title	Abstract Numbers
Abstracts Accepted for Plenary and Parallel Oral Presentations	
Virtual Forums: Breast 1 & 2	1 – 18
Virtual Forum: Colorectal	19 – 27
Virtual Forum: Endocrine, Head & Neck	28 – 36
Virtual Forums: Hepato-pancreato-biliary 1 & 2	37 – 54
Virtual Forum: Melanoma	55 – 63
Virtual Forum: Peritoneal Surface Malignancies	64 – 72
Virtual Forum: Quality Improvement/Clinical Outcomes	73 – 81
Virtual Forum: Sarcoma	82 – 90
Virtual Forum: Upper Gastrointestinal	91 – 99
Abstracts Accepted for ePoster Presentations	
Posters: Breast	P1 – P70
Posters: Colorectal	P71 – P94
Posters: Endocrine	P95 – P99
Posters: Other: Urology/Head & Neck	P100
Posters: Hepato-pancreato-biliary	P101 – P155
Posters: Melanoma	P156 – P175
Posters: Peritoneal Surface Malignancies	P176 – P200
Posters: Quality Improvement/Clinical Outcomes	P201 – P219
Posters: Sarcoma	P220 – P231
Posters: Upper Gastrointestinal	P232 – P249
Posters: Global Partner Posters Program	GPP1 – GPP17
Abstracts Accepted for Video Presentations	
Top Rated Videos	V1 – V11
Presentations Withdrawn/Global Partner Posters Not Published	
8, P145, GPP18-GPP23	

ABSTRACTS

Accepted for
VIRTUAL FORUM SESSIONS

SSO 2021 – International Conference on Surgical Cancer Care
March 18-19, 2021
Virtual Meeting

Ann Surg Oncol (2021) 28:S1–S162
https://doi.org/10.1245/s10434-021-09682-9

1

Time to Progression in Elderly Breast Cancer Patients Deemed Non-Surgical Candidates Receiving Primary Endocrine Therapy

C. Morin,[1] A. White,[1]* K. Rojas,[2] M. Javid,[1] C. Zelkowitz,[1] T. Fortes,[3] M. Silver,[1] C. Andaz,[1] D. Manasseh,[1] P. Borgen.[1] *1. Maimonides Medical Center, Brooklyn, NY; 2. Sylvester Comprehensive Cancer Center, Miami, FL; 3. Sparrow Hospital, Lansing, MI.*

Introduction Surgical oncologists must often weigh the risks and benefits of breast surgery in elderly or comorbid patients. An emerging non-surgical option is to initiate primary endocrine therapy without a plan for surgery unless necessary. However, median time to progression in newly-diagnosed patients who opt for primary endocrine therapy has not been described, and the proportion of patients who will eventually need salvage surgery is unknown. Methods A retrospective review of newly-diagnosed patients receiving primary endocrine ablative therapy at a single institution in Brooklyn, New York was performed. Time to progression and the rate of salvage surgery was determined. Progression was defined as a change in imaging or physical exam that led to a change in therapy. Tumor size was measured over time with mammogram, sonogram, MRI or physical exam. Reasons for a change in therapy were documented as progression of disease or intolerable side effects. Results Between January 2006 and October 2020, 95 women with estrogen receptor (ER) positive breast cancer received primary endocrine therapy due to comorbidities, advanced age, preference and/or tumor size (Table 1). The median Charlson Comorbidity Index was 5, translating to an estimated 10-year survival of 21%. Most of the patients had early stage node-negative disease and almost all received an aromatase inhibitor. The median time to progression was 20.4 months (13.5 – 28.5) with a median follow-up of 30.5 months (longest 177.2 months). Of the 24 patients (25.3%) who had a progression while on therapy, 14 patients (14.7%) underwent salvage surgery. Conclusion A good surgeon is technically adept, but a great surgeon knows when not to operate. To make this decision, surgeons must be able to balance the morbidity from breast surgery and average time to progression on therapy. This study revealed that median time to progression on primary endocrine therapy was almost two years and the low rescue surgery rate showed that the majority of the patients (85.3%) were able to avoid surgery. Further investigation by a randomized trial could provide more clarity about the risks and benefits of this approach.

Table 1. Demographics and Treatment Results of Women on Primary Endocrine Therapy

n=95	Median (IQR) or N (%)
Age	82 (74 – 86)
Female	95 (100%)
Charlson Comorbidity Index	5 (4 – 6)
Presenting Tumor Size (cm)	2.2 (1.3 – 3.2)
Presenting T Stage	
Tis	7 (7.4%)
T1	37 (39.4%)
T2	33 (35.1%)
T3	6 (6.4%)
T4	11 (11.7%)
Reason(s) for Therapy	
Comorbidities	71 (89.9%)
Advanced Age	73 (93.6)
Inoperable Tumor	19 (27.1%)
Therapy Choice	
Aromatase Inhibitor	88 (92.6%)
SERM[1]	5 (5.3%)
Combination Including CDK 4/6 Inhibitor	1 (1.1%)
Patients Changing Therapy Due to Side Effects	25 (26.3%)
Patients Who Progressed During Study Period	24 (25.3%)
Time to Progression	20.4 months (13.5 - 28.5)
Patients Requiring Salvage Surgery	14 (14.7%)

[1]Selective estrogen receptor modulator

2

Sentinel Node Biopsy Should Not be Routine in Older Patients with ER Positive Breast Cancer

E. McKevitt,[1]* R. Cheifetz,[1] K. DeVries,[2] R. Warburton,[1] C. Lohrisch,[1] L. Gondara,[2] A. Laws,[3] A. Nichol.[1] *1. University of British Columbia, Vancouver, BC, Canada; 2. BC Cancer, Vancouver, BC, Canada; 3. University of Calgary, Calgary, BC, Canada.*

Introduction: The SSO Choosing Wisely campaign recommended against the routine use of sentinel lymph node biopsy (SLNB) in clinically node negative patients aged ≥70 with estrogen receptor positive (ER+) breast cancer. We have previously shown that, at our institution, SLNB positivity influences adjuvant therapy decisions in this population. We sought to validate the association of SLNB positivity and adjuvant treatment in a larger population-based cohort, and to evaluate the impact of this finding on oncologic outcomes. Methods: Female patients aged ≥70 having surgery for a first ER+ breast cancer 2010-2016 were identified from our provincial Breast Cancer Outcome Unit prospective database. Multivariable logistic regression analysis was used to assess the effect of SLNB positivity on adjuvant treatment. Overall survival (OS) and breast cancer specific survival (BCSS) were assessed using Kaplan-Meier analysis and Cox regression was used to assess contributions of SLNB positivity and adjuvant treatment on survival. Results: We identified 2662 patients with a median age of 75 and a median tumor size of 15 mm. SLNB was positive in 23%. Use of chemotherapy (CT), hormone therapy (HT) and radiotherapy (RT) were associated with SLNB positivity (Table 1). The 5-year OS was 86% and BCSS was 96% with a median follow-up of 4.3 years. There was improved BCSS with receipt of HT (HR 0.5 95% CI 0.3-0.9, p=0.01) and worse BCSS with grade 3 vs grade 1 disease (HR 4.1, 95% CI 2.1-8.1, p<0.0001). Age, tumor size, status of SLNB and use of RT were not significant. Patients with a positive SLNB who did not receive any adjuvant therapy had lower BCSS (HR 3.2 95% CI 1.2-8.4, p=0.017) than those with a negative SLNB. However, amongst those who received any combination of CT, HT and RT, there was no significant difference in BCSS regardless of nodal status. Conclusions: BCSS survival in this population was excellent at 96%. Although the use of adjuvant treatment was associated with a positive SLNB, BCSS was not changed based on nodal status when patients received HT. Our results support the Choosing Wisely recommendations; SLNB can be safely omitted in elderly patients willing to take HT.

Table 1: Associations of Nodal Status with Adjuvant Treatments

Adjuvant Treatment	Surgical Procedure	Nodal Status	OR of Receiving Adjuvant Treatment	95% LCI	95% UCI	P-value
Hormone Therapy	All	Positive	2.3	1.8	3.0	<0.0001
N=2064 (78%)	All	Negative	REF			
Chemotherapy	All	Positive	6.4	4.1	10.0	<0.0001
N=145 (5%)	All	Negative	REF			
Any Radiotherapy	Mastectomy	Positive	12.9	9.8	17.0	<0.0001
N=1635 (62%)	Mastectomy	Negative	REF			
	BCS	Positive	1.9	1.4	2.6	0.0002
	BCS	Negative	REF			
Locoregional Radiotherapy*	Mastectomy	Positive	28.4	6.8	118.4	<0.0001
N=422 (16%)	Mastectomy	Negative	REF			
	BCS	Positive	132.9	67.0	263.5	<0.0001
	BCS	Negative	REF			

BCS=Breast Conserving Surgery
* compared to breast/chest radiotherapy only

3

Cost of Low-Value Sentinel Lymph Node Biopsy in Older Women with Breast Cancer: Results of a Statewide Collaborative

T. Wang,* B. Bredbeck, N. Berlin, A. Baskin, B. Sinco, T. Hughes, L. Dossett. *University of Michigan, Ann Arbor, MI.*

Introduction: Most women ≥70 years old diagnosed with breast cancer have early stage, hormone receptor positive tumors with an excellent prognosis. In these patients, the Society of Surgical Oncology (SSO) recommends against the use of sentinel lymph node biopsy (SLNB), and the National Comprehensive Cancer Network (NCCN) allows for radiotherapy (RT) omission. Despite this, national data demonstrate that more than 80% and 60% of women eligible for omission continue to receive SLNB and RT, respectively. Qualitative data suggest that providers associate SLNB with minimal patient harms. Our objectives were to evaluate 1) the relationship between the utilization

of unnecessary SLNB and RT and 2) costs of low-value SLNB. Methods: Using the Michigan Value Collaborative (MVC) registry, we evaluated women ≥70 years old who received surgery for breast cancer in 2012-2019. MVC includes 87 Michigan hospitals and provides risk-adjusted, price-standardized claims data. Primary outcomes included SLNB utilization and association of SLNB receipt with RT. Random intercept linear regression models were used to evaluate 30- and 90-day episode payments for patients receiving or omitting SLNB. Results: During the study period, 11,536 women ≥70 years old received surgical treatment for breast cancer at MVC sites, with 73% of patients undergoing lumpectomy and 27% undergoing mastectomy. SLNB was performed in the majority of women (65%). Women who received SLNB were significantly more likely to receive RT (48%) compared to those who omitted SLNB (29%; p<0.01). Overall, SLNB receipt was associated with significantly increased 30-day ($12,751 vs $9,879) and 90-day ($19,983 vs $15,366) episode payments (p<0.01), independent of RT receipt or type of surgery. Conclusion: Current national guidelines recommend against routine SLNB in older women with low-risk breast cancer. Low-value SLNB utilization has significant implications including higher rates of RT receipt and increased costs (>$4,500), which is likely due to nuclear medicine, anesthesia, and professional fees. Thus, targeted efforts to eliminate overtreatment could result in reduced harms and substantial savings.

4

Effects of Adjuvant Therapy on Recurrence and Survival Among Older Women with Early Stage Breast Cancer M. Meneveau,* J. Keim-Malpass, T. Camacho, R. Anderson, S.L. Showalter. *Surgery, University of Virginia, Charlottesville, VA.*

Background: The Cancer and Leukemia Group B-9343 (C9343) trial demonstrated that women age ≥70 years with ER^+, <2cm breast cancer (BC) can safely omit radiation therapy (RT) and be treated with breast conserving surgery (BCS) and adjuvant endocrine therapy (AET) alone. AET adherence is poor in older women, leaving an under-treated cohort who may be at increased risk of recurrence and death. We hypothesized that the choice of adjuvant treatment (RT+AET, RT alone, AET alone) and AET adherence impact disease recurrence and survival in C9343 eligible women. Methods: The SEER-Medicare database was used to identify C9343 eligible women who underwent BCS between 2007-2016. Tumor characteristics, demographics, and treatment variables were collected. Medicare Part D claims files were used to identify AET use. The proportion of days covered (PDC) by AET was used to categorize adherence (PDC≥0.8 adherent, PDC<0.8 nonadherent). The primary outcome of interest was recurrence. Adjusted recurrence-free and overall survival (OS) were assessed using Cox Proportional Hazards Models. Results: The cohort included 10,719 women of whom 7.3% were treated with only BCS, 13.9% had RT alone, 15.5% initiated AET alone, and 33% had RT+AET. As depicted in Table 1, the RT+AET group had the lowest recurrence rate (3.4%, HR=0.35, 95%CI: 0.25-0.49) followed by patients with AET only (4.3%, HR=0.43, 95%CI: 0.29-0.65) and those with RT alone (6.6%, HR= 0.69, 95%CI: 0.49-0.97). There was no difference in recurrence between RT+AET and AET only (HR=0.81, 95%CI: 0.54-1.21). In the AET only group, adherent patients had lower recurrence compared to nonadherent patients (HR 0.65, 95%CI: 0.50-0.85). Conclusions: Treatment decisions and AET adherence impact disease recurrence and survival. While RT+AET may represent over-treatment for some patients, women that do not adhere to AET are at risk for worse outcomes. Treatment decisions regarding RT omission should be tailored to the individual patient, taking into consideration the chances of AET non-adherence and the patients' own tolerance for risk.

Hazards of Recurrence and Death by Treatment

Treatment Category	Recurrence			Overall Survival		
	Hazard Ratio [1] (95% CI)	p	5-Year Recurrence [2]	Hazard Ratio [1] (95% CI)	p	5-Year Overall Survival [2]
A. RT + AET	0.35 (0.25,0.49)	<0.0001	3.4%	0.60 (0.51,0.70)	<0.0001	90.3%
B. RT Only	0.69 (0.49,0.97)	0.0348	6.6%	0.78 (0.65,0.93)	0.0057	87.6%
C. AET Only	0.43 (0.29,0.65)	<0.0001	4.3%	0.91 (0.77,1.09)	0.2968	85.8%
D. None	Reference		9.5%	Reference		84.6%
	Hazard Ratio [3] (95% adj. CI)	p adj. [3]		Hazard Ratio [3] (95% adj. CI)	p adj. [3]	
A vs C	0.81 (0.54,1.21)	0.6179		0.65 (0.55,0.77)	<0.0001	
B vs C	1.58 (1.02,2.46)	0.0396		0.86 (0.70,1.04)	0.1580	
A vs B	0.51 (0.37,0.70)	<0.0001		0.76 (0.65,0.90)	0.0003	
	Hazard Ratio [4] (95% CI)			Hazard Ratio [4] (95% CI)		
AET Only PDC ≥ 0.80	0.65 (0.50,0.85)	0.0017	3.1%	0.96(0.84,1.09)	0.4935	90.1%
AET Only PDC < 0.80	Reference		4.7%	Reference		89.6%

1. Adjusted for all covariates; single imputation estimates.
2. 5-yr recurrence and overall-survival calculated from direct adjusted survival curves which average over the sample covariate distribution.
3. Adjusted p-values and confidence intervals test the hypotheses that HR ratio = 1, where p-values are adjusted for multiple comparison false positive rates using the Bonferroni correction.
4. Adjusted for all covariates + radiation therapy.
adj = Adjusted; p = P-value

5

DCIS Biologic Risk Signature Predicts Risk of Recurrence and RT Benefit After BCS B. Mann,[1]* D. O'Malley,[1] a. park,[2] K. Shackleton,[3] J.P. Collins,[2] A.K. Rose,[2] P. Whitworth,[4] T. Bremer.[5] *1. Breast Service, Royal Womens Hospital, Kew, VIC, Australia; 2. The Royal Melbourne Hospital, Parkville, VIC, Australia; 3. Peter MacCallum Cancer Centre, Parkville, VIC, Australia; 4. Ascension Saint Thomas Hospital, Nashville, TN; 5. Prelude Corporation, Laguna Hills, CA.*

INTRODUCTION: Radiation therapy (RT) after breast conserving surgery (BCS) for DCIS reduces the risk of ipsilateral breast events (IBE) without altering survival. Its use varies widely due to differing assessments of the risk/benefit ratio of this treatment. Precise assessment of post-BCS RT benefit would allow individualized treatment decisions. We performed validation of a biologic risk signature, DCISionRT® (PreludeDx, Laguna Hills, CA), to assess IBE risk after BCS and the benefit of RT. METHODS: Women with DCIS meeting eligibility criteria were identified from a retrospective Australian cohort. Medical records were reviewed to collect treatment and outcomes, and FFPE tissue was provided to the PreludeDx CLIA lab for blinded testing of a panel of biomarkers (HER2, PR, Ki-67, COX2, p16, FOXA1 and SIAH2) scored by board-certified pathologists. The prognostic effect of DS for IBE risk was assessed by multivariate Cox proportional hazards (CPH) analyses, adjusting for adjuvant treatments. The predictive effect of DS for RT IBE benefit was assessed by multivariate CPH analysis, including the RT:DS interaction. RESULTS: 183 women had Decision Scores (DS) and outcomes available with a median follow-up of 73 months. 72 of these women received RT (39%) and 66 received endocrine therapy (ET, 36%). The total cohort had 5-year IBE risks of 10%, while women treated with RT had 4% risks and those treated without RT had 14% risks. After BCS and no ET, women with higher DS results had greater IBE risk (DS per 5 units HR=2.4), after adjusting for RT. Elevated categorical DS (DS>3) predicted increased IBE risk in all women (HR=2.8), adjusting for ET, RT. In women treated without ET, elevated continuous DS had greater IBE risk (HR=3.6) and greater relative RT benefit (RT:DS HR = 0.1), compared to lower DS. CONCLUSIONS: Women with elevated DS had a significantly higher risk of IBE. Most importantly, women with higher DS had a greater relative benefit from RT compared to women with lower DS. This validation supports previous findings that DCISionRT provides prognostic and predictive information to allow personalized treatment decisions.

Multivariate Cox Proportional Hazards Analysis of DCISionRT for IBE Risk and RT Benefit.

	Hazard Ratio (HR)	95% Confidence Interval	p-value
Prognostic for IBE Risk (multivariate analysis)			
No ET (adjusted for RT, n=117)			
Continuous DS (per 5 units) 1	2.4	1.2 - 4.8	0.0098
All patients (adjusted for RT and ET, n=183)			
Categorical DS ≤3 vs >3 2	2.8	1.2 - 6.1	0.012
Predictive of RT Benefit (multivariate analysis)			
No ET (n=117, DS:RT interaction)			
Continuous DS (per 5 units)	3.6	1.7 - 7.5	0.0007
RT (alone)	1.4	0.3 - 6.7	0.67
RT:DS (per 5 units) 3	0.1	0.01 - 0.95	0.045

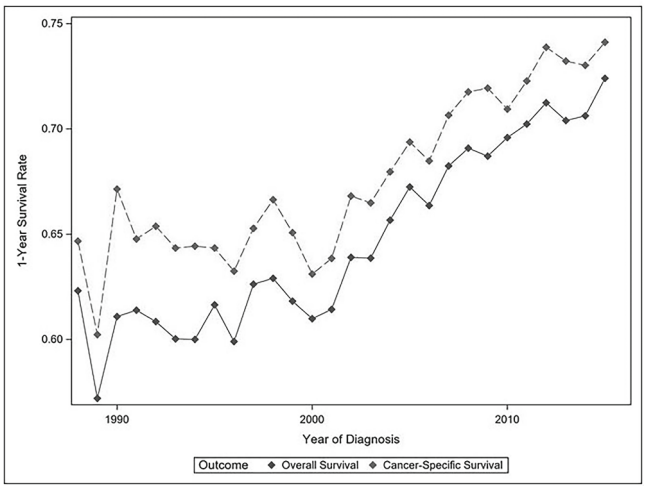
1) Multivariate analysis of DS adjusted for RT in women treated with BCS without endocrine treatment, n=117. 2) Multivariate analysis of DS adjusted for RT and ET in women treated with BCS, n=183. 3) Multivariate analysis of DS testing interaction of DS on RT in women treated with BCS without endocrine treatment.

6

Survival Outcomes Among Patients with Metastatic Breast Cancer: Review of 47,000 Patients M. Taskindoust,* S. Thomas, S. Sammons, O.M. Fayanju, R. Greenup, L.H. Rosenberger, G. DiLalla, S. Hwang, J.K. Plichta. *Surgery, Duke University Medical Center, Durham, NC.*

Introduction: Although metastatic breast cancer (MBC) remains incurable, advances in systemic therapies have significantly improved survival. Using a contemporary dataset of patients with de novo MBC, we explored how overall (OS) and cancer specific survival (CSS) have changed over time. Methods: All patients with de novo MBC 1988-2016 were selected from SEER 18. Subgroup analyses were conducted for those diagnosed 2010-2016. Unadjusted OS and CSS were estimated by the Kaplan-Meier method and stratified by age, tumor phenotype, and metastatic disease characteristics. Cox Proportional Hazards models were used to determine which factors were associated with OS and CSS. Results: 47,034 patients were included (19,444 from 2010-2016). Median OS and CSS improved over time (Figure) and were 25 and 27mo, respectively. For patients diagnosed in 1988, the 1y OS was 62% (95% CI 58-66%) and CSS was 65% (95% CI 60-69%) vs those diagnosed in 2015 (OS 72%, 95% CI 71-74%; CSS 74%, 95% CI 72-76%). When stratified by age, patients >70y were more likely to die from non-MBC causes than those <40y or 40-70y, but they also had the lowest CSS. Patients with triple negative breast cancer (TNBC) had the worst prognosis and were most likely to die from MBC vs HER2+ and HR+/HER2- patients. Those with >3 sites of metastatic disease were also more likely to die from MBC with nearly identical OS and CSS (5y OS 9%, 95% CI 4-16%, CSS 9%, 95% CI 4-17%), when compared to those with 1 site (5y OS 31%, 95% CI 30-32%, CSS 35%, 95% CI 34-37%). After adjustment, improved CSS was associated with bone-only disease (HR 0.88, 95% CI 0.83-0.94), while age >70 (vs <40: HR 1.78, 95% CI 1.60-.98), TNBC (vs HER2+: HR 3.12, 95% CI 2.89-3.36), and >3 sites of metastatic disease (vs 1 site: HR 3.24, 95% CI 2.68-3.91) were associated with a worse CSS (all p<0.001). Conclusions: Providing accurate prognostic estimates is a cornerstone of care and counseling for patients with advanced disease. As treatments for patients with MBC have expanded, OS and CSS have improved, and patients, particularly those with limited distant disease and those with HER2+ or HR+/HER2- tumors, are dying from non-MBC causes more than ever before.

Figure. 1-Year Overall and Cancer-Specific Survival Rates by Year of Diagnosis



7

Resource Conservation in Breast Cancer Surgery Care: Important Lessons Learned From the COVID-19 Crisis J. Prigoff,* J. Gipe, R. Rao, L. Wiechmann, J. Ascherman, R. Grant, C. Rohde, B. Taback. *Surgery, Columbia University Irving Medical Center, New York, NY.*

Background: As the COVID-19 pandemic peaked in New York City, resource-conserving methods to treat breast surgery patients were employed. This study aimed to elucidate whether the switch to a resource-conserving model for breast surgery led to any variance in outcomes from our baseline. Methods: This is a single institution case-control study. Patients were included in the "COVID-19 group" if they had surgery between March 17-June 9, 2020. These patients were matched to a similar cohort from one year prior. The primary outcome was the rate of hospital admission for patients undergoing mastectomy. Secondary outcomes were length of stay, surgical complication rate, use of visiting nurse services (VNS), and the number of follow up appointments. Results: Forty-seven patients were included in the COVID-19 group and 148 patients in the non-COVID-19 group. The rate of ambulatory surgery was higher for the COVID-19 group undergoing mastectomy (45.8% vs 5.7%, P<0.001). For mastectomies, the COVID-19 group also had a lower rate of surgical complications (4.2% vs 15.1%, P=0.159), reduced length of stay for non-ambulatory patients (1.15 days vs 1.48 days, P=0.082), lower usage of visiting nurse services (16.7% vs 37.7%, P=0.064) and fewer in-person appointments (3.0 vs 3.3, P=0.381). No patients were diagnosed with COVID-19. There were also significantly fewer in-person follow up appointments among the COVID-19 group undergoing lumpectomies (0.76 vs 1.38, P= 0.002) Conclusions: The COVID-19 pandemic incentivized our institution to adopt new practices like ambulatory mastectomy and telehealth visits for breast cancer patients in an effort to preserve hospital resources and limit exposure to the novel coronavirus. During this time, we reduced overnight admissions as well as a variety of other time and resource intensive outcomes while patients had similar, if not better, clinical outcomes.

Postoperative Outcomes and Length of Stay for Mastectomy

Variable	COVID -19 Group (N=24)	Non-COVID-19 Group (N=53)	P-Value
Ambulatory Surgery	11 (46%)	3 (5.7%)	<0.001
Visiting Nurse Services Used	4 (17%)	20 (37.8%)	0.064
Length of Stay for Non-Ambulatory Patients	1.15	1.48	0.082
Surgical Complications	1 (4.2%)	8 (15.1%)	0.159
Emergency Room Visit	0	3 (5.7%)	0.320
Readmission	1 (4.2%)	1 (1.9%)	0.529
Return to OR for Surgical Complication	1 (4.2%)	4 (7.5%)	0.501
Post-operative COVID Infection	0	0	-
Number of Follow up Appointments within 30 days	3.5	3.3	0.577
Number of In-person Follow up Appointments within 30 days	3.0	3.3	0.381

8

High-dimensional Analyses Elucidate Myeloid and Lymphoid Compartment Remodeling by in Situ Immunomodulation in a Mouse Model of Breast Cancer T. Oba,[1]* M.D. Long,[1] T. Keler,[2] H. Marsh,[2] S.I. Abrams,[1] S. Liu,[1] F. Ito.[1] *1. Roswell Park Cancer Institute, Buffalo, NY; 2. Celldex Therapeutics Inc., Hampton, NJ.*

Introduction: T-cell exclusion from the tumor microenvironment (TME) correlates with poor clinical outcomes in breast cancer, and remains a major obstacle in cancer immunotherapy. Evidence indicates crucial roles of conventional type 1 dendritic cells (cDC1s) for inducing antitumor T-cell immunity; however, strategies to engage cDC1s into 'immune cold tumors' remain elusive. To this end, we developed a novel therapeutic regimen: in situ immunomodulation (ISIM) comprised of intratumoral Flt3L injection to recruit cDC1s and radiotherapy (RT) to promote immunogenic death of cancer cells, and dual TLR3/CD40 stimulation to activate antigen-loaded cDC1s. Methods: We performed single-cell RNA sequencing (scRNAseq) to assess functional changes of immune cells in ISIM-treated AT-3 tumors, a mouse model of triple negative breast cancer insensitive to anti-PD-L1 therapy. Results: ISIM mediated robust regression of primary tumors, as well as non-irradiated distant tumors, and rendered non-T cell-inflamed tumors responsive to anti-PD-L1 therapy. Furthermore, serial ISIM overcame acquired resistance to anti-PD-L1 therapy, resulting in eradication of tumors; and developed tumor-specific systemic immunological memory. scRNAseq analysis revealed a massive influx of Slamf6-expressing cell clusters in ISIM-treated tumors. These clusters also expressed Tcf7, Lef1, stem cell/memory markers, and intermediate levels of Pdcd1, but were negative for Havcr2, suggesting stem-like progenitor exhausted T cells. We also found a concomitant decrease of clusters expressing Arg1, Mrc1 and Ccl8, consistent with M2-like tumor associated macrophages in ISIM-treated tumors. Furthermore, scRNAseq of tumors treated with ISIM±CD4 depletion identified significantly differentially expressed genes as well as long non-coding RNAs in CD8 T cells. In line with these findings, depletion of CD4 T cells decreased antitumor efficacy of ISIM. Conclusion: In situ induction and activation of tumor-residing cDC1s can overcome primary and acquired resistance to anti-PD-L1 therapy. scRNAseq analysis revealed significant remodeling of myeloid and lymphoid compartment by ISIM.

9

Longitudinal Study of Psychosocial Outcomes After Surgery in Women with Unilateral, Sporadic Breast Cancer D.W. Lim,[1]* H. Retrouvey,[2] I. Kerrebijn,[4] K. Butler,[3] A.C. O'Neill,[3] T.D. Cil,[5] T. Zhong,[3] S.O. Hofer,[3] D.R. McCready,[5] K.A. Metcalfe.[6] *1. Women's College Research Institute, Women's College Hospital, Toronto, ON, Canada; 2. University of Toronto Division of Plastic Surgery, Toronto, ON, Canada; 3. University Health Network & Mount Sinai Hospital Division of Plastic Surgery, Toronto, ON, Canada; 4. University of Toronto Department of Pharmacology and Toxicology, Toronto, ON, Canada; 5. University Health Network (Princess Margaret Cancer Centre) Division of General Surgery, Toronto, ON, Canada; 6. University of Toronto Lawrence S. Bloomberg Faculty of Nursing, Toronto, ON, Canada.*

Background: Rates of bilateral mastectomy continue to rise in women with unilateral, non-hereditary DCIS and breast cancer. We aim to better understand how psychosocial outcomes evolve over time after breast cancer surgery. Methods: We performed a prospective cohort study of women with unilateral, sporadic stage 0-III breast cancer at an urban academic breast centre between 2014 and 2017. Women completed standardized psychosocial questionnaires prior to and at 6 and 12 months after breast cancer surgery. Outcomes were evaluated between three surgical groups: unilateral lumpectomy, unilateral mastectomy and bilateral mastectomy. We used linear mixed models to evaluate the change in psychosocial scores between groups over time, controlling for age, clinical stage, receptor status, and receipt of reconstruction and adjuvant treatment. P values < .05 were considered significant. Results: 506 eligible women underwent unilateral lumpectomy (UL, 42.7%), unilateral mastectomy (UM, 35.8%) or bilateral mastectomy (BM, 21.5%). Breast satisfaction remained stable in the UL group and decreased in the UM and BM groups from baseline to 6 months (P < .001). Psychological well-being improved in the UL group and decreased in the UM and BM groups from baseline to 6 months (P < .001). Over time, women in the BM group had lower chest physical and sexual well-being scores than women in the UL but not the UM groups (P < .001). Distress (P < .001) and depression (P < .001) scores declined over time in all groups, with no difference between groups. Several covariates were significant in the model. Younger age was associated with worse psychological and chest physical well-being, and high distress scores (P < .01 for all). Women who had immediate breast reconstruction had higher sexual well-being scores over time (P < .001). Conclusions: Psychosocial outcomes after breast surgery vary between women according to the specific surgical procedure performed. In particular, we did not observe a benefit in any outcome measure with bilateral mastectomy over unilateral breast surgery. These findings may prove informative for women contemplating contralateral prophylactic mastectomy.

10

Surgical Management of the Axilla in the Z1071 Era: Propensity-Score Matched Analysis of the NCDB S.A. Naffouje,* A. Sabesan, S. Hoover, C. Laronga. *Surgical Oncology, Moffitt Cancer Center, Tampa, FL.*

Introduction: ACoSOG Z1071 trial introduced the potential for sentinel lymph node biopsy/targeted axillary dissection (SLNB/TAD) as definitive management of the node-positive axilla following neoadjuvant chemotherapy compared to complete axillary dissection (CAD). We investigated the survival outcomes of Her2+ breast cancer [subtype with the highest predicted pathological complete response (pCR)]. Methods: National Cancer Database (NCDB) for breast cancer were analyzed for pts with HER2+ clinically node-positive breast cancer treated with neoadjuvant chemotherapy followed by definitive surgery. We included pts whose intent of surgical management of the axilla was reported as either SLNB/TAD or CAD. Pts were matched between SLNB/TAD and CAD groups based on a multivariate logistic regression for the likelihood of receiving either procedure. Kaplan-Meier method was used to study survival in the matched groups. Results: 6,479 pts met the inclusion criteria. The mean age was 52.63±11.63 years. Half were cT2 (3,145, 48.5%) and 4,127 (63.7%) were hormone receptor (HR) negative. Breast-conserving surgery was completed in 2,220 (34.3%). 2,368 (36.5%) had pCR to neoadjuvant treatment. SLNB/TAD was the preferred axillary management in 1,776 (27.4%) whereas 4,703 (72.6%) had CAD. The mean number of retrieved nodes in the SLNB/TAD group was 3.65±3.99 (median, 3) vs. 11.28±8.21 (median, 11) in the CAD group. We matched 1,418 SLNB/TAD to 2,836 CAD pts (1:2) per the propensity score with an adequate balance between the groups. Kaplan-Meier analysis showed no difference in overall survival between SLNB/TAD and CAD (66.20±0.58 vs. 66.72±0.35 months; p=0.384). Cox logistic regression identified age, Charlson comorbidity index ≥2, lower inner quadrant tumors, cT stage, HR+, response to neoadjuvant therapy, and pathologic nodal status as significant predictors of survival, whereas the choice of surgical axillary management was not. Conclusion: SLNB/TAD provides comparable survival outcomes to CAD in HER2+ clinically node-positive breast cancer pts after neoadjuvant chemotherapy.

11

Triple Technique for Identifying Sentinel Lymph Nodes Following Breast Cancer Neoadjuvant Chemotherapy: Is More Really Better? S. Fuzesi,* J. Paily, R. Ha, L. Sun, L. Wiechmann, R. Rao, B. Taback. *Surgery, Columbia University, New York, NY.*

Background Identification of the histopathologically positive previously biopsied lymph node (PBLN) following neoadjuvant chemotherapy (NAC) is critical for monitoring response and guiding subsequent therapeutic decisions. However, conventional sentinel lymph node biopsy (SLNB) techniques has shown limited success in this situation. Recommendations for improvement suggest using dual tracer techniques, removing more lymph nodes and the addition of implanted markers such as SAVI SCOUT which has shown success and feasibility to identify the PBLN. Our study determines the accuracy of the three techniques: blue dye (lymphazurin), radioisotope, and implanted fiducial marker (SAVI SCOUT). Methods Patients with PBLN marked with a SAVI SCOUT and/or clip and who received NAC were identified from 2016 to 2019. The accuracy of the three localizing techniques was evaluated. Secondary outcomes included total number of lymph nodes retrieved and each retrieval event for PBLN per technique. Results We identified 65 patients who underwent lymph node biopsy prior to NAC. The clip marking the PBLN was identified in 64 patients (98%). The PBLN was identified by the SAVI SCOUT in 61/64 (95%) patients, radioisotope 44/62 (71%) patients and blue dye in 28/44 (64%) patients. A SAVI SCOUT was placed at the time of biopsy instead of a clip in 13 patients and identification of the PBLN was 100% for those patients. The mean number (range) of lymph nodes removed with the SAVI SCOUT was

2.7 (1-10), with radioisotope was 4.3 (0-11) and with blue dye was 3.6 (0-11) (p=0.004). The mean number of events with the SAVI SCOUT was 1, with radioisotope was 2.0 and with blue dye was 1.8 (p<0.005). When radioisotope was used, the clip was found in the hottest node 40% of the time, in the 2nd and 3rd hottest node 5% and 12% of the time. The clipped node was not hot in 43%. Conclusions This study demonstrates that the most accurate method of identifying the PBLN is with placement of a fiducial marker. Furthermore, the addition of radioisotope and blue dye may result in an excessive number of lymph nodes removed and more retrieval events during SLNB following NAC.

Patient Characteristics and Sentinel Lymph Node Biopsy Details for N= 65 Patients with Previously Biopsied Lymph Nodes

Characteristic	No. (%)	P
Clinical T Stage TX/T1 T2 T3 T4	 6 (9%) 48 (74%) 9 (14%) 2 (3%)	
Clinical N Stage N0 N1 N2 N3	 9 (14%) 48 (74%) 7 (11%) 1 (2%)	
Receptor Status HR+/HER2- HR+/HER2+ HR-/HER2+ TNBC	 31 (48%) 11 (17%) 7 (11%) 16 (25%)	
Localization Techniques Implanted marker Radioisotope Blue dye	 65 (100%) 63 (97%) 45 (69%)	
Clip identification Implanted marker Radioisotope Blue dye	 64/65 (98%) 61/64 (95%) 44/62 (71%) 28/44 (64%)	
Mean nodes removed (Range) Implanted marker Radioisotope Blue dye	 5.2 (1-11) 2.7 (1-10) 4.3 (0-11) 3.6 (0-11)	 P= 0.004
Mean retrieval events (Range) Implanted marker Radioisotope Blue dye	 2.4 (1-6) 1 2.0 (0-6) 1.8 (0-5)	 P= 0.000001

HR= Hormone Receptor; HER2= Human Epidermal Growth Factor Receptor 2; TNBC= Triple Negative Breast Cancer

12

Factors Associated with Residual Nodal Disease Among Breast Cancer Patients Treated with Neoadjuvant Chemotherapy: Results of CALGB 40601 (HER2+) and 40603 (triple-negative) (Alliance)

A. Weiss,[1]* J. Campbell,[2] K. Ballman,[3] W. Sikov,[4] L. Carey,[5] S. Hwang,[6] M. Poppe,[7] A. Partridge,[8] D.W. Ollila,[5] M. Golshan.[9]
1. Surgery, Brigham and Women's Hospital, Boston, MA; 2. Mayo Clinic, Rochester, MN; 3. Weill Cornell Medicine, New York City, NY; 4. Women's and Infants Hospital, Providence, RI; 5. UNC Lineberger, Chapel Hill, NC; 6. Duke University, Durham, NC; 7. Huntsman Cancer Institute, Salt Lake City, UT; 8. Dana-Farber Cancer Institute, Boston, MA; 9. Yale School of Medicine, New Haven, CT.

Introduction: De-escalation of axillary surgery demands careful patient selection. The CALGB 40601 and 40603 trials reported outcomes and pathologic complete response (pCR) rates after neoadjuvant chemotherapy (NAC) in HER2+ and triple-negative (TN) breast cancer (BC) patients. We sought to determine factors associated with pathologic node-negative status (ypN0). Methods: 760 patients with stage II-III HER2+ or TN BC on the 40601/40603 trials were analyzed. Those with pre-NAC sentinel or axillary lymph node dissection (n=122), missing cN (n=58) or ypN status (n=41) were excluded. Immunohistochemical stains were used per institutional standards; ypN0(i+) was considered ypN0. Chi-square and Kruskal Wallis tests were used to compare groups. Incidence of residual disease (RD) in the nodes (ypN+) was estimated for patients with/without breast pCR by subtype (HR+/HER2+, HR-/HER2+, TN) and pre-NAC clinical nodal status (cN0, cN1, cN2-3). Multivariable analysis determined factors associated with nodal pCR. Results: Of 539 patients, 45% (241) presented with cN0 disease, 44% (237) cN1, 11% (61) cN2-3. Among pre-NAC cN0 patients, 89% (214/241) were ypN0, including 96% of breast pCR and 82% of breast RD patients. Only 4% (4/108) of cN0 patients who experienced a breast pCR were ypN+. Among pre-NAC cN1, 66% (157/237) were ypN0, including 92% of breast pCR and 40% of breast RD patients. (Table) ypN0 patients more often had stage II disease (71% vs 48% ypN+, P<.0001), smaller tumors (mean clinical tumor size, 4.5 cm [standard deviation 2.4] vs 5.7 cm [3.2], P=.0027), cN0 disease (52% vs 21%, P<.0001), breast-conserving surgery (51% vs 40%, P=.0184), and breast pCR (61% vs 16%, P<.0001), than ypN+ patients. The only factor associated with ypN0 status was breast pCR (odds ratio .08, CI .04-.15, P<.0001). Conclusions: Patients who are cN0 with aggressive phenotypes who receive full NAC may be ideal candidates for axillary surgery de-escalation with a breast pCR. More research is needed to define the optimal patient for axillary surgery de-escalation after NAC including long-term clinical outcomes.

Rates of ypN0 and ypN+ disease among patients with breast pCR and breast RD, stratified by tumor subtype

Breast pCR			
	Number of patients	ypN0	ypN+
cN0	108	104 (96%)	4 (4%)
HR+ / HER2+	21	21 (100%)	0 (0%)
HR- / HER2+	15	14 (93%)	1 (7%)
TNBC	72	69 (96%)	3 (4%)
cN1	121	111 (92%)	10 (8%)
HR+ / HER2+	24	23 (96%)	1 (4%)
HR- / HER2+	31	27 (87%)	4 (13%)
TNBC	66	61 (92%)	5 (8%)
cN2/cN3	34	30 (88%)	4 (12%)
HR+ / HER2+	5	5 (100%)	0 (0%)
HR- / HER2+	7	6 (86%)	1 (14%)
TNBC	22	19 (86%)	3 (14%)
Breast RD			
	Number of patients	ypN0	ypN+
cN0	133	110 (82%)	23 (18%)
HR+ / HER2+	38	29 (76%)	9 (24%)
HR- / HER2+	11	9 (82%)	2 (18%)
TNBC	84	72 (86%)	12 (14%)
cN1	116	46 (40%)	70 (60%)
HR+ / HER2+	31	12 (39%)	19 (61%)
HR- / HER2+	25	13 (52%)	12 (48%)
TNBC	60	21 (35%)	39 (65%)
cN2-3	27	10 (37%)	17 (63%)
HR+ / HER2+	9	2 (22%)	7 (78%)
HR- / HER2+	4	2 (50%)	2 (50%)
TNBC	14	6 (43%)	8 (57%)

13

Margin Width Does Not Impact Local Recurrence After Neoadjuvant Chemotherapy and Breast Conservation Therapy

M.M. Mrdutt,* A. Heerdt, V. Sevilimedu, A. Mamtani, A. Barrio, M. Morrow. *Surgery, Memorial Sloan Kettering Cancer Center, New York, NY.*

Introduction: A margin of "no tumor on ink" is well established in primary breast conservation therapy (BCT), but what constitutes an adequate margin for BCT following neoadjuvant chemotherapy (NAC) remains controversial. We sought to determine the impact of margin width on ipsilateral breast tumor recurrence (IBTR) in the NAC-BCT population. Methods: Consecutive patients managed with NAC and BCT between November 2013 and July 2020 were identified from a prospectively maintained database. The association between clinical characteristics, margin width and IBTR was evaluated using the Wilcoxon rank-sum test, Fisher's exact test, and Chi-square test. Results: 594 cancers in 590 patients were managed with NAC and BCT. All patients received RT, 92% received AC-T based chemotherapy. Median age was 54 (IQR 45, 62), 84% of patients had cT1/T2 tumors and 65% were N+. 31% of patients were hormone receptor (HR)+HER2-, 37% HER2+, and 32% HR-HER2-. Pathologic complete response (pCR) rates were 31% breast (ypT0), 66% nodal and 29% both. Margin width was > 2mm in 523 cancers (88%) and ≤ 2mm in 71 (12%). At a median follow-up of 36 months, there were 23 IBTRs, a 4-year Kaplan Meier (KM) estimated IBTR rate of 4% (95% CI: 3%-6%). The crude median time to IBTR was 16 months, with almost 75% occurring before 24 months. 4-year KM estimated IBTR did not differ significantly based on margin width (7% ≤ 2mm, 4% > 2mm; p =0.3). On univariate analysis, lack of pCR, lymphovascular invasion (LVI), receptor subtype, clinical T and N stage, and pathologic T stage but not margin width were associated with IBTR ($p < 0.05$). On multivariable analysis LVI (OR 4.7), triple negative subtype (HR-HER- ref, HER2+ OR 0.2, HR+HER2- OR 0.4), and higher clinical T stage (T1 ref, T3 OR 3.5, T4 OR 12.2) were predictive of IBTR (all $p < 0.05$, Table). Conclusion: Pathologic features and tumor biology associated with IBTR in the primary surgery setting were also associated with

IBTR after NAC in this study. Rates of IBTR were not reduced with wider margins suggesting that even in the neoadjuvant setting, a margin exceeding "no tumor on ink" is not routinely indicated.

Patient and Tumor Characteristics

Characteristics		Overall (n = 594)	No IBTR (n = 571)	IBTR (n = 23)	Univariate p-value
Age at diagnosis, years (median, IQR)		54 (45, 62)	54 (46, 62)	48 (40, 55)	0.06
Clinical T Stage*	1	114 (19%)	111 (19%)	3 (13%)	<0.001
	2	387 (65%)	378 (66%)	9 (39%)	
	3	76 (13%)	68 (12%)	8 (35%)	
	4	17 (3%)	14 (3%)	3 (13%)	
Clinical N Stage	0	230 (39%)	222 (39%)	8 (35%)	0.9
	1	325 (55%)	311 (54%)	14 (61%)	
	2/3	39 (6%)	38 (7%)	1 (4%)	
Receptor Subtype*	HR+HER2-	183 (31%)	177 (31%)	6 (26%)	0.005
	HR+/-HER2+	223 (37%)	220 (39%)	3 (13%)	
	HR-HER2-	188 (32%)	174 (30%)	14 (61%)	
Tumor Differentiation	Well	4 (1%)	4 (1%)	0 (0.0%)	0.7
	Moderate	112 (19%)	109 (19%)	3 (13%)	
	Poor	478 (80%)	458 (80%)	20 (87%)	
Pathologic T Stage	ypT0	185 (31%)	184 (32%)	1 (4%)	0.02
	ypTis	48 (8%)	45 (8%)	3 (13%)	
	ypT1	278 (47%)	264 (46%)	14 (61%)	
	ypT2	78 (13%)	73 (13%)	5 (22%)	
	ypT3	5 (1%)	5 (1%)	0 (0%)	
Pathologic N Stage	ypN0	390 (66%)	381 (67%)	9 (39%)	0.01
	ypN1	151 (25%)	140 (24%)	11 (48%)	
	ypN2/3	53 (9%)	50 (9%)	3 (13%)	
Multifocal Residual Disease		167 (41%)	160 (41%)	7 (32%)	0.5
Lymphovascular Invasion*		151 (25%)	139 (24%)	12 (52%)	0.006
Extensive Intraductal Component		49 (14%)	45 (13%)	4 (21%)	0.3
Final Margin	≤ 2mm	71 (12%)	67 (12%)	4 (17%)	0.3
	> 2mm	523 (88%)	504 (88%)	19 (83%)	

*significant for IBTR on multivariable analysis

14

Loss of HER2 Positivity Following Neoadjuvant Chemotherapy is Not Associated with Oncologic Outcomes C.L. Wetzel,[1]* T.L. Sutton,[1] J.R. Garreau,[2] N. Johnson.[2] *1. Surgery, Oregon Health and Science University, Portland, OR; 2. Legacy Cancer Institute, Portland, OR.*

Background: Patients with Human Epidermal Growth Factor Receptor 2 (HER2) positive breast cancer are frequently treated with herceptin based neoadjuvant chemotherapy (NCT) often with pathologic complete response (pCR). There is a subset of patients with residual disease post NCT who have lost HER2 amplification. This has been suggested to be associated with inferior oncologic outcomes in small cohorts. We also hypothesized that outcomes would be worse in this cohort and sought to investigate this further in our patient population. Methods: We queried our multi-institutional cancer registry for women with HER2+ breast cancer undergoing NCT from 2011-2017. Clinicopathologic, treatment-related, and outcomes data were collected. Chart review was used to identify post-NCT HER2 status as assessed by immunohistochemistry and fluorescence in situ hybridization. Kaplan-Meier and Cox proportional hazards analysis were used to evaluate oncologic outcomes. Results: N=235 patients were treated with NCT for HER2+ breast cancer over the study period. 101 (43%) did not have a pCR and were included in the study. Median age was 56 years. 86 (85%) were hormone receptor (HR) positive. At a median follow-up of 58 months estimated 5-year recurrence-free survival (RFS) was 81% (n=13 recurrences), estimated 5-year overall survival (OS) of 90% (n=8 deaths). Twenty-five patients were HER2-negative on final pathology. There were no significant predictors of HER2 loss. 21 (84%) of post-NCT HER2-negative and 72 (95%) of post-NCT HER2-positive patients received adjuvant targeted therapy (P=0.059). Post-NCT HER2 status was not associated with RFS (P=0.469, Figure) or OS (P=0.728). Conclusion: With the largest study to date, loss of HER2 positivity following NCT is not associated with worse 5-year RFS or OS. This may in part be secondary to higher percent of HR+ biology and use of ongoing endocrine therapy. Patients who become HER2-negative post-NCT should continue the standard targeted adjuvant regimens in line with patients whose cancers remain HER2-positive. Additional investigations of the interplay between HR and HER2 status post-NCT may reveal previously unappreciated relationships.

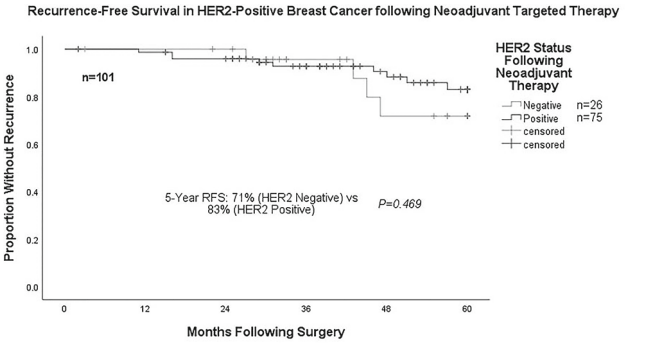


Figure: Kaplan-Meier plot of 5-year recurrence-free survival (RFS) for n=101 women with HER2-positive breast cancer treated with neoadjuvant targeted therapy not experiencing a pathologic complete response. Outcomes stratified by HER2 status of residual cancer.

15

Improving the Prognostic Accuracy of Residual Cancer Burden After Neoadjuvant Chemotherapy R. White,[1]* C. Livasy,[2] E. Donahue,[1] E.A. Elder,[1] B.J. Neelands,[1] A. Patrick,[1] M. Needham,[1] A.R. Tan,[1] T. Sarantou,[1] L. Hadzikadic-Gusic.[1] *1. Clinical Trials Department, Atrium Health-Levine Cancer Institute, Charlotte, NC; 2. Atrium Health, Charlotte, NC.*

INTRODUCTION: Residual cancer burden (RCB) after neoadjuvant chemotherapy (NAC) has been associated with prognosis and disease-free survival. In some settings additional systemic therapy is now recommended in patients with persistent disease. Optimizing the prognostic value of RCB may impact subsequent treatment recommendations. METHODS: This is a single institution retrospective review of patients from 2010 to 2016. RCB index was calculated and survival end points of relapse free survival (RFS), distant relapse free survival (DRFS) and overall survival (OS) were analyzed using Kaplan Meier and Cox Proportional Hazards methods. Harrell's Concordance Index was used to quantify the discriminative ability of univariate and multivariable models. Other factors were added to the analysis to optimize prognostic value. RESULTS: We analyzed 546 patients. Median follow up was 61 months. Distribution of phenotypic subtypes was 37% HR+/HER2-, 36% HER2+ and 27% TNBC. RCB distribution was RCB-0 23%, RCB-1 13%, RCB-2 41% and RCB-3 23%. RCB-0 was achieved in 36% TNBC, 30% HER2+ and 8% HR+/HER2- patients. RCB-3 was identified in 34% HR+/HER2-, 19% TNBC, and 14% HER2+ patients. Local recurrence was identified in 5%; distant recurrence was identified in 17%. Death occurred in 16%. Kaplan Meier 5-year survival estimates were 84%, 78%, and 83% for OS, RFS, and DRFS, respectively. Univariately, RCB index has good prognostic ability for OS, RFS, and DRFS, with Harrell's c-indices of 0.68, 0.68 and 0.67, respectively. The RCB index discriminates well for each survival endpoint within HER2+ and TNBC subtypes but does not for HR+/HER2- (OS C-indices = 0.74, 0.77, 0.53 respectively). When controlling for additional variables, including phenotypic subtype, age, and clinical stage, the models have higher prognostic ability for OS, RFS, and DRFS (Harrell's c-indices 0.74, 0.71, 0.72, respectively). CONCLUSIONS: In this large series, RCB was prognostic for OS, RFS, and DRFS after NAC. We demonstrated that a multivariable model including RCB index, age, phenotypic subtype and clinical stage improved the discriminative ability for OS, RFS and DRFS, compared to univariate models of RCB.

Harrel's C Index for Overall Survival, Relapse Free Survival and Distant Relapse Free Survival in Univariate and Multivariable Models

	Harrell's C Index		
Univariate and Multivariable Models	Overall Survival (OS)	Relapse Free Survival (RFS)	Distant Relapse Free Survival (DRFS)
Clinical Stage	0.62	0.61	0.63
RCB	0.68	0.68	0.67
Clinical stage, RCB, Age	0.71	0.70	0.71
Clinical stage, RCB, Age, Phenotypic subtype	0.74	0.71	0.72
Pathological stage, RCB, Age, Phenotypic subtype	0.72	0.70	0.70
RCB, Age, Phenotypic subtype	0.71	0.69	0.68

16

High BRCA2 Expression is Associated with Better Survival in Triple Negative Breast Cancer (TNBC) V. Satyananda,* M. Oshi, K. Takabe. *Surgical Oncology, Roswell Park Cancer Institute, Buffalo, NY.*

Introduction: DNA repair genes, BRCA 1 and 2 are most studied genes in breast cancer, their mutations have a high risk of carcinogenesis. Little is known of the role of BRCA gene expression in cancer progression and prognosis. We hypothesize that extreme high expression of BRCA 2 gene leads to enhanced DNA repair, accelerated cell proliferation and better survival in breast cancer. Methods: Breast cancer cohort of The Cancer Genome Atlas (TCGA) database was utilized (n=1065). The group was divided into low expression (< 33%) and high (> 33%) expression of BRCA 2 gene, hormone receptor expression was ER+/Her2-=579, TNBC= 159, Her 2+= 175. METABRIC cohort was used for validation(n=1094). Gene Set Enrichment Analysis (GSEA) was utilized for genes of cell proliferation. Kaplan Meir curves were used to calculate survival, with $p < 0.05$ used for significance. Results: There was no difference in disease specific (DSS), disease free (DFS) or overall survival (OS) by the BRCA2 gene expression levels when entire breast cancer cohort was considered in either TCGA or METABRIC. In TNBC cohort of TCGA(high n=384 and low n=190) there was significant worse 10-year DSS ($p= 0.032$) and OS ($p < 0.05$) in low compared to high BRCA2 expression group, these results were completely validated in METABRIC, with TNBC (high n=908 and low n=446) patients showing significant poor 10-year DSS ($p= 0.04$) and OS ($p=0.44$) in low BRCA2 expression group. GSEA demonstrated strong and significant enrichment of HALLMARK genes for cell proliferation gene sets. Mitotic spindle and G2M checkpoint and protein secretion were enriched in significantly greater level in BRCA 2 high group, but none to BRCA 2 low group, of TCGA cohort. No gene sets enriched to either high or low BRCA groups in METABRIC. We cannot help but speculate that TNBC with high BRCA2 expression are associated with accelerated cell proliferation, which may explain better response to chemotherapy, leading to better DSS and OS. Conclusion: High expression of BRCA 2 gene was associated with better survival in TNBC. We predict BRCA 2 gene expression level can be used as a prognostic marker for survival, these results warrant further investigation.

17

Tumor Infiltrating Lymphocytes (TIL) as a Biomarker of Abscopal Effect After Cryoablation Versus Resection S.Y. Khan,[1]* M.W. Melkus,[1] V. Chu,[1] L. Brandi,[2] H. Khan,[3] R. Layeequr Rahman.[4] *1. Department of Surgery, School of Medicine, Texas Tech University Health Sciences Center, Lubbock, TX; 2. Department of Pathology, School of Medicine, Texas Tech University Health Sciences Center, Lubbock, TX; 3. Julia Jones Matthews Department of Public Health, Texas Tech University Health Sciences Center, Lubbock, TX; 4. Department of Surgery, School of Medicine, Texas Tech University Health Sciences Center, Lubbock, TX, United States; Breast Center of Excellence, Texas Tech University Health Sciences Center, Lubbock, TX.*

Introduction: Morphological evaluation of tumor-infiltrating lymphocytes (TILs) in breast cancer is gaining momentum as evidence strengthens the clinical relevance of this immunological biomarker. Here, we compared changes in TILs in the unmanipulated contralateral cancer after cryoablation versus resection of ipsilateral cancer as an assessment of abscopal effect in a murine model. Methods: Balb/C mice were transplanted on each side with $1x10^6$ cells of the highly metastatic triple negative breast cancer 4T1-12b-luciferase expressing cell line into the mammary fat pad near nipple 4 and 9. Tumor growth and metastasis were monitored by palpation, caliper measurements and in vivo imaging for luminescence during the course of the experiment. At 2 weeks post-transplant, the left tumor was treated by either resection (n=5) or cryoablated (n=5) and 1 week later the untreated contralateral tumor was excised and scored by a clinical pathologist for TILs by hematoxylin and eosin (H&E)-stained sections as described by International Immuno-Oncology Biomarker Working Group on Breast Cancer. The initial resected tumor (treatment) was also scored and served as an unmanipulated tumor internal control. At 5 weeks post tumor treatment, the mice were re-challenged with $1x10^6$ 4T1-12b-luc cells subcutaneous in the upper left back and monitored for tumor growth and metastasis. Results: The resected ipsilateral tumors TIL score (baseline) compared with contralateral tumor TIL score a week after cryoablation or resection is shown in Table 1. There was no correlation between tumor volume and TIL percentages. At 4 weeks post treatment, mice that underwent cryoablation had no recurrence, no metastasis and were able to prevent tumor growth when re-challenged, whereas 40% of mice that underwent resection had primary tumor recurrence with distant tumor growth. Conclusion: The TIL score analysis in combination with tumor remission suggests that cryoablation induced an overall more robust and tumor specific TIL response than resection suggesting abscopal effect.

Table 1

	Baseline (1)	Contralateral Resection (2)	Contralateral Cryoablation (3)	p value
Intratumoral TIL score	3%	2%	2.6%	ANOVA: 0.232 1 vs 2: 0.209 1 vs 3: 0.755 2 vs 3: 0.542
Stromal TIL score	1%	2.8%	2.8%	ANOVA: 0.104 1 vs 2: 0.148 1 vs 3: 0.148 2 vs 3: 1.000
Peripheral TIL score	31%	42%	50%	ANOVA: 0.034* 1 vs 2: 0.231 1 vs 3: 0.028* 2 vs 3: 0.440

One-way ANOVA was performed with Tukey's multiple comparison test. *A p-value < 0.05 is statistically significant.

18

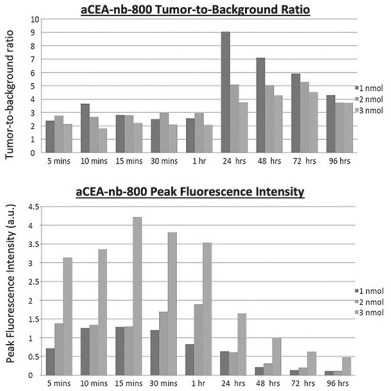
Prognosis and Chemotherapy Use in Breast Cancer Patients with Single and Multiple Lymphatic Micrometastases: An NCDB Analysis R. Weiser,[1]* E. Polychronopoulou,[1] W. Haque,[2] S.S. Hatch,[1] J. He,[1] S. Qiu,[1] A. Markowitz,[1] W.J. Gradishar,[3] Y. Kuo,[1] V.S. klimberg.[1] *1. University of Texas Medical Branch, Galveston, TX; 2. Houston Methodist Hospital, Houston, TX; 3. Northwestern University, Chicago, IL.*

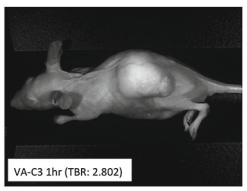
Introduction: The number of involved lymph nodes affects prognosis and treatment of breast cancer patients. Nevertheless, current staging and treatment recommendations do not distinguish between patients with a single versus multiple lymphatic micrometastases. In this study, we aim to better characterize these patients, their surgical and radiation outcomes and response to chemotherapy. Methods: The National Cancer Database was retrospectively queried to identify 486,800 women with stage I-III, ER/PR+, HER2- breast cancer and a nodal status of N0, Nmic with 1 (Nmic1) or more (Nmic>1) involved nodes, and N1 with one involved lymph node (N1.1), between 2010 and 2016. Univariate and multivariate analyses were used to compare patients with different nodal statuses in terms of treatment characteristics, survival and benefit from chemotherapy with relation to the 21-gene recurrence score (RS). Results: Of the 23,072 patients with Nmic disease, 88.3% were Nmic1 and 11.7% were Nmic>1. Patients with Nmic>1 disease were younger, had larger tumors, with a higher grade and more lymphovascular invasion, and were more commonly treated by axillary lymph node dissection, radiation and chemotherapy than Nmic1 patients. In this respect, they were more similar to patients with 1 macrometastatic lymph node (N1.1). Absolute survival of Nmic>1 patients (88.1%) was likewise worse than that of Nmic1 patients (90.1%), but similar to that of N1.1 patients (87.9%). Like N1.1 patients, both Nmic1 and Nmic>1 patients exhibited a ~2% absolute survival advantage associated with the use of chemotherapy, for patients with a RS of 11-25. For a RS>25, Nmic>1 patients showed a 3.5% absolute survival benefit associated with chemotherapy, lower than Nmic1 (4.8%) and N1.1 (10.9%) patients. Conclusions: Patients with breast cancer and Nmic>1 disease have a worse prognosis than those with Nmic1 disease, similar to N1.1 patients. Our data suggests that these patients with a RS of 11-25 may have some benefit from the addition of chemotherapy. These findings should be taken into account when considering adjuvant chemotherapy in patients with lymphatic micrometastases.

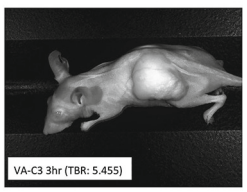
19

Rapid Tumor Labeling Kinetics with a Site-specific Near-infrared Anti-CEA Nanobody in a Patient-Derived Mouse Model of Colon Cancer T. Lwin,[3]* M.A. Turner,[1] S. Amirfakhri,[1] B. Cosman,[1] R.M. Hoffman,[1] S. Hernot,[2] M. Bouvet.[1] *1. Surgery, University of California San Diego, La Jolla, CA; 2. Vrije Universiteit Brussel, Brussels, Belgium; 3. Dana Farber Cancer Center, Boston, MA.*

Introduction: Nanobodies are the smallest biologic antigen-binding fragment derived from camelid-derived antibodies made of only heavy chains. Nanobodies can penetrate tumors with greater efficiency compared to intact antibodies. Nanobodies have a peak signal within hours of injection. This study evaluates the efficacy of an anti-CEA nanobody conjugated to NIR fluorophore LICOR-IRDye800CW in a patient-derived mouse model of colon cancer for fluorescence guided surgery (FGS). Methods: Anti-CEA nanobodies were conjugated with IRDye800CW using cysteine- maleimide chemistry. LS174T human colon cancer cells or fragments of colon cancer collected from patients undergoing surgery at the VA medical center in San Diego were implanted subcutaneously in nude mice. After tumors reached 7-10 mm in size, 1-3 nmols of anti-CEA was injected intravenously. Mice were serially imaged using the Pearl Trilogy Imager (LICOR, Lincoln, NE) at 800 nm. Peak fluorescence signal and tumor to background ratio (TBR) was recorded. Results: Subcutaneous colon cancer tumors were detectable using the aCEA-cnb-800 within 5 mins of injection of the probe at all 3 doses evaluated. The maximal fluorescence intensity values were obtained within 15 mins – 1 hr for all 3 doses evaluated. The highest TBR was at 24 hours for the lowest dose (1 nmol); 24-72 hrs for the intermediate dose (2 nmol); 72 hrs for the highest dose (3 nmol). The TBR values ranged from 2.2 to 5.6. In the patient derived model of colon cancer, fluorescence signal was detectable with a TBR of 2.8 at 1 hr and 5.5 at 3 hrs. Conclusions: Fluorescent anti-CEA nanobodies rapidly and specifically labeled colon cancer in both cell-line based and patient-derived subcutaneous models. Nanobodies enable tumor-labeling kinetics with the rapidity of non-specific dyes such as indocyanine green, but with tumor-binding specificity of antibodies. This is an advantage compared to fluorescently-labeled intact antibodies which have optimal labeling at 48-96 hours after injection. This rapid kinetic of nanobodies allow for same day administration and imaging. The anti-CEA-nb-800 is a promising molecule for FGS of colon cancer.







20

The Ccl20/Ccr6 Axis Promotes Colitis-Associated Carcinogenesis in Smad4 Conditional Knockout Mice P.M. Smith,* D. Hanna, K. Washington, A.L. Means, R. Beauchamp. *Surger, Vanderbilt University Medical Center, Nashville, TN.*

Introduction – We previously reported that Dextran sodium sulfate (DSS) induced colitis induces invasive colon adenocarcinomas in mice with intestine-specific Smad4 knockout and that intestinal SMAD4 loss results in increased expression of CCL20, a chemokine implicated in both inflammatory bowel disease (IBD) and colon cancer. Here we investigate whether the Ccl20/Ccr6 axis plays a causative role in colitis-associated tumorigenesis due to SMAD4 loss. Methods – Transgenic mice with Cre-recombinase expression under the control of an intestine-specific promoter (Lrig1) and LoxP sites inserted around critical exons of the Smad4 gene locus are administered tamoxifen to induce Smad4 loss ($Smad4^{\Delta Lrig1}$). After recombination, sub-epithelial stroma is isolated for RNA-sequencing (RNA-seq). $Smad4^{\Delta Lrig1}$ are additionally crossed with mice that have GFP knocked into the Ccr6 gene. $Smad4^{\Delta Lrig1}$; $Ccr6^{+/-}$ and $Smad4^{\Delta Lrig1}$; $Ccr6^{-/-}$ mice were subjected to DSS to induce chronic colitis and dissection 9 weeks later for histological examination. Results – Loss of intestinal epithelial Smad4 expression was associated with a 3-fold increase in Ccl20 expression in the epithelium and 2.75-fold increase in Ccr6 expression in the sub-epithelial stroma of mouse colons (both $p<0.01$). Nine weeks after colitis induction, 100% of Ccr6-expressing ($Smad4^{\Delta Lrig1}$; $Ccr6^{+/-}$) mice had one or more invasive adenocarcinomas of the colon compared to 16.7% of Ccr6-null mice ($Smad4^{\Delta Lrig1}$; $Ccr6^{-/-}$; $p<0.05$). Ccr6-expressing mice additionally developed a significantly higher number of invasive tumors compared to Ccr6-null mice (1.7 vs 0.2 tumors per mouse, $p<0.03$) (Table 1). Conclusions – Loss of intestinal TGFβ signaling is associated with an increase in epithelial Ccl20 expression and a corresponding increase in stromal Ccr6 expression in mice, both of which have been observed in humans with IBD and colitis associated cancer (CAC). Blocking the Ccl20/Ccr6 axis through Ccr6 knockout significantly diminishes the susceptibility to CAC in Smad4-null mice. These results support the hypothesis that the tumor suppressor role of TGFβ/SMAD4 involves regulation of inflammatory pathways, including the Ccl20/Ccr6 axis.

Number of Mice Developing Invasive Tumors by 9 Weeks Post-DSS

Genotype	Female	Male	Total	Percentage
Smad4ΔLrig1; Ccr6+/-	0 of 0	3 of 3	3 of 3	100.0%
Smad4ΔLrig1; Ccr6-/-	1 of 3	0 of 5	1 of 6	16.7%

p=0.0238 by Mann-Whitney U test

21

Circulating Hybrid Cells as a Novel Liquid Biomarker of Treatment Response in Gastrointestinal Cancers B.S. Walker,* T.L. Sutton, L. Zarour, J.G. Hunter, J.P. Dolan, S.G. Wood, V. Tsikitis, D. Herzig, C.D. Lopez, E. Chen, S.C. Mayo, M.H. Wong. *Surgery, Oregon Health & Science University, Portland, OR.*

Introduction Real-time monitoring of treatment response with a liquid biomarker would inform treatment decisions in patients undergoing neoadjuvant (NAT) therapies for rectal (RC) and esophageal cancers (EC), and in patients with metastatic colorectal cancer receiving hepatic arterial infusion therapy (HAIT). Circulating hybrid cells (CHCs) are immune-tumor cell fusion hybrids detectable in the peripheral blood of patients with GI cancers by their co-expression of leukocyte marker, CD45, and epithelial protein, cytokeratin (CK). In pancreatic adenocarcinoma, CHCs ($CD45^{+}/CK^{+}$) are found at higher numbers and better correlate with overall survival than traditional circulating tumor cells (CTCs, $CD45^{-}/CK^{+}$), but their potential as an indicator of treatment response has not been previously explored. Methods Peripheral blood specimens were collected from RC and EC patients prior to resection, or longitudinally during NAT and HAIT. For CHC enumeration, peripheral blood mononuclear cells (PBMCs) were isolated then immunostained for expression of CD45 and CK. Treatment response was determined per AJCC tumor regression grading (TRG). CHC counts were normalized to 50,000 PBMCs then analyzed by ANOVA and receiver operating characteristics (ROC) analysis. Results Fifty-eight samples collected from patients with RC (n=23) and EC (n=35) prior to resection and 2 patients receiving HAIT were evaluated. In the NAT group, 13 (23%) patients had a pathologic complete response (pCR, TRG 0), while 37 (66%) had non-pCR (TRG 1-2), and 6 (11%) demonstrated no response (TRG 3). On ROC analysis, CHC levels successfully discriminated pCR from non-pCR in both RC and EC with an area under the curve (AUC) of 0.82 (95% CI 0.71-0.92, $p<0.001$, Figure 1a). In patients followed longitudinally during NAT (n=2) and HAI therapy (n=2), CHCs levels decreased by >90% with initiation of therapy but increased with dose reductions and prior to clinical evidence of disease progression (Figure 1b). Conclusion CHCs are a novel noninvasive biomarker with great potential for monitoring treatment response and disease progression to help guide decisions for further therapy, definitive resection, or safe observation.

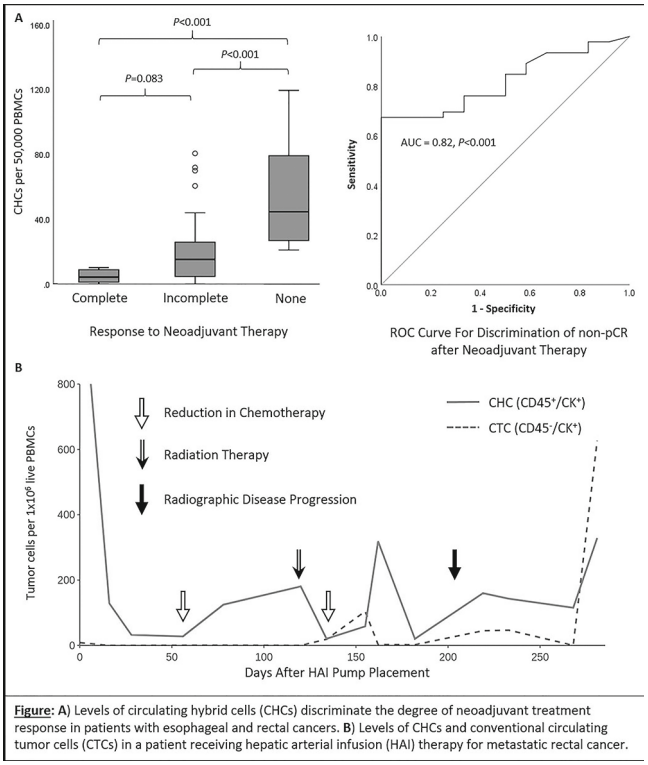


Figure: A) Levels of circulating hybrid cells (CHCs) discriminate the degree of neoadjuvant treatment response in patients with esophageal and rectal cancers. B) Levels of CHCs and conventional circulating tumor cells (CTCs) in a patient receiving hepatic arterial infusion (HAI) therapy for metastatic rectal cancer.

22

Impact of Persistent Retroperitoneal and Lateral Pelvic Lymph Nodes After Neoadjuvant Therapy on Long-term Outcomes: An Analysis of the United States Rectal Cancer Consortium

M.K. Turgeon,[1]* A.C. Gamboa,[1] J.M. Keilson,[1] L. Maguire,[2] K. Hrebinko,[3] J. Holder-Murray,[3] J.T. Wiseman,[3] A. Ejaz,[4] K. Edwards-Hollingsworth,[5] A.T. Hawkins,[5] P. Bauer,[6] M. Silviera,[6] S. Maithel,[1] G.C. Balch.[1] *1. Surgery, Emory University, Atlanta, GA; 2. University of Michigan, Ann Arbor, MI; 3. University of Pittsburgh Medical Center, Pittsburgh, PA; 4. The Ohio State University, Columbus, OH; 5. Vanderbilt University Medical Center, Nashville, TN; 6. Washington University School of Medicine in St. Louis, St. Louis, MO.*

Introduction The management of positive retroperitoneal and lateral pelvic lymph nodes (RLPN) in rectal cancer patients remains unclear. Eastern (Japan and Korea) protocols consider metastasis to RLPN as regional disease and recommend total mesorectal excision and RLPN lymphadenectomy. In contrast, Western protocols consider RLPN metastases as advanced disease that portends unfavorable oncologic outcomes. With the adoption of a total neoadjuvant therapy paradigm, more patients have a RLPN clinical response on imaging. We sought to evaluate the impact of radiographic persistent RLPN after neoadjuvant therapy on survival. Methods The U.S. Rectal Cancer Consortium database (2007-2017) was reviewed for patients with primary rectal adenocarcinoma with isolated RLPN metastasis, who received neoadjuvant therapy prior to undergoing curative-intent low anterior or abdominoperineal resection. Primary outcomes were recurrence-free survival (RFS) and overall survival (OS). Results Of 77 patients, all received neoadjuvant therapy, with 97% (n=75) receiving neoadjuvant chemoradiation and 47% (n=35) receiving total neoadjuvant therapy. Post-treatment, 57% (n=44) had radiographic persistence of RLPN. Median number of positive RLPN on imaging was 1 (IQR 1-2). Median follow-up was 19 months. Receipt of total neoadjuvant therapy was associated with radiographic RLPN disappearance (OR 4.77, 95% CI 1.81-12.60, p<0.01). However, RFS and OS were no different between patients who had radiographic disappearance or persistence of RLPN on univariate or multivariable analyses (all p>0.05) (Figure 1, Panels A, B). Conclusions While a total neoadjuvant therapy strategy is associated with the radiographic disappearance of RLPN, persistence of RLPN on imaging is not associated with worse recurrence-free survival or overall survival in well-selected patients. We suspect this may be related to false positives on imaging. Thus, in well-selected patients, radiographic persistence of RLPN after preoperative therapy should not preclude resection.

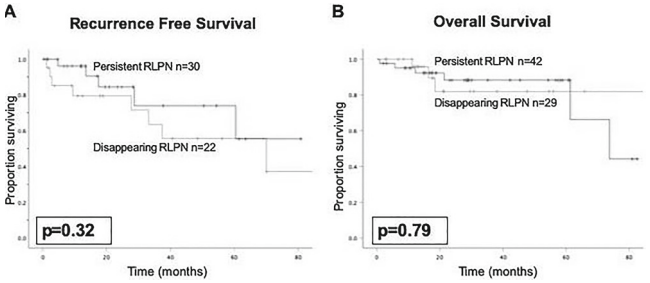


Figure 1 Kaplan-Meier curves comparing RFS (Panel A) and OS (Panel B) for disappearing (blue) vs persistent (red) RLPN after neoadjuvant therapy

23

Malignant Features in Pre-Treatment Metastatic Lateral Lymph Nodes in Low Rectal Cancers Predict Distant Metastases and Survival, But Not Local Recurrences

H. Kroon,[1]* N. Dudi-Venkata,[1] S. Bedrikovetski,[1] j. Liu,[1] A. Haanappel,[1] A. Ogura,[2] C. van de Velde,[3] H. Rutten,[4] G. Beets,[5] M. Thomas,[1] M. Kusters,[6] T. Sammour.[1] *1. Surgery, Royal Adelaide Hospital, Adelaide, SA, Australia; 2. Nagoya University Graduate School of Medicine, Nagayo, Japan; 3. Leiden University Medical Center, Leiden, Netherlands; 4. Catharina ziekenhuis, Eindhoven, Netherlands; 5. Netherlands Cancer Institute, Amsterdam, Netherlands; 6. Amsterdam UMC, Amsterdam, Netherlands.*

Introduction: Pre-treatment enlarged lateral lymph nodes (LLNs) in patients with low rectal cancer predict local recurrences after neoadjuvant (chemo)radiotherapy (n(C)RT) followed by total mesorectal excision (TME). Not much is known what the impact on oncological outcomes is when malignant features are present in LLNs. Methods: An international multi-center cohort study at five tertiary referral centers in the Netherlands and Australia was conducted. All patients were diagnosed with low rectal cancer with or without LLNs on pre-treatment MRI and underwent n(C)RT followed by TME. LLNs were considered enlarged in case of a short-axis of ≥5mm on pre-treatment MRI. Malignant features in LLNs were defined as nodes with internal heterogeneity or border irregularity. Survival was estimated using the Kaplan-Meier method with the Mantel-Haenszel test. Results: A total of 213 patients were included. The majority was male (67.7%) with a median age of 64 years (range 20-89). Median pre-treatment LLN short-axis was 7mm (range 5-28), 52.2% of the LLNS had malignant features. After a median follow-up of 47 months, patients with enlarged LLNs (7-9mm and 10mm+) had a worse 3-year local recurrence-free survival (LRFS; p=0.0005), but similar distant metastatic-free (DMFS; p=0.38) and overall survival (OS; p=0.52) compared to patients with smaller LLNs (0-4 and 5-6mm). On the other hand, patients with malignant features in the LLNs had a similar LRFS (p=0.37), but worse DMFS (p=0.02) and OS (p=0.0003) compared to patients without malignant features in the LLNs. Conclusion: Malignant features present in LLNs on pre-treatment MRI are predictive for worse DMFS and OS, but not for local recurrences.

Three-year oncological outcomes for metastatic lateral lymph nodes according to short-axis size and malignant features.

variable	0-4mm (n=98)	5-6mm (n=57)	7-9mm (n=38)	10mm+ (n=20)	P-value	Malignant features - (n=55)	Malignant features + (n=60)	P-value
Lateral local recurrence (%)	0 (0)	1 (2)	3 (8)	4 (20)	0.0001	2 (4)	6 (10)	0.28
Local recurrence (%)	2 (2)	2 (4)	5 (13)	5 (25)	0.0005	4 (7)	8 (13)	0.37
Distant metastases (%)	21 (21)	14 (25)	9 (24)	8 (40)	0.38	9 (16)	22 (37)	0.02
Disease recurrence (%)	22 (22)	16 (28)	11 (29)	9 (45)	0.23	11 (20)	26 (43)	0.008
Mortality (%)	24 (24)	16 (28)	12 (32)	8 (40)	0.52	8 (15)	28 (47)	0.0003

24

Is there a Role for Adjuvant Chemotherapy in Pathologic Node-Negative, Locally Advanced Rectal Cancer After Neoadjuvant Chemoradiation Therapy? J.M. Keilson,[1]* A.C. Gamboa,[1] M.K. Turgeon,[1] L. Maguire,[2] K. Hrebinko,[3] J. Holder-Murray,[3] J.T. Wiseman,[4] A. Ejaz,[4] K. Edwards-Hollingsworth,[5] A.T. Hawkins,[5] E. Otegbeye,[6] M. Silviera,[6] S. Maithel,[1] G.C. Balch.[1] *1. Division of Surgical Oncology, Emory University School of Medicine, Atlanta, GA; 2. University of Michigan, Ann Arbor, MI; 3. University of Pittsburgh, Pittsburgh, PA; 4. The Ohio State University, Columbus, OH; 5. Vanderbilt University, Nashville, TN; 6. Washington University School of Medicine, St. Louis, MO.*

Background Neoadjuvant chemoradiation followed by resection and adjuvant chemotherapy (AC) is a standard treatment paradigm for locally advanced rectal adenocarcinoma. However, the utility of AC in select populations is unclear and is often omitted. Our aim was to assess the value of AC stratified by pathologic lymph node (pLN) status. Methods The US Rectal Cancer Consortium database (2007-2017) was reviewed for patients with primary, non-metastatic rectal adenocarcinoma who received neoadjuvant chemoradiation followed by curative intent resection. Those who received neoadjuvant chemotherapy or underwent local resection were excluded. Patients were categorized by pLN status. Primary outcome was overall survival (OS). Results Of the 256 patients identified, 71% were pLN negative and 29% were pLN positive. Median age was 58 years, 64% were male, and median follow-up was 32 months. Of pLN negative patients, 69% received AC. Receipt of AC was not associated with improved 5-year OS (p=0.27; Fig 1A). This finding persisted on multivariable analysis when accounting for age, pre-treatment stage, and post-operative complications. Factors associated with a decreased odds of receiving AC included age >65 years, short course radiation, and readmission (all p<0.01). 85% of pLN positive patients received AC. In contrast with pLN negative patients, receipt of AC conferred improved 5-year OS (p=0.02; Fig 1B) and remained significant when controlling for post-operative complications (p=0.03). Age >65 years and post-operative complications were associated with a decreased odds of receiving AC on both univariate and multivariable analyses (p<0.04). Finally, on subset analysis of pre-treatment clinical stage III patients, AC was not associated with improved OS in the pLN negative cohort but trended towards improved OS in pLN positive patients (Fig 1C, D). Conclusions After receiving neoadjuvant chemoradiation, adjuvant chemotherapy for pathologic LN negative patients does not appear to be associated with improved survival. Further validation and prospective studies are needed to evaluate the utility of adjuvant chemotherapy in this setting.

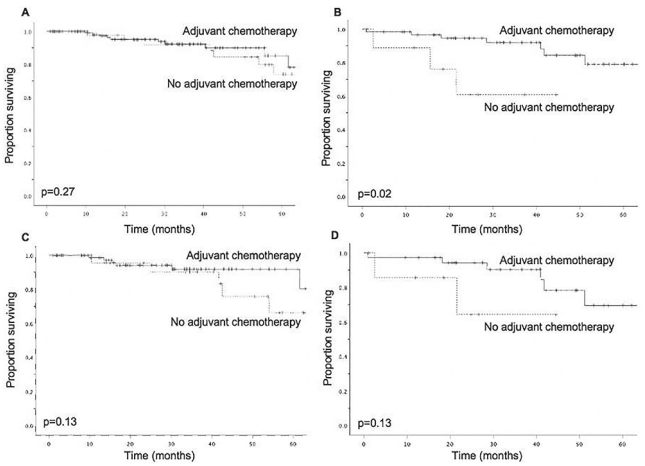


Figure 1. Kaplan-Meier curves for overall survival comparing receipt of adjuvant chemotherapy among all patients with pathologic lymph node negative (A) or positive (B) disease. Pre-treatment clinical stage III-specific analysis of patients with pathologic lymph node negative (C) or positive (D) disease.

25

Short-Course Radiation with Consolidation Chemotherapy Does Not Increase Operative Morbidity Compared to Long-Course Chemoradiation: A Retrospective Study of the U.S. Rectal Cancer Consortium P.S. Bauer,[1]* A. Gamboa,[2] E. Otegbeye,[1] W. Chapman Jr.,[1] G.C. Balch,[2] S. Rivard,[3] S. Regenbogen,[3] K. Hrebinko,[4] J. Holder-Murray,[4] J.T. Wiseman,[5] A. Ejaz,[5] K. Edwards-Hollingsworth,[6] A.T. Hawkins,[6] S. Glasgow,[1] S. Hunt,[1] P.E. Wise,[1] M. Silviera.[1] *1. Washington University School of Medicine, St. Louis, MO; 2. Emory University, Atlanta, GA; 3. University of Michigan, Ann Arbor, MI; 4. University of Pittsburgh Medical Center, Pittsburgh, PA; 5. The Ohio State University, Columbus, OH; 6. Vanderbilt University Medical Center, Nashville, TN.*

Introduction: Total neoadjuvant therapy for the treatment of rectal cancer is increasing, but short-course radiation followed by consolidation chemotherapy (SC TNT) remains less widely used in the U.S. than long-course chemoradiation (LCRT). SC TNT may improve compliance and downstaging, but its contribution to intra- and post-operative complications with total mesorectal excision (as a result of an increased radiation-to-surgery interval) is largely unknown. Previous single-center retrospective analysis revealed a similar risk of morbidity after SC TNT when compared to LCRT; however, validation by a large, multi-institutional study is needed. Methods: The U.S. Rectal Cancer Consortium database (2007–2018) consisting of data from 6 academic centers was retrospectively reviewed for patients with nonmetastatic, rectal adenocarcinoma treated with neoadjuvant LCRT or SC TNT before low anterior (LAR) or abdominoperineal resection (APR). The primary endpoint was severe post-operative morbidity (Clavien-Dindo Grade ≥3). Cohorts were compared by univariate analysis. Multivariable logistic regression modeled the odds of severe morbidity. Results: Of 788 included patients, 151 (19%) received SC TNT and 637 (81%) received LCRT. The cohorts were similar, although the LCRT group had more distal tumors (50.2% vs. 33.8%, p<0.0001) and more node-negative disease (30.0% vs. 21.2%, p<0.0001). The rate of intra-operative complications was similar (SC TNT 5.3% vs. 4.4%, p=0.65). Overall post-operative morbidity was similar (SC TNT 38.4% vs. 46.3%, p=0.08). The rate of severe morbidity was similar with LAR (SC TNT 9.1% vs. 15.3%, p=0.10) and APR (SC TNT 24.4% vs. 29.7%, p=0.49). SC TNT did not increase the odds of severe morbidity relative to LCRT on multivariable analysis (OR 0.64, 95% CI 0.37–1.10). Conclusions: SC TNT does not increase intra- or post-operative morbidity after total mesorectal excision for rectal cancer when compared to LCRT. Concern for surgical complications should not discourage the use of SC TNT in regimens aiming to increase the likelihood of complete clinical response.

Rectal Cancer Operative Outcomes Stratified by Procedure and Neoadjuvant Regimen

Outcome	LAR			APR		
	SC TNT n=110	CRT n=398	p	SC TNT n = 41	CRT n = 239	p
Complications						
Any Complication (%)	34 (30.9)	150 (37.7)	0.19	24 (58.5)	145 (60.7)	0.80
Severe Complication (%)	10 (9.1)	61 (15.3)	0.10	10 (24.4)	71 (29.7)	0.49
Reoperation (%)	2 (1.8)	45 (11.6)	<0.01	4 (9.8)	39 (17.6)	0.21
EBL (mean mL ± SD)	320 ± 368	275 ± 306	0.31	437 ± 281	463 ± 620	0.71
Intraoperative Complication (%)	6 (5.5)	15 (4.0)	0.49	2 (4.9)	12 (5.2)	0.92
30-day Mortality (%)	0 (0)	1 (0.3)	0.60	1 (2.4)	2 (0.8)	0.36
Median Length of Stay (IQR)	5 (4 – 8)	5 (4 – 8)	0.18	6 (4 – 7)	6 (5 – 9)	0.28
Readmission (%)	26 (23.6)	121 (31.4)	0.11	13 (31.7)	64 (28.1)	0.64
Operative Details (%)						
Approach Minimally Invasive Open Missing	. 72 (65.5) 38 (34.6) 0	. 258 (64.8) 132 (33.2) 8 (2.0)	0.32	. 20 (48.8) 21 (51.2) 0	. 108 (45.2) 124 (51.9) 7 (2.9)	0.52
En bloc resection	3 (2.7)	27 (6.8)	0.11	8 (19.5)	53 (22.2)	0.70
Diverting loop ileostomy	103 (94.5)	343 (88.6)	0.07	NA	NA	

Legend: SC TNT= Short course radiation with consolidation chemotherapy; CRT=Long course chemoradiation; LAR=Low Anterior Resection; APR=Abdominoperineal Resection EBL=Estimated Blood Loss; IQR=Interquartile Range

26

Timing of Primary Tumor Resection in Synchronous Metastatic Colon Cancer Patients Undergoing Hepatic Arterial Infusion Pump Placement F. Verheij,[1]* K. Soares,[1] G. Beets,[2] N. Kok,[2] M. D'Angelica,[1] J. Garcia-Aguilar.[1] *1. Memorial Sloan Kettering Cancer Center, New York, NY; 2. Netherlands Cancer Institute, Amsterdam, Netherlands.*

INTRODUCTION: Hepatic arterial infusion (HAI) chemotherapy is associated with improved survival in colon cancer with liver metastases. However, the morbidity associated with performing a colon resection simultaneously with the placement of a HAI pump (HAIP) has not been fully investigated. In this study, we analyzed perioperative outcomes in patients receiving HAIP placement with simultaneous colon resection compared to patients receiving HAIP after prior colectomy. METHODS: This is a retrospective analysis of patients with colon cancer and synchronous liver metastases who received HAIP placement between 2007 and 2018 at the Memorial Sloan Kettering Cancer Center. Clinicopathologic characteristics, operative data, complications, and time to first cycle of HAI chemotherapy were compared between patients who underwent colon resection simultaneously with HAIP placement and those who underwent HAIP placement after prior colectomy. RESULTS: Two hundred fifty-eight patients underwent simultaneous colectomy and HAIP placement, and 116 patients underwent HAIP placement after prior colon resection. Grade 1-2 complications were more common in patients who underwent simultaneous colon resection and HAIP placement ($P < 0.001$), but no significant difference in grade 3-4 complications was seen. Subgroup analysis of patients with simultaneous liver resection during HAIP placement showed no difference in grade 3-4 complications as well (simultaneous resection, 128 patients; prior colon resection, 85 patients; $P = 0.277$). The interval between HAIP placement and the start of HAI chemotherapy did not differ significantly between the two groups (simultaneous resection, 27 days [interquartile range 17–34]; prior resection, 30 days [interquartile range 21–34]; $P = 0.924$). CONCLUSIONS: Simultaneous HAIP placement and resection of the colon primary show similar postoperative outcome and no delay in the administration of HAI chemotherapy. Simultaneous HAIP implantation and colectomy should be considered a safe option.

Postoperative complications after HAIP placement

Complication	HAIP with colon resection (n = 258)	HAIP with colon resection (n = 258)	P value*
Grade 1-2	95 (36.8)	22 (19.0)	<0.001
Grade 3-4	37 (14.3)	15 (12.9)	0.872
Surgical site infection**	66 (25.6)	17 (14.7)	0.022
-Superficial	34 (13.2)	11 (9.5)	0.391
-Deep	11 (4.3)	0 (0.0)	0.021
-Organ/space	21 (8.1)	6 (5.2)	0.390
Ascites	5 (1.9)	3 (2.6)	0.707
Cardiovascular	20 (7.8)	2 (1.7)	0.030
Ileus, paralytic	21 (8.1)	3 (2.6	0.065
Pleural effusion	3 (2.1)	2 (1.7)	0.647
Pulmonary embolus	6 (2.3)	2 (1.7)	1.0
Urinary retention/tract infection	8 (3.1)	1 (0.9)	0.285

The data are expressed as n (%) unless otherwise specified. HAIP hepatic arterial infusion pump.
*X2 test or Fisher exact test.
**Categorized according to the guidelines of the Centers for Disease Control and Prevention.

27

Outcomes Following a Rectal and/or Simultaneous Versus Liver-First Approach for Synchronous Rectal Liver Metastasis: An Analysis of the U.S. Rectal Cancer Consortium A. Hamad,[1]* A.C. Gamboa,[2] G.C. Balch,[2] J. Mankiko,[3] L. Maguire,[3] M. Mohammed,[4] J. Holder-Murray,[4] K. Edwards-Hollingsworth,[5] A.T. Hawkins,[5] E. Otegbeye,[6] M. Silviera,[6] J.T. Wiseman,[7] S. Abdel-Misih,[8] A. Ejaz.[1] *1. The Ohio State University, Columbus, OH; 2. Emory University, Atlanta, GA; 3. University of Michigan, Ann Arbor, MI; 4. University of Pittsburgh, Pittsburgh, PA; 5. Vanderbilt University, Nashville, TN; 6. Washington University, St. Louis, MO; 7. Dignity Health – Cancer Institute at St. Joseph's Hospital and Medical Center, Phoenix, AZ; 8. Stony Brook University Hospital, Stony Brook, NY.*

Background: The sequence of surgical approach for patients with rectal cancer and synchronous liver metastases (RC-SLM) remains controversial. We sought to compare short- and long-term outcomes between a liver-first (LF) and rectal-first and/or simultaneous (RF/S) approach among patients with RC-SLM. Methods: Patients who underwent resection for RC-SLM between 2007-2017 were identified using the US Rectal Cancer Consortium. Short- and long-term outcomes were compared based on sequence of surgical approach (LF vs. RF/S). Results: Among 169 patients with RC-SLM, approximately two-thirds of the cohort underwent a RF/S (n=109, 64.5%) versus a LF approach (n=60, 35.5%). LF patients were slightly older (59±12 years) compared to RF/S patients (55±12 years; P=0.04), however there was no difference in gender, tumor size or location, or number of liver lesions between the two groups (all P>0.05). Most patients received chemotherapy prior to any surgical resection (LF: n=44, 74.6% vs. RF/S: n=79, 73.1%; P=0.84), however a higher percentage of RF/S patients (n=72, 66.1%) received neoadjuvant chemoradiation compared to LF patients (n=30, 50%; P=0.04). At the time of liver resection, LF patients more commonly underwent a major hepatectomy (n=18, 47.4%) compared to RF/S patients (n=16, 28.1%)(P=0.04). Following rectal surgery, post-operative morbidity was similar between the two groups (LF: 56.3% vs. RF/S: 52.7%; P=0.69), however LF patients had a higher proportion of major (≥3 Clavien-Dindo grade) complications (59.3% vs 39.6% P=0.03). There was no difference in length of stay (RF/S: 6 days, IQR: (5,10) vs. LF: 6 days, IQR:(4,1); P=0.95) or 90-day readmission rates (RF/S: 18% vs. LF: 7%; P=0.64). After controlling for all factors, disease-free (DFS) (HR:1.38, 95%CI: 0.69-2.73) and overall survival (OS) (HR: 0.99, 95%CI: 0.53-1.84) was similar between groups (both P>0.05). Conclusion: Patients undergoing a LF or RF/S approach for RC-SLM have similar short and long-term outcomes at high-volume multidisciplinary centers. Future research should focus on identifying which patients benefit most from a RF/S versus LF approach.

28

SOX4 Expression is Associated with Disease Severity in Papillary Thyroid Carcinoma J.W. Thiesmeyer,[1]* F. Valle Reyes,[1] T.M. Ullmann,[1] C.E. Egan,[1] J. Greenberg,[1] M.D. Moore,[1] B.M. Finnerty,[1] T. Beninato,[2] R. Zarnegar,[1] I.M. Min,[1] T.J. Fahey III.[1] *1. NewYork-Presbyterian Hospital/Weill Cornell Medical Center, New York, NY; 2. Rutgers Cancer Institute of New Jersey, New Brunswick, NJ.*

Introduction: SOX4 promotes carcinoma invasiveness by regulating the epithelial-to-mesenchymal transition, but its role in thyroid cancer is unknown. Data suggests that SOX4 levels may be higher in elderly patients. Since older thyroid cancer patients tend to present with more aggressive disease, we explored the relationship between age, SOX4 expression, and disease stage. Methods: The Cancer Genome Atlas database was queried for papillary thyroid carcinoma (PTC) SOX4 mRNA expression. Mean z-scores were compared for clinical and tumor variables with Student's t-test, one-way ANOVA, or Pearson's correlation, as appropriate. Multivariable logistic regression modeling for predictors of positive z-scores was performed. Results: 388 patients were included. Higher T stage (T3 0.24±1.01, T4 0.37±1.18, p=0.007) and nodal disease (N0 -0.21±1.01 vs. N1 0.27±0.89, p<0.001) were associated with higher SOX4 expression. M1 patients (n=6) had high expression compared to M0 patients [0.54±1.20 vs. 0.14±0.98, p=0.34], but sample size was limiting. Expression was higher with increasing American Thyroid Association risk (p<0.001). Tall cell histologic subtype (0.54±0.56) compared to classical (0.18±0.96) or follicular (-0.72±0.98) (p<0.001), and tumors with

extrathyroidal extension (minimal 0.33±0.92, moderate 0.42±1.26, p<0.001) had higher expression. Disease recurrence was associated with increased SOX4 (p=0.02), though overall survival was not (p=0.75); median follow-up was 14mos (7-31). Age was slightly negatively correlated with SOX4 expression (r=-0.159, p=0.002), but this was not significant on multivariable regression modeling (adjusted odds ratio (AOR) 0.97, 95%-CI [0.94-1.01]). Tall cell histology (AOR 3.8, 95%-CI [1.13-13.01], p=0.03), and BRAFV600E mutation (AOR 19.6, 95%-CI [4.4-86.9], p<0.001) were significantly associated with positive z-score in the multivariable model. Conclusion: Advanced PTCs have higher SOX4 expression than earlier stage tumors. The relationship between age and SOX4 is unclear. Further studies are needed to determine whether the expression of this transcription factor affects tumor aggressiveness in thyroid cancer.

Association of SOX4 expression with patient demographics and tumor characteristics.

	Sample Size (%)	SOX4 Z-Score (mean ± SD)	p-value
Sex, female	271 (74.5)	-0.01 (1.02)	0.74
Hispanic ethnicity	31 (10.3)	0.71 (1.15)	<0.001
Race			0.80
White	249 (83.6)	0.12 (1.01)	
Black	17 (5.7)	0.29 (1.48)	
Asian	32 (10.7)	0.14 (0.77)	
AJCC T Stage			0.007
T1	106 (29.3)	-0.15 (0.94)	
T2	125 (34.5)	-0.11 (1.05)	
T3	119 (32.9)	0.24 (1.01)	
T4	12 (3.3)	0.37 (1.18)	
AJCC N Stage			<0.001
N0	172 (52.9)	-0.21 (1.01)	
N1	153 (47.1)	0.27 (0.89)	
AJCC M Stage			0.34
M0	193 (97.0)	0.14 (0.98)	
M1	6 (3.0)	0.54 (1.20)	
ATA Risk Stratification			<0.001
Low	139 (39.1)	-0.31 (1.02)	
Intermediate	199 (56.1)	0.21 (0.97)	
High	17 (4.8)	0.26 (1.09)	
Histologic Subtype			<0.001
Classical	249 (69.6)	0.18 (0.96)	
Follicular	81 (22.6)	-0.72 (0.98)	
Tall Cell	28 (7.8)	0.54 (0.56)	
Extrathyroidal Extension			<0.001
None	250 (70.8)	-0.13 (1.01)	
Minimal	94 (26.6)	0.33 (0.92)	
Moderate/Advanced	9 (2.6)	0.42 (1.26)	

The Cancer Genome Atlas computes the relative expression of an individual gene in a tumor sample to the gene's expression distribution in a reference population, which is all profiled samples. The returned value indicates the number of standard deviations away from the mean of expression in the reference population (Z-score).

29

Transcriptome-Driven Analysis of Ligand-Receptor Interactions in the Microenvironment of Pheochromocytoma and Paraganglioma Subtypes S. Batchu,[1]* A.A. Hakim,[1] U. Atabek,[2] F. Spitz,[2] Y. Hong.[2]
1. Surgery, Cooper Medical School of Rowan University, Pine Brook, NJ; 2. Cooper University Hospital, Division of Surgical oncology., Camden, NJ.

Introduction Pheochromocytomas and paragangliomas (PCPG) are rare catecholamine-secreting endocrine tumors deriving from chromaffin cells of the embryonic neural crest. Although distinct molecular PCPG subtypes have been elucidated, certain important clinical characteristics of these tumors have yet to be fully examined, namely interactions within the tumor microenvironment. Methods Tumor purities of 175 PCPGs from The Cancer Genome Atlas were estimated using known mRNA expression signatures of stromal/immune cells and DNA methylation patterns. Using the purity estimates and bulk tumor expression values, non-negative linear regression was used to estimate the average expression of each gene in the stromal/tumor compartments for each PCPG molecular subtype. The inferred expression profiles were annotated with a curated database of ligand-receptor interactions and assumed as reasonable proxies for molar concentrations in the law of mass action, allowing for quantification of directional ligand-receptor complex concentrations under equilibrium. Results Across all PCPG subtypes compared to normal samples, tumor-to-tumor signaling between bone morphogenic protein 7 (BMP7) and cognate receptor BMPR1B was increased. Tumor-to-stroma signaling enriched for interactions between predicted tumor-originating delta-like ligand 3 (DLL3) and predicted stromal NOTCH receptors. Top tumor-to-stroma interactions in Wnt-altered tumors frequently included WNT4, WNT1, and WNT3A ligands. Pseudohypoxia subtype tumors displayed increased predicted stromal expression of genes related to immune-exhausted T cell response, including those for inhibitory receptors HAVCR2 and CTLA4 (Figure) in addition to increased interactions of tumor-expressing ephrins A2 and A5 with EphA8 stromal receptor compared to other subtypes. Conclusions The predicted stromal and tumor compartment deconvolution yielded previously unrecognized interactions and putative biomarkers in PCPG. In vivo evaluation of these targets will be important for confirming clinical utility.

30

Reassessing the Impact of Tumor Size on Operative Approach in Adrenocortical Carcinoma J.J. Hue,* K. Bingmer, H. Zhao, J.B. Ammori, S. Wilhelm, C.W. Towe, L.D. Rothermel.
General Surgery, University Hospitals Cleveland Medical Center, Univeristy Heights, OH.

Background: Adrenocortical carcinoma (ACC) is considered by some to be a relative contraindication to minimally invasive adrenalectomy (MIA). We aimed to use an administrative dataset to analyze postoperative outcomes based on tumor size. We hypothesized that MIA may have similar outcomes to open adrenalectomy (OA) among patients with small tumors. Methods: The National Cancer Database (2010-16) identified patients with ACC who received surgery. Patients with node-positive or metastatic disease at presentation were excluded. Tumors were grouped: <5 cm (n=125), 5-10 cm (n=431), and >10 cm (n=443). The primary and secondary outcomes were margin positivity and overall survival, respectively. Multivariable models were used to control for confounding factors. Results: 999 patients were analyzed: 370 (37%) MIA and 629 (63%) OA. As size increased, the rate of MIA decreased (<5 cm: 64.8%, 5-10 cm: 47.8%, >10 cm: 18.7%, p<0.001). Larger tumors were associated with conversion to open in univariable (<5 cm: 3.7%; 5-10 cm: 16.5%; >10 cm: 28.9%, p<0.001) and multivariable analyses (5-10 vs <5 cm: OR=6.2, p=0.02; >10 vs <5 cm: OR=16.5, p<0.001). The overall positive margin rate was 19%. Tumor size and starting operative approach were not associated with margins. MIA which were converted had an increased positive margin rate relative to complete MIA on univariable (37.7% vs 17.7%, p=0.001) and multivariable analyses (OR=2.69, p=0.01). Patients who required conversion (median survival 32.8 months) had poor median survival relative to OA (60.6 months, p=0.01) and complete MIA (56.0 months, p=0.01). Complete MIA was not associated with survival relative to OA (HR=1.06, p=0.69), but conversion (HR=1.80, p=0.01), positive margins (HR=2.15, p<0.001), and increasing size (>10 vs <5 cm: HR=1.68, p=0.02) were all associated with poor survival. Conclusion: Positive margins are associated with a survival disadvantage in ACC. Tumors ≥5 cm were associated with an increased likelihood of conversion, and a subsequent increased rate of positive margins. MIA may be considered for select patients, such as those with tumors <5 cm, but surgeons must assure an adequate oncologic resection with negative margins.

31

Gastric Neuroendocrine Tumors: Reappraisal of Type in Predicting Outcomes A. Hanna,[1]* C. Kim-Kiselak,[1] R. Tang,[2] D. Metz,[1] Z. Yang,[1] R. DeMatteo,[1] D. Fraker,[1] R. Roses.[1] *1. University of Pennsylvania, Philadelphia, PA; 2. Massachusetts General Hospital, Boston, MA.*

Introduction: Type 1 gastric neuroendocrine tumors (GNETs) are typically indolent, multifocal and managed either expectantly or endoscopically. In contrast, locoregional surgery has traditionally been recommended for patients with Type 3 GNETs due to the risk of metastasis. Despite these generalizations, patients can and do present with aggressive Type 1 or indolent Type 3 GNETs. This study aimed to identify predictors of outcome in GNET independent of tumor type. Methods: A single-institution retrospective cohort study of 121 patients with a pathologic diagnosis of primary GNET between January 2009 and March 2019 was performed. GNETs were designated as Type 1 (n=74) if atrophic gastritis was present, or as Type 3 (n=47) in the absence of atrophic gastritis and gastrinoma. Patients with Type 2 GNETs were excluded from the analysis. Demographic, clinical, and histopathologic factors were compared between and within the groups. Kaplan-Meier and multivariable Cox regression analysis was used to assess the impact of various factors on progression free survival (PFS), regional and distant metastasis and overall survival (OS).

Results: Median follow up for the entire cohort was 60.1 months, with 5 year PFS and OS of 52% and 89.1%, respectively. On multivariable Cox regression, Type 1 GNETs were more likely to recur or progress than Type 3 GNETs (HR = 4.63, p < 0.001). While there was no difference in OS between GNET types (HR = 0.38, p = 0.09), higher tumor grade (HR = 13.6, p = 0.02), presence of nodal or distant metastases (HR = 4.2, p = 0.03), and tumor size above 0.5 cm (HR = 1.46, p = 0.03) predicted shorter OS on multivariable analysis. Patients with small (<0.5cm) and low grade tumors ("low risk") were less likely to develop regional or distant metastases (logrank p < 0.001). Low risk patients showed longer 5 year OS among Type 3 patients (100% vs 67.3%, p < 0.05; Figure 1) but not among Type 1 GNET patients. Conclusions: Tumor grade and size predict survival in patients with GNETs, regardless of tumor type. Small and low grade Type 3 GNETs are associated with a low risk of progression and may be managed less aggressively.

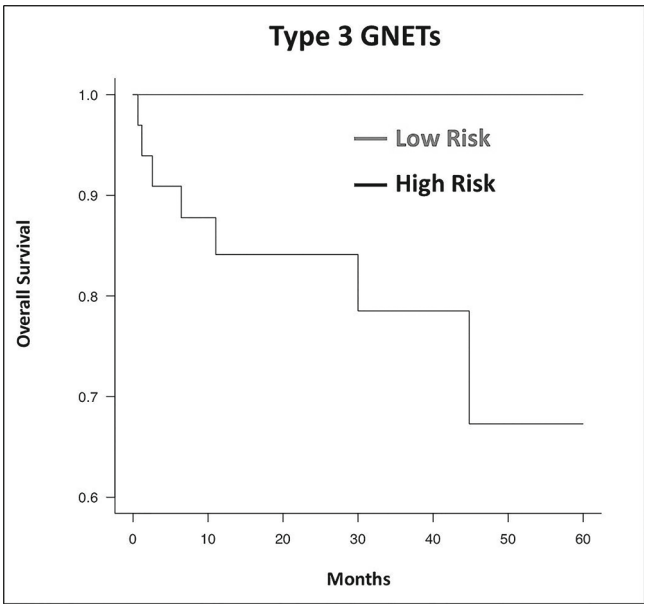


Figure 1 Kaplan Meieir comparison of overall survival between low risk (tumor size < 0.5 cm and grade 1) and high risk (tumor size > 0.5 or grade 2/3) Type 3 GNETs

32

Management of Duodenal Neuroendocrine Tumors: Surgical Versus Endoscopic Mucosal Resection C.G. Tran,* S.K. Sherman, M.O. Suraju, A. Nayyar, H. Gerke, R. El Abiad, C. Chandrasekharan, J.S. Dillon, T.M. O'Dorisio, P. Ear, A.M. Bellizzi, J.R. Howe. *University of Iowa, Iowa City, IA.*

Background Management of duodenal neuroendocrine tumors (dNETs) is not standardized, with smaller lesions (<1-2cm) generally treated by endoscopic mucosal resection (EMR) and larger dNETs by surgical resection (SR). This study reviewed how patients were selected for these therapies and compared outcomes. Methods Patients with dNETs undergoing EMR or SR were identified through our pathology and NET database, and clinicopathologic variables recorded. Chi-squared and Wilcoxon tests compared variables. Survival was determined by Kaplan-Meier analysis, and Cox regression tested association with survival. Results In 103 patients, 63 underwent EMR and 40 had SR. Patients selected for SR had larger tumor size, higher T-stage, more frequent nodal and distant metastases, and younger age (Table). There was no significant difference in progression-free (PFS) and overall survival (OS) between EMR and SR patients. Seven patients had local recurrence post-EMR. Four of these patients had original tumor size >1cm and one was node-positive. In patients with 1-2cm dNETs, PFS was similar between patients undergoing SR and EMR (median not reached [NR], log-rank p = 0.21); however, longer OS was seen in SR compared to EMR patients (median NR vs. 112 months, log-rank p = 0.02). In 1-2cm dNETs, SR patients were more likely to be node-positive and younger (median 60 vs. 73 years), with no differences in T stage, grade, tumor size, or Charlson score. After bivariable Cox adjustment for age, resection method did not correlate with survival. Comparison of patients with surgically resected dNETs vs. 256 with jejunoileal NETs revealed significantly longer PFS (median NR vs. 47.6 months, HR 3.56, P = 0.001) and OS (median 173 vs. 119 months, HR 2.3, P = 0.03) in dNET patients. Discussion Patients with more advanced dNETs are generally selected for SR. In patients with intermediate-sized tumors (1-2cm), outcomes for EMR and SR were roughly equivalent, and recurrences could be salvaged, suggesting that initial EMR is a reasonable strategy. Tumors larger than 2cm or with nodal or liver metastases may be better managed by SR. In comparison to jejunoileal NETs, dNETs treated by SR had improved PFS and OS.

Clinicopathologic factors and survival outcomes in patients with duodenal neuroendocrine tumors undergoing endoscopic mucosal resection and surgical resection

Variable		Total (n = 103)	EMR (n = 63)	Surgical resection (n = 40)	P value	EMR, 1-2 cm (n = 20)	Surgical resection, 1-2 cm (n = 15)	P value
Sex (%)	Female	47 (46%)	27 (43%)	20 (50%)	0.61	8 (40%)	7 (47%)	0.96
	Male	56 (54%)	36 (57%)	20 (50%)		12 (60%)	8 (53%)	
Age at resection, median (range)		63.9 (28.5-87)	69.4 (28.5-87)	57.9 (36.9-75.6)	< 0.001	72.6 (31.2-85.5)	59.2 (37.3-70.9)	0.04
Tumor size, median, mm (range)		11 (1-148)	7 (1-36)	15 (5-148)	0.001	13 (10-16)	12 (10-18)	0.95
Grade (%)	1	41 (66%)	27 (73%)	14 (56%)	0.21	8 (62%)	6 (60%)	1
	2	20 (32%)	10 (27%)	10 (40%)		5 (38%)	4 (40%)	
	3	1 (2%)	0 (0%)	1 (4%)		0 (0%)	0 (0%)	
Progressed (%)	No	74 (82%)	47 (85%)	27 (77%)	0.47	12 (75%)	11 (92%)	0.36
	Yes	16 (18%)	8 (15%)	8 (23%)		4 (25%)	1 (8%)	
Died (%)	No	67 (74%)	39 (70%)	28 (82%)	0.28	11 (65%)	11 (100%)	0.05
	Yes	23 (26%)	17 (30%)	6 (18%)		6 (35%)	0 (0%)	
T stage (%)	1	30 (42%)	25 (61%)	5 (16%)	< 0.001	3 (25%)	3 (20%)	1
	2	33 (46%)	14 (34%)	19 (61%)		8 (67%)	10 (67%)	
	3	6 (8%)	2 (5%)	4 (13%)		1 (8%)	2 (13%)	
	4	3 (4%)	0 (0%)	3 (10%)		0 (0%)	0 (0%)	
PFS, median, months		NR	NR	NR	0.64	NR	NR	0.21
OS, median, months		NR	118	NR	0.15	112	NR	0.02
Follow-up, median, months		68.2	56.2	95.7	0.85	55.6	51.8	0.88

33

RNA Sequencing in SBNETs to Identify Novel Therapeutic Targets S.K. Sherman,[1]* C.G. Tran,[1] X.L. Peng,[2] A.C. Reisetter,[3] A.T. Scott,[1] G. Li,[1] B.J. Brown,[4] T.A. Braun,[4] P. Breheny,[3] P. Ear,[1] J.J. Yeh,[5] J.R. Howe.[1] *1. Department of Surgery, University of Iowa Carver College of Medicine, Iowa City, IA; 2. Lineberger Comprehensive Cancer Center and Department of Pharmacology, University of North Carolina, Chapel Hill, NC; 3. Department of Biostatistics, University of Iowa College of Public Health, Iowa City, IA; 4. Center for Bioinformatics and Computational Biology, University of Iowa College of Engineering, Iowa City, IA; 5. Lineberger Comprehensive Cancer Center and Department of Surgery, University of North Carolina, Chapel Hill, NC.*

Introduction: Finding molecular drivers of small bowel neuroendocrine tumors (SBNETs) is important for identifying new therapeutic targets. Bulk RNAseq data includes expression from non-tumor tissues, obscuring pathways responsible for tumorigenesis. We hypothesized that new methods would allow selection of tumor-specific genes for pathway analysis. Methods: Normal, primary tumor, nodal, and liver metastasis tissues were collected from 39 SBNET patients and RNASeq performed. DESeq2 compared gene expression in tumor vs. normal tissue using paired analyses with false-discovery rate correction. Tumor genes of interest were identified by selecting genes significantly over/underexpressed in all 3 tumor sites vs. normal, and with the DECODER non-negative matrix factorization algorithm. Ingenuity Pathway Analysis (IPA) was performed using these genes to identify common pathway and regulatory factors. Results: There were 1461 genes with ≥2-fold expression differences at p<0.001 in all 3 tumor sites vs. normal, and 1009 genes categorized as key tumor genes by the DECODER algorithm. These independent gene sets were similar with 88% of DECODER genes in the top expression decile, supporting utility of both methods in identifying differentially expressed SBNET genes. Identified genes included enzymes, ion channels/transporters, transcription factors, receptors, and kinases (153, 109, 75, 58, and 42 genes). Using IPA, key genes indicated activation of synaptogenesis, opioid, and Akt/PI3K signaling pathways. Predicted regulators of observed expression included calcium homeostasis, NEUROG3, MITF, HDAC, and REST pathways (Table). Drugs targeting these pathways include established ones such as somatostatin

or Akt/MapK/Erk inhibitors, as well as histone deacetylase inhibitors and calcium modulators. Conclusions: Filtering gene expression analysis using two complementary methods helped remove confounding expression from non-tumor tissues in bulk RNAseq data, identifying genes with important roles in SBNET tumorigenesis. These genes affect known pathways and highlight potential for further investigation of HDAC and calcium systems. We are currently using SBNET spheroid models to test promising candidate drugs.

Table: Predicted significantly affected pathways, genes, and their roles in cellular processes. Fold changes shown are the smallest fold-change across primary tumors, nodal, and liver metastases relative to normal small bowel.

Pathway	Gene	Name	Fold Change	Cellular Role
Synaptogenesis Signaling (Activated)	CAMK2B	Calcium/Calmodulin dependent protein kinase II beta	33.6	Neuronal differentiation, G1/S transition
	CDH12	Cadherin 12	21.4	Regulation of epithelial-mesenchymal transition, Wnt/B-catenin signaling, cellular adhesion
Opioid Signaling (Activated)	PRKCG	Protein kinase C gamma	32.8	Signal transduction via diacyl glycerol, cellular survival
	OPRK1	Opioid receptor kappa 1	27.9	Surface receptor, inhibition of adenylate cyclase
cAMP Response Element Binding (CREB) Signaling (Activated)	GRIA2	Glutamate ionotropic receptor AMPA type subunit 2	22.6	Glutamate receptor regulating ion influx, vesicle binding
	RASD1	Ras related dexamethasone induced 1	6.0	MAP/ERK kinase regulation, growth, differentiation
RE1-Silencing Transcription Factor (REST) (Inhibited)	PCSK1	Proprotein convertase subtilisin/kexin type 1	91.9	Pro-hormone processing, glucagon, insulin processing
	SYP	Synaptophysin	5.4	Synaptic vesicle membrane protein
Histone Deacetylase (HDAC) (Inhibited)	NEUROD1	Neuronal differentiation 1	16.7	Chromatin binding, transcriptional regulation of neuronal genes, differentiation
	SSTR2	Somatostatin receptor type 2	8.6	Somatostatin signaling, inhibition of hormones and secretory proteins
NEUROG3 Transcription Factor (Activated)	NKX2-2	NK2 homeobox 2	41.1	Transcription factor, role in neuronal differentiation, development, endocrine disorders
	ST18	Suppression of tumorigenicity 18	31.7	Transcription factor, role in proliferation, apoptosis, RNA transcription
Calcium Homeostasis (Activated)	MYT1	Myelin transcription factor 1	27.7	Transcription factor, regulates cyclin-dependent kinases, PTEN, neural-specific genes in development
	CASR	Calcium sensing receptor	13.1	Membrane protein responding to extracellular calcium
Micro-Ophthalmia Inducible Transcription Factor (MITF) (Activated)	TPH1	Tryptophan hydroxylase 1	61.2	Serotonin synthesis
	QDPR	Quinoid dihydropteridine reductase	9.8	NADPH binding, phenylalanine degradation, serotonin synthesis

34

Incidence and Predictors of Secondary Cancers in Neuroendocrine Tumors S. Bateni,* N. Coburn, C.H. Law, S. Singh, S. Myrehaug, A. Assal, J. Hallet. *University of Toronto, Toronto, ON, Canada.*

INTRODUCTION: While long-term follow-up is crucial for neuroendocrine tumors (NET) due to prolonged survival, data on secondary cancers (SC) are scarce. We evaluated the risk and predictors of SC after NET diagnosis. METHODS: We performed a population-based retrospective cohort study of gastrointestinal (GI) and pulmonary NET from Surveillance, Epidemiology, and End Results (SEER) (2000-2016). Standardized incidence ratios (SIR) were calculated to compare SC incidence among NET to the general US population. Accounting for the competing risk of death, we examined the incidence of SC with cumulative incidence functions (CIF) and predictors of SC were identified with Fine-Gray multivariable models. RESULTS: We identified 58,596 NET patients. NET had increased incidence of SC for all cancers (SIR 1.35, 95%CI 1.31-1.39), GI cancers (SIR 1.90, 95%CI 1.79-2.00), lung cancers (SIR 1.36, 95%CI 1.26-1.47), and prostate cancer (SIR 1.28, 95%CI 1.18-1.38). Gastric NET had increased incidence of enteric SC, rectal NET had increased incidence of colorectal SC, and appendiceal NET had increased incidence of enteric and colorectal SC (Table 1). Enteric NET did not have an increased incidence of colorectal SC. Median time to SC was 40 months (IQR 17-77). The 5-year CIF of SC was 5.4% (95%CI 5.2-5.6%) for all NET, 5.9% (95%CI 5.6-6.2%) for GI NET, 3.8% (95%CI 3.3-4.4%) for pancreas NET, and 4.8% (95%CI 4.4-5.2%) for pulmonary NET. Factors independently associated with SC were age 60-69 (sub-hazard ratio [sHR] 5.71, 95%CI 3.90-8.38) and 70-79 years (sHR 5.43, 95%CI 3.69-7.98), and enteric NET (sHR 1.15, 95%CI 1.05-1.25). Factors inversely associated with SC included pancreatic NET (sHR 0.82, 95%CI 0.72-0.93), regional (sHR 0.83, 95%CI 0.77-0.90) or distant NET stage (sHR 0.39, 95%CI 0.35-0.43), and poorly (sHR 0.69, 95%CI 0.58-0.81) or undifferentiated NET (sHR 0.45, 95%CI 032-0.64). Stratified analyses by NET site had similar findings. CONCLUSIONS: There is an increased incidence of SC after NET diagnosis, with different patterns from known NET-related genetic syndromes. These data should be used to include secondary prevention in surveillance strategies tailored to NET type and patient risk factors.

Table 1. Standardized incidence rates for secondary cancers for patients with NETs compared to the US population, stratified by NET primary site.

		Standardized incidence rate (95%CI) for secondary cancers								
		All cancers	Gastric cancers	Enteric cancers	Colorectal cancers	Pancreas cancers	Thyroids cancers	Lung cancers	Prostate cancers	Urinary cancers
Primary NET site	All	1.35 (1.31-1.39)	5.02 (4.45-5.63)	7.86 (6.61-9.29)	1.44 (1.32-1.58)	1.66 (1.42-1.93)	2.82 (2.42-3.27)	1.36 (1.26-1.47)	1.28 (1.18-1.38)	1.25 (1.12-1.39)
	Gastric	2.04 (1.87-2.23)	*	9.85 (5.25-16.8)	0.99 (0.64-1.46)	2.59 (1.60-3.95)	3.5 (2.07-5.70)	0.97 (0.69-1.34)	0.90 (0.60-1.58)	1.04 (0.65-1.58)
	Enteric (small bowel)	1.22 (1.14-1.29)	1.44 (0.90-2.18)	*	0.80 (0.62-1.01)	1.40 (1.00-1.92)	2.61 (1.81-3.65)	1.02 (0.86-1.21)	1.35 (1.17-1.55)	124 (1.01-1.50)
	Appendix	1.68 (1.46-1.92)	1.64 (0.34-4.80)	20.7 (11.0-35.5)	3.04 (2.09-4.27)	2.12 (0.85-4.37)	1.82 (0.67-3.96)	1.62 (1.05-2.40)	1.04 (0.63-1.60)	2.17 (1.36-3.29)
	Rectal	1.22 (1.15-1.30)	1.25 (0.76-1.93)	1.63 (0.70-3.22)	2.36 (2.04-2.70)	1.45 (1.02-1.99)	1.72 (1.17-2.44)	1.20 (1.02-1.41)	1.43 (1.25-1.63)	0.98 (0.76-1.23)
	Pancreas	1.16 (1.04-1.30)	2.49 (1.24-4.46)	8.79 (4.54-15.4)	0.65 (0.37-1.06)	*	+	0.96 (0.67-1.33)	1.03 (0.76-1.37)	+
	Pulmonary	1.41 (1.32-1.50)	0.74 (0.32-1.47)	1.14 (0.31-2.91)	1.01 (0.79-1.28)	1.44 (0.99-2.03)	3.90 (2.92-5.10)	*	1.31 (1.07-1.58)	1.54 (1.23-1.90)

* not reported because risk of misclassification of multifocal/recurring NET at same primary site; + not reported due to secondary cancer sites associated with multiple endocrine neoplasia (MEN) syndromes

35

A Change in Surgical Margin: Do Wider Surgical Margins Lead to Decreased Rates of Local Recurrence in T1 and T2 Oral Tongue Cancer? J.R. Daniell,[1]* D. Rowe,[1] D. Wiesenfeld,[1] L. McDowell,[2] K. Hall,[3] A. Nastri,[1] T.A. Iseli,[1] T. Wong.[1] *1. The Royal Melbourne Hospital, Parkville, VIC, Australia; 2. Peter MacCallum Cancer Centre, Melbourne, VIC, Australia; 3. University of Adelaide, Adelaide, SA, Australia.*

Introduction: To assess the impact of a change in macroscopic/surgical margin (SM) width upon histological margins (HM) and locoregional failure (LRF) in early oral tongue squamous cell carcinoma (OTSCC). Methods: In 2009 we made a change to our SM protocol, increasing the SM from 10mm to 15mm. This was following a retrospective review of our historical outcomes, treated between 1999 and 2008 at the same institution, in early OTSCC patients (n=78). We conducted a retrospective review of all patients (n=142) who underwent treatment for early OTSCC between 2009 and 2016 following the increase in SM to 15mm. The outcomes of our study were analysed in comparison with the Iseli et al study. Results: There was a significant increase (Absolute Difference (AD) 33.1%, Relative Difference (RD) 52%, Odds Ratio (OR) 4.01, 95% Confidence Interval (CI) 2.14 to 7.59, P <0.001) in the rate of clear HM. The rates of close (AD 21.9%, RD 63%, OR 0.41, CI 0.22 to 0.75, P 0.002) and involved (AD 11.4%, RD 850%, (OR 0.10, 95% CI 0.01 to 0.48, P <0.001) HM decreased significantly. In our cohort LRF decreased, with significant reductions in local (AD 24.7% RD (OR 0.09, CI 0.03 to 0.27, P <0.001) and regional (AD 24.6%, OR 0.12 CI 0.04 to 0.32) recurrence rates. Conclusion: This study demonstrates that a SM of 15mm delivers significantly lower rates of close/involved HM and improved local and regional disease recurrence in early OTSCC when compared with 10mm.

Comparison of 15mm vs. 10mm surgical margin

	15mm surgical margin, n (%)	10mm surgical margin, n (%)	OR (95% CI)	P-Value
Surgical Margin status				
Clear	91 (64.1)	24 (30.8)	4.01 (2.14, 7.59)	<0.001
Close	49 (34.5)	44 (56.4)	0.41 (0.22, 0.75)	0.002
Involved	2 (1.4)	10 (12.8)	0.10 (0.01, 0.48)	<0.001
Disease status at last follow-up				
Local Recurrence	5 (3.5)	22 (28.2)	0.09 (0.03, 0.27)	<0.001
Regional Recurrence	7 (4.9)	23 (29.5)	0.12 (0.04, 0.32)	<0.001
Death	33 (23.9)	19 (34.5)	0.60 (0.29, 1.26)	0.133

36

Identification of SYCP2 as a Candidate Epigenetically-Regulated Driver of HPV16-Positive Head and Neck Cancers D. Wong,[1]* A. Berglund,[2] R. Putney,[2] A. Elahi,[1] A. Ajidahun,[1] E. Siegel,[2] I. Getun,[1] E.S. Glazer,[1] D. Shibata.[1] *1. Surgery, University of Tennessee Health Science Center, Memphis, TN; 2. Moffitt Cancer Center, Tampa, FL.*

Introduction: Human papillomavirus (HPV)-associated carcinogenesis is thought to be mediated in part by broad HPV type-specific alterations in host DNA methylation. HPV is a major etiologic factor for 30-60% of head and

neck squamous cell carcinomas (HNSCC) with HPV16 being most common. Using multi-omic resources from The Cancer Genome Atlas (TCGA), including genome-wide methylation and RNA-Seq gene expression data, we sought to identify candidate epigenetic drivers of HPV16-associated HNSCC. Methods: Within TCGA, 59 HPV16+ HNSCC, 238 HPV- HNSCC and 50 normal head/neck mucosal tissues (NMT) were identified. Differentially methylated regions (FDR<0.01, Δβ>0.03; Illumina HumanMethylation 450K Array) across sample types and corresponding changes in gene expression (RNA-Seq) were identified. Methylation and expression changes for SYCP2 were examined across multiple cancer types via TCGA's Pan-Cancer Atlas. Overall (OS) and disease-specific (DSS) survival correlations were performed by the Kaplan-Meier method. Validation of expression (quantitative RT-PCR) and methylation (methylation-specific PCR) was performed in HNSCC cell lines (CRL3212 HPV16+, HTB43 HPV-). Results: Of a panel of differentially methylated genes, SYCP2 (Synaptonemal Complex Protein 2) was identified as the target of greatest interest. SYCP2 was among the most significantly hypomethylated (FDR<0.01) genes with concordant increase in gene expression in HPV16+ HNSCC compared to HPV- HNSCC and NMT. SYCP2 has been previously reported to be overexpressed in HPV+ HNSCC. The TCGA Pan-Cancer Atlas demonstrated that SYCP2 is hypomethylated with overexpression in other tumor types (e.g. bladder adenocarcinoma). SYCP2 expression in HNSCC was associated with improved OS (HR=0.56, p=0.004) and DSS (HR=0.47, p=0.003). Hypomethylation and increased expression was demonstrated in HPV16+ CRL3212 but not in HTB43. Conclusion: Leveraging the multi-omic resources of TCGA, we have identified SYCP2 to be a candidate epigenetically-regulated driver of HPV16+ HNSCC with validation of hypomethylation and expression in vitro. Further investigation of the oncogenicity of SYCP2 in HNSCC and other cancers is warranted.

37

Patterns of Whole Genome Sequencing and Actionable Mutations in Resected Cholangiocarcinoma L.W. Thornblade,* P. Wong, D. Li, S.G. Warner, M. Raoof, J. Kessler, A. Amini, J. Lin, V. Chung, G. Singh, Y. Fong, L. Melstrom. *Surgery, City of Hope National Medical Center, Duarte, CA.*

INTRODUCTION: Cholangiocarcinoma is an uncommon cancer with limited chemotherapeutic options and a 5-year survival of 15%. Gene expression profiling can identify actionable mutations that make tumors susceptible to targeted therapies. To assess the frequency of actionable mutations, we examined results of tumor genomic profiling for patients with resected cholangiocarcinoma. METHODS: We performed an IRB-approved retrospective review of patients with cholangiocarcinoma treated with resection at a comprehensive cancer center (2010-2020). Records were sampled for risk factors, tumor features, and treatment characteristics. For any patient whose tumor was analyzed by partial or whole exome sequencing, we report the mutational burden, distribution of mutations, and potential targeted therapies. Outcomes examined included recurrence and death. RESULTS: A total of 114 patients (mean 65±11 years, 45% female) underwent resection during the study period. Mean tumor size was 4.5±2.5cm, 54% were intrahepatic, and 46% were poorly differentiated. One third had pathologically positive lymph nodes (36%), and 75% had margin negative (R0) resections. Adjuvant therapies included chemotherapy (75%), radiation (40%), and immunotherapy (10%). 32% of patients underwent tumor genomic profiling yielding a mean of 3.1 actionable mutations per patient (range 0-14). Mean mutational burden was 2.4/Mb. Mutations aligned with a median of 1 targeted drug per patient (range 0-11). Most common mutations included KRAS (24%), p53 (24%), IDH1/2 (14%), PIK3CA (11%), and BRAF V600E (8%). Targeted therapies were applied for only 4% of patients in this series. At a median of 22 months follow up, 23% had evidence of recurrence and 29% were deceased. DISCUSSION: While use of tumor genomic profiling via whole exome sequencing has increased over the last decade, it is applied in only a minority of patients with cholangiocarcinoma. In this series, mutations associated with approved drugs were identified in a majority of sequenced tumors, emphasizing the need for uniform incorporation of whole genome sequencing in all tumors to inform consideration of targeted therapies into cholangiocarcinoma treatment algorithms.

38

COX-2 Expression is Associated with Poor Disease-Free and Overall Survival in Cholangiocarcinoma: A Potential Target for Intervention P. Burchard,* L.I. Ruffolo, N. Ullman, B. Belt, A. Chacon, R. Hernandez-Alejandro, D.C. Linehan. *Surgery, University of Rochester, Rochester, NY.*

Introduction: Cholangiocarcinoma (CCA) is the second most frequently diagnosed primary liver malignancy. A prominent feature of CCA is the presence of a dense fibro-inflammatory reaction and elevated leukocyte infiltrate. Cyclooxygenase 2 (Cox-2) is a mediator of inflammatory prostaglandin synthesis and recent evidence demonstrates elevated Cox-2 expression in some cancers correlates poorly with survival and is associated with the gain of malignant cellular features. Here we present our findings of Cox-2 expression within the human CCA tumor microenvironment (TME) and a spontaneous murine model of CCA. Methods: A human CCA tissue macro-array was compiled of archived biliary tumor specimens at our institution over a 10-year period. Histology and Cox-2 immunohistochemistry (IHC) staining were performed on tumor and adjacent normal liver tissue sections. Mice with targeted expression of activated Kras and loss of p53 in the liver were intercrossed to generate KPPC mice that form CCA tumors that faithfully recapitulate the disease. KPPC hepatic tumors and normal livers from littermate controls underwent histological and genomic analyses. Results: Digital quantification of Cox-2 staining in human tumors demonstrated a 6-fold increase compared to normal biliary epithelium (p <0.0001). Kaplan-Meier analysis demonstrated that high Cox-2 expression correlated with worse disease-free (p = 0.027) and overall survival (p = 0.034) (Figure 1). Histology and IHC analysis of KPPC tumors revealed heavy sirius red staining and significantly increased tumor infiltrating CD45 leukocytes, similar to human CCA. RNA sequencing and gene expression analysis demonstrated that Cox-2 expression was the most significantly elevated gene in CCA tumors compared to littermate controls (p <0.0001). IHC confirmed elevated expression of Cox-2 by CCA tumors that localized to malignant biliary cells and stroma. Conclusion: Cox-2 is significantly elevated in human CCA and correlates with poor prognosis. Targeted therapies against Cox-2 represent an innovative therapeutic strategy and can be tested through this novel KPPC pre-clinical model prior to clinical translation.

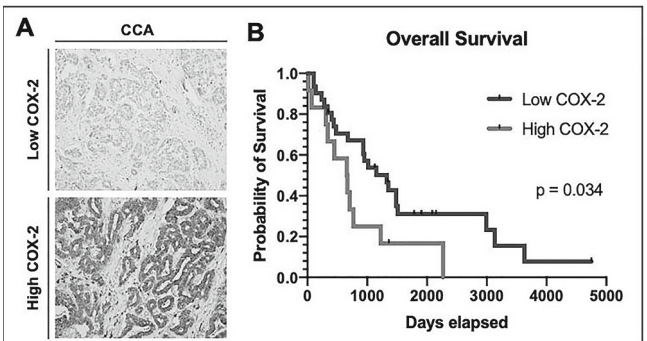


Figure 1. (A) Representative immunohistochemistry staining of cholangiocarcinoma (CCA) with high and low COX-2 expression. (B) Survival analysis of patients with high and low COX-2 expression

39

KRAS Mutation Predicts Magnitude of Response and Outcomes in Hepatic Arterial Infusion Pump Therapy of Unresectable Colorectal Liver Metastases H.M. Kolbeinsson,[3]* R. Preihs,[1] A. Bengel,[1] S. Chandana,[2] M. Assifi,[1] M. Chung,[1] G. Wright.[1] *1. Spectrum Health Medical Group, Division of Surgical Oncology, Grand Rapids, MI; 2. Cancer and Hematology Centers of West Michigan, Grand Rapids, MI; 3. Spectrum Health General Surgery Residency, Grand Rapids, MI.*

Background: KRAS mutation predicts negative outcomes following resection of colorectal liver metastases and adjuvant hepatic arterial infusion (HAI) pump chemotherapy. Less is known on the effects of KRAS mutation on tumor response in patients with unresectable colorectal liver metastases treated with HAI chemotherapy. Methods: This is a retrospective review investigating the effects of KRAS mutation on tumor response in patients with unresectable colorectal liver metastases treated with HAI chemotherapy. Maximal tumor response and objective response rate (ORR) was assessed with

computed tomography imaging. ORR was defined as cross-sectional decrease in target lesions by >50%. Results: Twenty-five patients with unresectable liver metastases from colorectal cancer were treated with HAI chemotherapy between August 2017 and May 2019. Median age was 59 (range 35-77) and 13 (52%) were male. Median number of liver lesions was 12 (range 1-59) and almost all (n=24) had prior chemotherapy before starting HAI therapy. Median number of cycles administered via HAI pump was 6 (range 3-12). Overall decrease in liver tumor burden was 63.5% (median, range -257 – 100%) with an ORR of 20/25 (80%) and 10 (40%) patients converting to resectable status. Eleven (44%) patients had KRAS mutation. When compared to wild-type, KRAS-mut tumors had a lower rate (7/11, 64% vs 13/13, 100%; p=0.03) and magnitude of response (median 58% vs 70%; p=0.04). Fewer patients with KRAS-mut tumors converted to resectable status during HAI therapy (2/11 vs 8/13, p=0.05). Figure 1 shows individual tumor burden response based on mutational status. Conclusions: KRAS mutational status in patients with unresectable liver metastases from colorectal cancer predicts worse response to HAI chemotherapy.

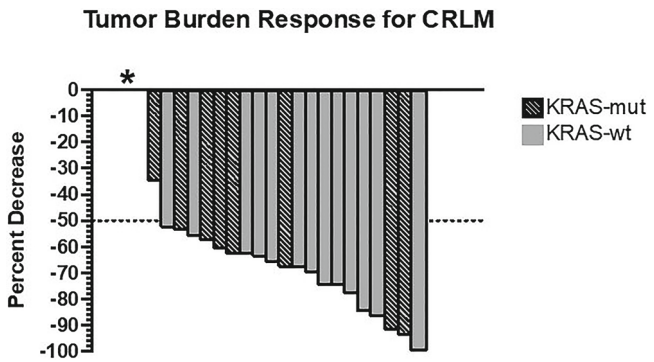


Figure 1. Waterfall plot of response rate by mutation status

40

Alpha-Fetoprotein at Time of Recurrence Predicts Post-Recurrence Outcomes Following Resection of Hepatocellular Carcinoma

D.I. Tsilimigras,[1]* M. Hyer,[1] F. Bagante,[1] D. Moris,[1] F. Ratti,[2] H. Marques,[3] O. Soubrane,[4] V. Lam,[5] G. Poultsides,[6] I. Popescu,[7] S. Alexandrescu,[7] G. Martel,[8] A. Workneh,[8] A. Guglielmi,[9] T. Hugh,[10] L. Aldrighetti,[2] I. Endo,[11] T.M. Pawlik.[1] *1. Department of Surgery, The Ohio State University Wexner Medical Center, Columbus, OH; 2. Ospedale San Raffaele, Milano, Italy, Milan, Italy; 3. Curry Cabral Hospital, Lisbon, Portugal; 4. Beaujon Hospital, Clichy, France; 5. Westmead Hospital, Sydney, NSW, Australia; 6. Stanford University, Alto Palo, CA; 7. Fundeni Clinical Institute, Bucharest, Romania; 8. University of Ottawa, Ottawa, ON, Canada; 9. University of Verona, Verona, Italy; 10. The University of Sydney, Sydney, NSW, Australia; 11. Yokohama City University School of Medicine, Yokohama, Japan.*

Introduction: While preoperative α-fetoprotein (AFP) is an important tumor marker among patients with hepatocellular carcinoma(HCC), the predictive value of AFP levels at time of recurrence relative to subsequent outcomes has not been examined. We sought to assess the impact of AFP levels detected at time of recurrence on outcomes of patients with recurrent HCC. Methods: Patients undergoing curative-intent resection of HCC between 2000-2017 were identified using an international multi-institutional database. Impact of AFP levels at time of recurrence on post-recurrence outcomes were examined. Results: Among 852 patients who underwent resection of HCC, 307 (36.0%) developed a recurrence. Median AFP levels at time of recurrence was 8 ng/ml (IQR: 3-100); most patients developed recurrence within 2 years following resection (early recurrence: 77.2%). Among 307 patients who developed recurrence, median and 3-year post-recurrence survival was 34.4 months and 48.5%, respectively. Patients with AFP>10ng/ml at time of recurrence had worse 3-year post-recurrence survival compared with individuals with AFP<10ng/ml (28.7% vs 66.5%;p<0.001). AFP correlated with survival among patients who had early (3-year survival: AFP>10 vs <10ng/ml, 30.1% vs 60.2%;p<0.001) or late (18.1% vs 78.7%;p=0.03) recurrence. AFP levels predicted 3-year post-recurrence survival among patients independent of therapeutic modality used to treat recurrent HCC (AFP>10 vs <10ng/ml; ablation+/-chemo [27.0%]; 41.1% vs 76.0%, IAT+/-chemo [22.5%]; 12.9% vs 46.1%, resection+/-ablation [10.7%]: 37.5% vs 100%; salvage transplantation [4.6%]: 60% vs 100%; all p<0.05). After adjusting for competing risk factors, patients with AFP>10ng/ml at time of recurrence had a two-fold higher hazard of death in the post-recurrence setting (HR 2.06, 95%CI 1.39-3.06). Conclusion: AFP levels at the time of recurrence following resection of HCC predicted post-recurrence survival independent of the secondary treatment modality used. Evaluating AFP levels at the time of recurrence can help inform post-recurrence risk stratification of patients with recurrent HCC.

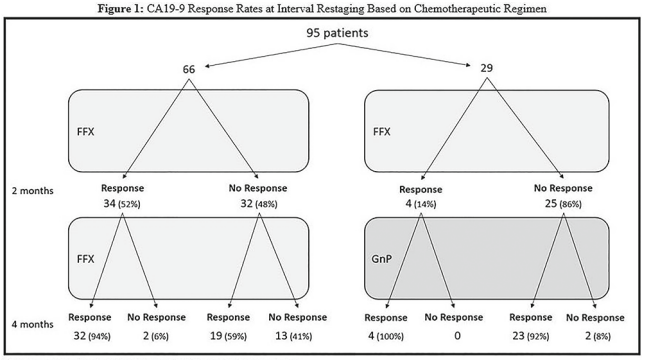
41

CA19-9 Response to 1st-Line Neoadjuvant FOLFIRINOX and 2nd-Line Gemcitabine-Based Chemotherapy in Patients with Operable Pancreatic Cancer

S. Thalji,[1]* M. Kamgar,[2] B. George,[2] M. Aldakkak,[1] K. Christians,[1] C.N. Clarke,[1] B. Erickson,[3] W. Hall,[3] P. Tolat,[4] A. Khan,[5] D.B. Evans,[1] S. Tsai.[1] *1. Medical College of Wisconsin, Department of Surgery, Division of Surgical Oncology, Milwaukee, WI; 2. Medical College of Wisconsin, Department of Medicine, Division of Medical Oncology, Milwaukee, WI; 3. Medical College of Wisconsin, Department of Radiation Oncology, Milwaukee, WI; 4. Medical College of Wisconsin, Department of Radiology, Milwaukee, WI; 5. Medical College of Wisconsin, Department of Medicine, Division of Gastroenterology, Milwaukee, WI.*

Introduction: A benefit of neoadjuvant (NeoTX) therapy for operable pancreatic cancer (PC) is the ability to assess treatment response. We examined carbohydrate antigen 19-9 (CA19-9) response to 1st and 2nd line chemotherapy (CTX). Methods: We identified patients (pts) with operable PC and elevated CA19-9 (>35 U/mL with total bilirubin <2 mg/dL) at diagnosis who received FOLFIRINOX (FFX) as initial treatment. Pts were then restaged after the first 2 months (mo) of FFX and we examined those who received an additional 2 mo of CTX. The second 2 mo of CTX consisted of either additional FFX or gemcitabine/nab-paclitaxel (GnP) based on physician judgement as part of a total NeoTX approach. CA19-9 was assessed at 2 mo intervals and response was defined as a ≥50% decline in CA19-9 from previous peak value. Results: Among 202 pts, 1st-line NeoTX FFX (2 mo) was associated with a CA19-9 response in 74 (37%) of 199 pts with evaluable CA19-9 levels. Following 2 mo of FFX, 85 (43%) of 199 pts were transitioned to radiotherapy, 15 (7%) had surgery, 4 (2%) stopped treatment, and 95 (48%) received an additional 2 mo of CTX. Of these 95 pts, FFX was continued in 66 (69%) and switched to GnP in 29 (31%). Pts who remained on FFX were more likely to have had a significant CA19-9 response to FFX (p=0.001). Of the 66 pts who stayed on FFX, 34 had a CA19-9 response to the initial 2 mo of chemo and 32 did not. Of these 32 pts, 19 additional pts (59%) had a response during the next 2 mo of FFX. Of the 29 pts who were switched to GnP, 4 had a CA19-9 response to the initial 2 mo of FFX (switched due to toxicity) and 25 did not. Of these 25 pts, 23 pts (92%) demonstrated a response when switched to GnP. In total, after 4 mo of CTX, 51 (77%) of the 66 pts who stayed on FFX had a CA19-9 response compared to 27 (93%) of the 29 pts who switched to GnP (p=0.06) (Figure 1). Conclusions: Pts with operable PC who lack a CA19-9 response to initial NeoTX FFX have very high rates of biochemical response when switched to GnP. Differences in CTX susceptibility may be related to cancer subtype and are being investigated in our clinical trials of adaptive NeoTX therapy.

Figure 1: CA19-9 Response Rates at Interval Restaging Based on Chemotherapeutic Regimen

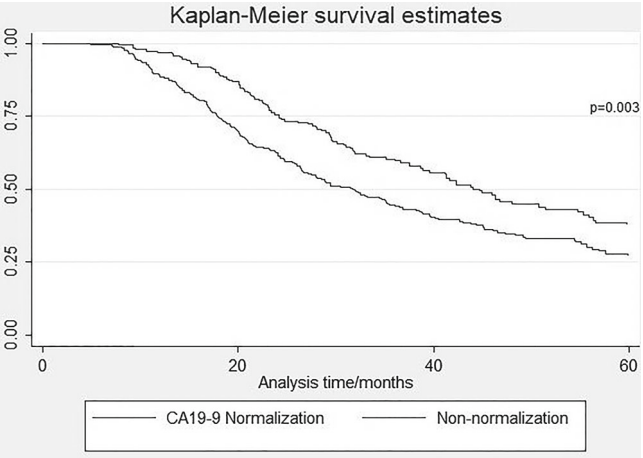


* Response defined as a ≥50% decline in CA19-9 from previous peak value
† FFX, FOLFIRINOX; Gnp, gemcitabine/nab-paclitaxel

42

The Clinical Impact of CA19-9 Normalization Following Neoadjuvant Therapy in Pancreatic Cancer: A Multi-Institutional Study A.Y. Hammad,[1]* S.S. AlMasri,[1] A. Paniccia,[1] K.K. Lee,[1] N. Bahary,[1] A.L. Desilva,[1] M. Aldakkak,[2] D.B. Evans,[2] S. Tsai,[2] A. Zureikat.[1] *1. Surgery, University of Pittsburgh Medical Center, Pittsburgh, PA; 2. Medical College of Wisconsin, Milwaukee, WI.*

Background: Carbohydrate antigen 19-9 (CA19-9) is the most clinically useful biomarker for the diagnosis and management of pancreatic cancer (PC). Data on the significance of normalization of the CA19-9 level following neoadjuvant therapy (NAT) are seldom reported. We sought to examine the implications of CA19-9 normalization during NAT on overall survival (OS). Methods: Patients who underwent surgical resection following NAT between 2010-2018 were retrospectively reviewed and those who had an elevated CA19-9 data correlating with total bilirubin of <2 U/mL on pre-NAT laboratory investigations were included. Normalization was defined as a post-NAT CA19-9 level of <37 IU/ml. Kaplan-Meier survival estimates, and Cox-proportion hazard regression were performed to identify predictors of survival. Results: Four hundred fifty-three patients were included (mean age 65, 50% females). Normalization was observed in 42% of the cohort (n=190). Normalization was associated with longer duration of NAT (2.7 vs. 2 months, p=0.009) and receipt of neoadjuvant radiation (61% vs. 46%, p=0.002). Normalizers were found to have smaller pathologic tumor size (2.4 vs. 3.0 cm), higher incidence of lymph node negative disease (60%vs. 39%), negative surgical margins (78% vs 60%) and less frequent perineural or lymph-vascular invasion (39% vs.18% and 63% vs. 44% respectively) (all p<0.05). Normalization was also associated with an improved OS on Kaplan Meier estimates (45 vs 32months, p=0.003, Figure) and on multivariate Cox regression analysis (Hazard ratio: 0.74 (95%CI: 0.57-0.95), p=0.01). Conclusion: In this multi-institutional analysis, we demonstrate that CA19-9 normalization following NAT is a significant prognostic indicator in surgically resected PC. CA19-9 normalization may serve as a useful endpoint when assessing NAT efficacy and duration in localized PC.



43

Neoadjuvant Chemotherapy-Associated Liver Injury in Pancreatic Cancer: Incidence and Implications E. Nelson,* E. Larson, P. Starlinger, A. Matthew, A. Abu Rmilah, R. Groeschl, R. Graham, T. Smyrk, T.E. Grotz, R. Smoot, S. Cleary, D. Nagorney, M. Farnell, M. Kendrick, M. Truty. *Surgery, Mayo Clinic, Rochester, MN.*

Background: Hepatotoxic neoadjuvant chemotherapy (NAC) is used in borderline/locally advanced (BR/LA) pancreatic ductal adenocarcinoma (PDAC). Chemotherapy-associated liver injury (CALI) is a known detrimental sequela of these agents. The incidence and effect of CALI on outcomes is unknown in patients after pancreatectomy. Methods: In a prospective cohort of BR/LA PDAC patients undergoing pancreatectomy after NAC, we calculated pre-resection AST to platelet ratio index (APRI): a non-invasive evaluation of CALI. CALI incidence was determined by blinded hepatobiliary pathologists. Overall (OS) and progression-free survival (PFS) were compared using Cox models. Probability of pancreatic fistula (POPF) was modelled as a logit function and stratified into 4 levels. Results: 143 patients underwent pancreatectomy with liver biopsy after NAC for BR/LA PDAC. 92 (64%) had CALI: steatosis in 46%, steatohepatitis (CASH) in 24% and sinusoidal obstructive syndrome (SOS) with fibrosis in 37%. We found a significant positive association between preresection APRI and the degree of CASH and SOS. Presence of CALI was correlated with complete/near complete pathologic response (χ^2 p = 0.014). Duration of neoadjuvant FOLFIRINOX was associated with improved pathologic response (p = 0.01). After median follow-up of 19.7mo, patients with a preresection APRI >.5 had prolonged OS and DFS (Fig1A, B) as did patients with CALI (Fig1C, D). 83 patients underwent pancreaticoduodenectomy. Positive predictors of POPF were preresection APRI, duct diameter and blood loss. The discretized logit model (no- [<2%], low- [5%], med- [15%] and high- [>40%] risk for fistula) demonstrated higher calibration than our institution's prior model, more evenly distributed patients into risk categories and increased discrimination in lower risk patients. Conclusion: A significant proportion of patients develop CALI after NAC for BR/LA PDAC. Preoperative APRI is associated with CALI and both are associated with prolonged survival. CALI's positive association with survival and treatment response suggest that the benefits of aggressive NAC outweigh its hepatotoxic effects. APRI can be used to help predict POPF risk.

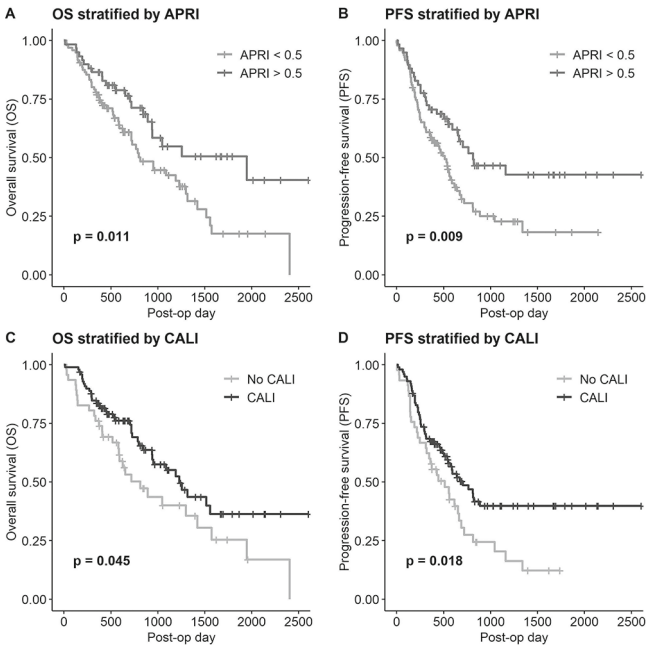


Figure 1: Patients with either preresection APRI >.5 (A, B; Cox p = .011; p = .009) or presence of CALI on operative liver biopsy (C, D; Cox p = .045; p = .018) had prolonged OS and DFS after pancreatectomy as depicted in Kaplan-Meier curves.

44

Individualized and Dynamic Multimodality Management of Localized Pancreatic Cancer Improves Survival: One Size Does Not Fit All S.S. AlMasri,[1]* A.Y. Hammad,[1] M. Zenati,[1] I. Nassour,[1] M. Hogg,[2] H. Zeh,[3] A. Singhi,[1] N. Bahary,[1] K.K. Lee,[1] A. Paniccia,[1] A. Zureikat.[1] *1. GI Surgical Oncology, University of Pittsburgh Medical Center, Pittsburgh, PA; 2. Northshore Medical Group, Chicago, IL; 3. UT southwestern Medical Center, Dallas, TX.*

Introduction: Neoadjuvant therapy (NAT) is increasingly utilized in localized pancreatic carcinoma (PC). Survival correlates with CA19-9 and histopathologic response following NAT. With several NAT and adjuvant therapy (AT) options now available, we hypothesized that the choice of NAT and AT regimens is best dictated by response to NAT (as measured by CA19-9 and histopathologic response), a strategy defined herein as dynamic perioperative therapy (DT). We aimed to evaluate the implications of DT in surgically treated PC. Methods: Patients with localized PC who received NAT (gemcitabine/nab-paclitaxel or FOLFIRIOX) between 2010-2019 were identified.

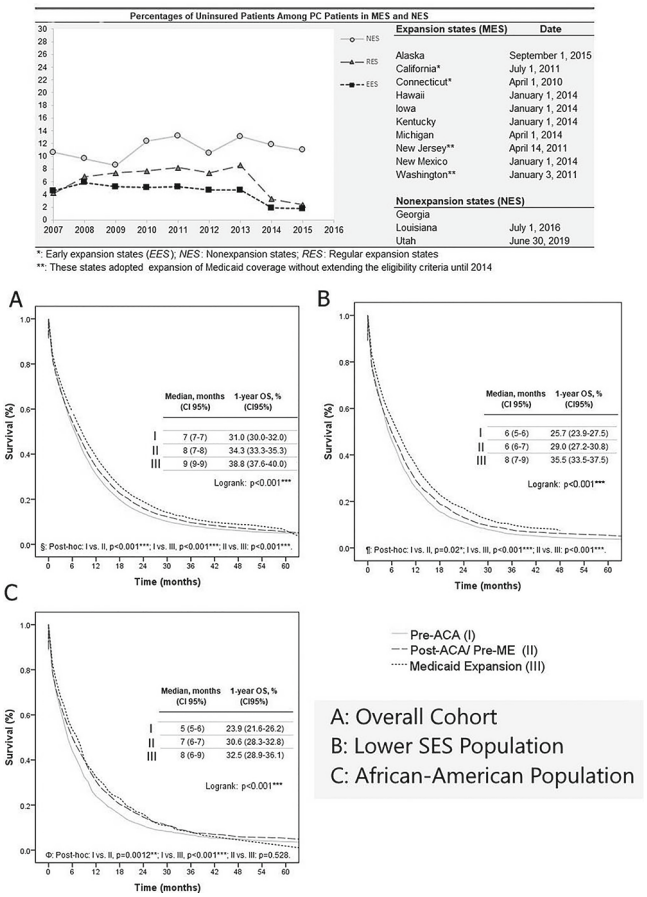
DT patients were those who remained or switched to an alternative NAT regimen as dictated by CA19-9 response and for whom AT regimen was selected based on CA19-9 and histopathologic response. Non-dynamic therapy (NDT) patients were those in whom NAT and AT were selected regardless of CA19-9 and tumoral response. Kaplan-Meier survival estimates and Cox-regression analyses were used to assess outcomes. Results: 322 patients were identified (mean age 65yrs, 50% females): 216 (67%) underwent DT and 106 (33%) had NDT. The DT group had more CA19-9 normalization (54 vs 38%, P=0.023), higher incidence histopathologic treatment response (moderate, complete and near complete response 73% vs 55%, P<0.001), lower pathologic tumor size (2.5 vs 2.9cm, P<0.027) and lower incidence of lymph node positive disease (58 vs 74%, P=0.008) compared to the NDT cohort. On survival analysis, the overall (OS) and progression-free survival (PFS) were significantly higher in the DT vs NDT group (39 vs 28 months P=0.014 and 19 vs 16 months P=0.048, respectively). On Cox regression analysis, DT remained an independent predictor of improved OS (hazard ratio (HR): 0.71, 95%CI 0.52-0.97, P=0.03). Conclusion: This is the first study to evaluate the role of DT in localized PC. We demonstrate that selecting NAT and AT regimens based on NAT response is associated with improved OS and PFS. This study supports an individualized and in-vivo assessment of response to perioperative therapy in PC patients.

45

The Impact of Medicaid Expansion on Pancreatic Cancer Survival

J. Mesquita-Neto,[1]* D. Weaver,[1] S. Kim,[1] J. Datta,[3] F.I. Macedo,[2] N.B. Merchant.[3] *1. Surgery, Wayne State University School of Medicine, Detroit, MI; 2. North Florida Regional Medical Center, University of Central Florida College of Medicine, Gainsville, FL; 3. Sylvester Comprehensive Cancer Center / University of Miami Miller School of Medicine, Miami, FL.*

INTRODUCTION: The Affordable Care Act (ACA) and Medicaid Expansion (ME) have decreased disparities in cancer care. Pancreatic cancer (PC) is a leading cause of cancer-related death and its survival relies on a readily accessible healthcare system. We examined whether the ACA/ME impacted on PC survival and access to curative-intent surgery. METHODS: From the SEER population-based registry, patients diagnosed with PC between 2007 and 2015 were stratified according to each state's ACA/ME status and socioeconomic standardized scores. Difference-in-differences (DiD) analysis, Kaplan-Meier method, Cox-model and logistic regression were used for intergroup comparison. RESULTS: Of 25,549 PC patients (median age: 58±6.3, 56.9% males, 65.3% Whites, 46.2% from middle socioeconomic status counties and 76.7% insured), the proportion of patients without insurance reduced significantly post-ME compared to pre-ME (3.3% vs. 9.1%, P<0.001). Patients treated after ME (OR, 2.93; 95%CI, 2.197-3.643; P<0.001) and after ACA/pre-ME (OR, 1.63; 95%CI, 1.325-2.007;P<0.001) were more likely to undergo the recommended surgical therapy (DiD=+8.4). One-year OS was significantly higher after ME compared to pre-ACA and post-ACA/pre-ME (38.8% vs. 31% vs. 34.3%, P<0.001). Absolute survival improvement of ME was +0.8 for the entire cohort and +3.8 in socioeconomically disadvantaged counties. In Cox regression, ME was an independent predictor of improved OS (HR, 0.76; 95% CI, 0.718-0.814; P<0.001). CONCLUSIONS: This is the first report to show that American states which adopted the ACA/ME had a decreased proportion of uninsured patients with PC, increased access to healthcare services, and improved survival in socioeconomically disadvantaged communities. Improved access to care through ACA/ME is a meaningful strategy to improve survival outcomes in PC.



Insurance Coverage and Mortality Changes Before and After Medicaid Expansion

46

Peritoneal Cell-free Tumor DNA is a Biomarker of Locoregional Recurrence in Resected Pancreatic Ductal Adenocarcinomas

K.M. Leick,* P.M. Kasi, A. Kazarian, A. Tomanek-Chalkley, A. Miller, H. Shrader, K. Coleman, C.H. Chan. *University of Iowa, Iowa City, IA.*

Background: There is an 80% recurrence rate after pancreatectomy for pancreatic ductal adenocarcinoma (PDAC) within 2 years, while locoregional (LR) recurrence occurs in 33% of cases. We hypothesized that peritoneal cell-free tumor DNA present in the intraoperative lavage fluid may be used as a predictive biomarker of LR recurrence. Methods: Under IRB-approved protocol, pre- and post-resection peritoneal lavage fluids were collected from PDAC patients undergoing curative pancreatectomy. Peritoneal lavage fluids from PDAC patients with peritoneal carcinomatosis were also collected. Cell-free DNA was extracted from peritoneal fluids using QIAGEN DNA extraction kit. Droplet digital PCR (ddPCR) was performed using BioRad ddPCR KRAS G12/G13 screening kit according to manufacturer's instructions. Results: Mutant KRAS DNA was detected in all peritoneal lavage fluids from PDAC patients with carcinomatosis (n=8) with a mutant allele frequency (MAF) of 0.16% to 57%. Mutant KRAS DNA was detected in 11/21 (52%) pre-resection and 15/18 (83%) post-resection peritoneal lavage samples. With a median follow-up of 11.1 months, 5/6 (83%) patients with MAF of ≥ 0.10% in post-resection peritoneal lavage fluid had recurrence with median time to recurrence of 12.6 months, while 4/12 (33%) patients with MAF of < 0.10% recurred with a median time of 14.9 months. Patients with MAF of ≥ 0.10% in their post-resection peritoneal lavage fluid had significantly shortened time to LR recurrence (Fig. 1, median of 12.6 months vs. not reached, P=0.02). Conclusions: This study suggests that detection of peritoneal cell-free tumor DNA may be a useful test to predict LR recurrence after pancreatectomy for PDAC.

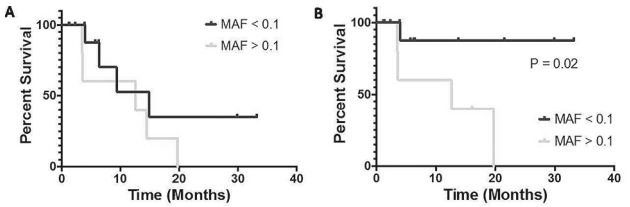
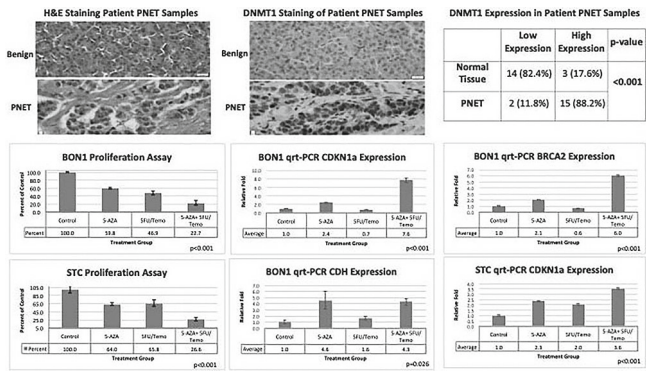


Figure 1: (a) Association of %MAF of peritoneal cell free tumor DNA with overall recurrence-free survival (a) and with LR recurrence-free survival (b) after pancreatectomy.

47

Novel Treatment Strategy of Targeting Epigenetic Dysregulation in Pancreatic Neuroendocrine Tumors C. Zhu,[1]* A. Lin,[1] J. Williamson,[1] U. Joneja,[1] N.K. Acharya,[2] R. Platoff,[1] R. Emery,[1] J. Badach,[1] U. Atabek,[1] F. Spitz,[1] Y. Hong.[1] *1. General Surgery, Cooper University Health Care, Camden, NJ; 2. Rowan University, Startford, NJ.*

Introduction Epigenetic dysregulation is a significant step in the progression of pancreatic neuroendocrine tumors (PNET). DNA methyltransferase1 (DNMT1) aberrantly silences tumor suppressor genes via methylation of promoters on DNA. Despite this, the role of epigenetic therapy remains unexplored as a potential therapeutic agent for PNET. We hypothesize that levels of DNMT1 are aberrantly upregulated in PNET, and targeting with epigenetic therapy will demonstrate tumor regression. Methods Tissue specimens were obtained from 17 patients with grade II PNET that underwent surgical resection. These were stained for DNMT1 expression. Expression intensity, extent, and final score were compared between PNET and benign samples by a blinded clinical pathologist. Human PNET cell line (BON1) and murine PNET cell line (STC) were treated with DNMT1 inhibitor 5-azacytidine (5-AZA) and chemotherapeutic agents 5-fluorouracil and temozolomide. Cell proliferation assay and respective evaluation of tumor suppressor gene expression were performed via qRT-PCR. Results There was 82.4% (14/17) of PNET samples that demonstrated high expression of DNMT1 on the final score compared to 11.8% (2/17) of benign samples (p=<0.001). Treatment of BON1 cell lines with 5 uM 5-AZA and chemotherapy resulted in a reduction of cell proliferation by 77.3% compared to 53.1% with chemotherapy alone (p<0.001). Treatment of STC cell lines with 0.3 uM 5-AZA and chemotherapy resulted in a reduction of cell proliferation by 73.4% compared to 34.2% with chemotherapy alone (p<0.001). Treatment with 5-AZA and chemotherapy resulted in the upregulation of tumor suppressors CDKN1a (7.6 rel. fold, p<0.001), BRCA2 (4.3 rel. fold, p<0.001), and CDH1 (6.0 rel. fold, p=0.026) in BON1 and CDKN1a (3.6 rel. fold, p<0.001) in STC. Conclusion Epigenetic dysregulation with DNMT1 is associated with PNET and serves as a potential targetable strategy. 5-AZA can reduce cell proliferation in combination with chemotherapy and upregulate previously silenced tumor suppressor genes in human and murine PNET cell lines. Epigenetic therapy warrants further research in an in vivo model for potential clinical implications for patients with PNET.



Pancreatic neuroendocrine tumors demonstrate epigenetic dysregulation and response to 5-azacytidine

48

Tumor and Tumor Microenvironment Landscape After Neoadjuvant Chemotherapy in Pancreatic Ductal Adenocarcinoma J. Kearney,* P. Kuhlers, A. Morrison, S. Maharry, J. Leary, X.L. Peng, H. Kim, M. Meyers, B. Calvo, U. Maduekwe, J. Yeh. *Surgery, University of North Carolina at Chapel Hill, Durham, NC.*

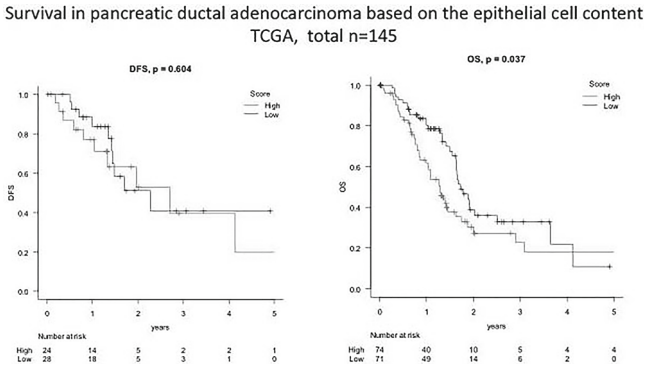
Introduction: Both tumor and tumor microenvironment (TME) have significant implications in pancreatic ductal adenocarcinoma (PDAC). We have developed de novo compartment deconvolution and weight estimation (DECODER), which can be used for any tumor type, to deconvolve the bulk tumor to understand tumor and TME alterations. The aim of this study is to evaluate differences in the tumor and TME in patients who undergo NAC. Methods: RNA sequencing of deidentified tumors obtained from an IRB-approved Tissue Procurement Facility was performed. DECODER was used to determine the compartment fractions of the tumor (e.g. basal-like, classical) and TME (immune, stroma, etc). DECODER compartments have been validated using known methods such as leukocyte fraction, molecular purity, and stroma score estimates as well as histology. Results: 33 of 48 (69%) patients underwent NAC. 28 patients (85%) received FOLFIRINOX and 6 patients (15%) received gemcitabine-containing regimens. Although no significant differences were observed in tumor or TME compartments between patients who did vs did not receive NAC, the effect on the TME was different between FOLFIRINOX vs gemcitabine-based regimens. Among patients who received FOLFIRINOX, tumors showed significantly less normal stroma (p=0.02) and less immune (p=0.2) fractions than patients who received gemcitabine-based regimens. The ratio of activated stroma, which has been found to be associated with worse prognosis in untreated tumors, to normal stroma was significantly greater in FOLFIRINOX treated patients (p=0.04). There was a trend towards a relative increase in the immune compartment compared to activated stroma in gemcitabine-treated patients (p=0.18). No difference in the "basal-like/classical-ness" of the tumors was seen between the groups. Conclusions: Our findings show that, using a newly developed deconvolution approach for bulk tumors, we see differential TME findings that are regimen dependent. Larger studies with pre- and post-treatment specimens will be needed to further evaluate how different therapies effect the tumor and TME and its implications for response and outcome.

49

An Abundance of the Intra-Tumoral Epithelial Cell as a Biological Prognostic Marker in Pancreatic Ductal Adenocarcinoma I. Ibrahim-zada,* M. Oshi, K. Takabe. *Surgical Oncology, Roswell Park Cancer Institute, Buffalo, NY.*

Introduction: Pancreatic ductal adenocarcinoma (PDAC) is epithelial cancer where accelerated cell proliferation determines prognosis and aggressive biology Numerous studies demonstrated that intratumor cell composition affects the plasticity of cancer and, ultimately, overall (OS) and disease-free survival (DFS). Therefore, we hypothesized that abundant intra-tumoral epithelial cell composition is associated with worse survival. Methods: We employed a large PDAC cohort, The Cancer Genome Atlas (TCGA), to evaluate whether the amount of intra-tumoral epithelial cells were associated with survival outcomes. A total of 145 patients were divided into high (74 patients) and low (71 patients) epithelial cells tumor groups using median cutoff. A computational algorithm of tumor component cell fraction, xCell, was utilized. All statistical analyses were performed using R software and Bioconductor. Results: There was no difference in baseline characteristics between two groups in TCGA PDAC cohort, including age, sex, race, primary site, pathological grade, perineural invasion, and AJCC staging. The patients with high epithelial cell PDACs showed significantly worse OS (p=0.0.37), but no difference in DFS (p=0.604). High epithelial cell PDAC was significantly associated with increased homologous recombination defects (p<0.001) and proliferation score (p<0.001) and with high MKi67 expression but the correlation was weak (r=0.272, p<0.01). On the other hand, low epithelial cell PDAC was associated with increased stromal cells (p<0.001), and anticancerous immune cells such as CD8, CD4, T helper type 1, dendritic cells, M1 macrophages. A number of immune- and inflammation-related gene sets were enriched to low epithelial cell PDAC such as allograft rejection, inflammatory response, IL6, and complement. Conclusion: Our study found that PDACs with

low epithelial cell composition was associated with better overall survival. We observed an inverse association of epithelial cell content with anticancer immune cell ratio. These findings imply that low epithelial cell PDACs are associated with anti-cancer immunity and, perhaps, less aggressive biology.



50

Spatial Computation of the Immune and Stromal Characteristics of Biophysical Subtypes of Pancreatic Ductal Adenocarcinoma
J. Sharib,[1]* M. Zaid,[2] A. Dai,[2] L. Widman,[2] S. Behr,[3] K. Kirkwood,[1] E. Koay.[2] *1. University of California San Franciso, Department of Surgery, San Francisco, CA; 2. MD Anderson Cancer Center, Department of Radiation Oncology, Houston, TX; 3. University of California San Francisco, Department of Radiology, San Francisco, CA.*

Background: Pancreatic adenocarcinoma (PDAC) with a conspicuous change in enhancement at the interface between tumor and parenchyma (high-delta) have more aggressive biology and exhibit worse clinical outcomes compared to inconspicuous (low-delta) tumors. Here, we hypothesized these imaging-defined biophysical subtypes of PDAC would exhibit spatial histologic differences in immune and stromal characteristics. Materials and Methods: Baseline CT scans of 46 treatment-naïve patients with PDAC who underwent pancreatectomy were classified into high and low delta. Corresponding slides stained for α-SMA, VEGF, and H&E were digitally scanned (20x) and analyzed using Definiens-TS to quantify expression and micro-vessel density. For H&E, tissue was segmented into tumor and stroma regions and the cells were phenotyped into lymphocytes, fibroblasts and tumor-cells. Spatial analysis (K-function, R software) characterized distributions of tumor-cells and lymphocytes. Kaplan-Meier, cox-proportional-hazards, logistic regression and t-test were used for statistical analysis. Results: Patients were 50% male, with a mean age of 66.3 years. When compared to high-delta tumors, low-delta tumors were significantly associated with better overall survival (33.5 vs. 19 months, p=0.007) and recurrence free survival (25 vs. 7 months, p=0.003). On multivariate-analysis, delta was an independent prognostic factor for survival (HR: 2.3, p=0.01). Pathology analysis revealed significant associations between low-delta tumors and low micro-vessel density (p=0.002) and low stromal α-SMA expression (p<0.0001), when compared to high-delta tumors. Spatial analyses showed that clustering of tumor-cells and lymphocytes at closer distances (<110μ, p=0.03) was significantly associated with low-delta tumors. Conclusion: Biophysical imaging subtypes of PDAC are associated with aggressive biology and clinical outcomes. The pathological differences of the immune and stromal properties of these subtypes may enable the use of the imaging-based classification to guide therapeutic decisions for pancreatic adenocarcinoma.

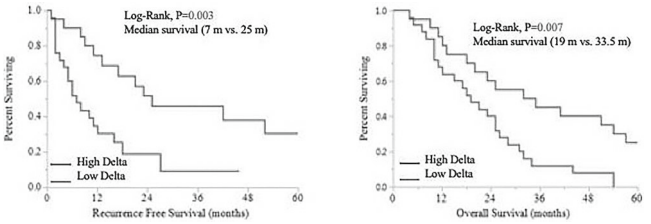
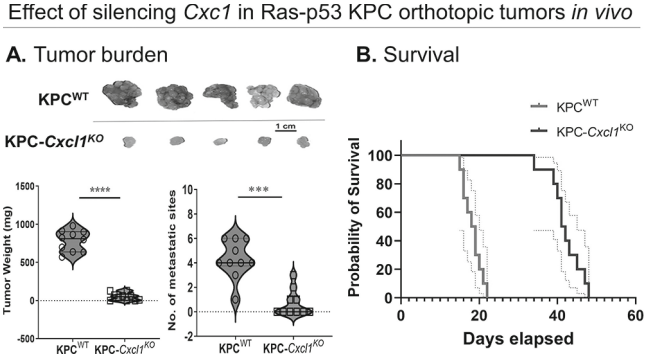


Figure 1. Kaplan-meier curves for recurrence free survival (left) and overall survival (right) for patients with high-delta and low-delta pancreatic adenocarcinoma who underwent upfront surgery

51

Genetic Silencing of Tumor-Intrinsic Cxcl1 Overcomes Immune Exclusion and Improves Survival in Ras-p53 Co-operative Pancreatic Cancer
A. Bianchi,* S. Mehra, X. Dai, I. De Castro, P. Sharma, A.R. Dosch, N. Nagathihalli, N.B. Merchant, J. Datta. *Surgery, University of Miami Miller School of Medicine, Miami, FL.*

INTRODUCTION: Ras-p53 cooperative mutations, which define >60% of human pancreatic ductal adenocarcinoma (PDAC), promote an immune-excluded tumor microenvironment. In Ras-p53 murine models that phenocopy human PDAC, overexpression of the myeloid chemoattractant Cxcl1 promotes T-cell exclusion. We dissected the role of tumor-intrinsic Cxcl1 in mediating immune exclusion in Ras-p53 PDAC. METHOD: Immune deconvolution and Cxcl1 expression were queried in TCGA PDAC samples (n=150). Single-cell RNAseq data in $Kras^{G12D/+}$;$Trp53^{fl/+}$;$Pdx1^{Cre}$ (KPC^{WT}) genetically engineered mice (GEM) were interrogated. CRISPR/Cas9 genome editing was used to silence Cxcl1 in KPC cells (KPC-$Cxcl1^{KO}$). Immunophenotyping of tumor-infiltrating myeloid/T-cell populations was performed by flow cytometry in in vivo orthotopic models utilizing KPC^{WT}/KPC-$Cxcl1^{KO}$ cells. Survival of KPC^{WT} and KPC-$Cxcl1^{KO}$ mice was compared using log-rank estimates. RESULTS: In TCGA samples, Cxcl1 overexpression was strongly associated with expression of its cognate receptor CXCR2, reduced $CD4^+$/$CD8^+$ T-cells, and increased $CD33^+$ myeloid-derived suppressor cells (MDSC). In KPC^{WT} GEMs, scRNAseq revealed that CXCR2 was exclusively expressed in polymorphonuclear (PMN) MDSCs. Conditioning bone marrow cells with KPC-$Cxcl1^{KO}$, vs KPC^{WT}, cells attenuated CXCR2 expression and PMN-MDSC polarization. Silencing Cxcl1 in KPC tumor cells disrupted migration of splenocyte-enriched MDSCs ex vivo; this effect was dependent on CXCR2 expression on MDSCs. Significantly fewer $CXCR2^+$ PMN-MDSC infiltrated KPC-$Cxcl1^{KO}$ vs KPC^{WT} tumors, which was accompanied by dramatically higher $CD4^+$ and $CD8^+$ T-cell infiltration (p<0.001). Functionally, KPC-$Cxcl1^{KO}$-infiltrating PMN-MDSCs demonstrated loss of suppressive markers Arg1, Ido, and Mpo, and inability to suppress T-cell IFNγ release vs KPC^{WT} PMN-MDSCs. KPC-$Cxcl1^{KO}$ mice demonstrated significantly decreased tumor burden (p<0.001) and improved survival (median 41 vs 18d; p<0.001) vs KPC^{WT} mice (Fig). CONCLUSION: Genetic silencing of tumor-intrinsic Cxcl1 overcomes PMN-MDSC-mediated immunosuppression, invigorates T-cell cytolytic function, and improves survival in Ras-p53 PDAC.



52

Targeting Semaphorin 4D Enhances T-Cell Penetration and Improves Disease Control in an Aggressive Murine Model of Pancreatic Cancer L.I. Ruffolo,[1]* N. Ullman,[1] K. Jackson,[1] P. Burchard,[1] M. Georger,[1] R. Jewell,[1] B. Belt,[1] R.C. Fields,[2] J. Mudd,[2] E. Galka,[1] L.O. Schoeniger,[1] R. Hernandez-Alejandro,[1] E. Gersz,[3] C. Mallow,[3] E.E. Evans,[3] T.L. Fisher,[3] M. Zauderer,[3] D.C. Linehan.[1] *1. Surgery, University of Rochester, Rochester, NY; 2. Washington University, St. Louis, MO; 3. Vaccinex, Inc., Rochester, NY.*

Background: Pancreatic ductal adenocarcinoma (PDAC) is one of the most aggressive malignancies and will become the second leading cause of cancer mortality by 2030. Despite advances in many solid tumors, immunotherapies have failed to demonstrate efficacy in PDAC. These failures are mediated by an immunosuppressive tumor microenvironment (TME). Semaphorin 4D (Sema4D) is a glycoprotein that binds its cognate receptors Plexin B1, B2 and CD72, an axis that has been shown to facilitate myeloid cell polarization towards an immunosuppressive phenotype. We hypothesized that Sema4D is a novel immunotherapeutic target in PDAC. Methods: C57b/6 mice were orthotopically injected with the KP2 PDAC line derived from $KRAS^{G12D}$, $TP53^{Flox/Wt}$;P48-Cre autochthonous tumors. Mice were treated with FOLFIRINOX (5-FU, Irinotecan, Oxaliplatin, weekly), immune checkpoint blockade (ICB) (anti-PD1, anti-CTLA-4 mAbs bi-weekly), and anti-Sema4D mAB (bi-weekly). Human and mouse circulating and tumor infiltrating leukocytes were interrogated using flow cytometry for immune subset and expression of Sema4D and Plexin receptors. Archived human PDAC tissues were assessed through quantitative immunohistochemistry (IHC) for the presence of CD8+ T-cells and Sema4D. Results: IHC Analysis of resected human tumors showed that elevated Sema4D and CD8 infiltration was associated with improved survival in resected PDAC, suggestive of T-cell expression upon activation. Tumor associated macrophages express Plexin B1/B2, the cognate receptors for Sema4D. KP2 injected mice exhibited longer survival when treated with the triple combination of FOLFIRINOX, ICB, and anti-Sema4D antibody, compared to all controls (P=0.02). Flow cytometric analysis of anti-Sema4D and ICB treated tumors show an increased population of CD8+ effector T cells within tumors (P=0.03). Conclusions: The combination of Sema4D to checkpoint blockade and chemotherapy in PDAC leads to improved survival and increased CD8+ T-cell infiltration of tumors. This represents a promising novel target in PDAC that may overcome the immunosuppressive TME and improve outcomes in this recalcitrant disease.

53

Increased Neoantigen Expression Sensitizes Pancreatic Cancer to the Anti-Tumor Effects of Immunotherapy U.Y. Panni,* D.R. Cullinan, S.P. Goedegebuure, D.G. DeNardo, K. Lim, W. Gillanders, W. Hawkins. *Hepatobiliary Surgery, Washington University in St. Louis, St.Louis, MO.*

Background: Expression of high-quality neoantigens and CD8+ T cell infiltration is associated with survival in pancreatic cancer. KPC is a genetically engineered mouse model (GEMM) that recapitulates human disease in terms of genetics and disease progression, but it does not express targetable neoantigens. Our study's objective was to treat a KPC-derived cell line, KP2.0, with DNA damaging agents to induce mutational changes and increase expression of neoantigens. We hypothesized that increased neoantigen expression would improve the efficacy of immunotherapy. Methods: KP2.0 cells were treated in vitro with sublethal doses of oxaliplatin and olaparib (OXPARPi). To improve the expression of the targetable neoantigens, we then performed single-cell cloning to generate six daughter clones from the parental KP2-OXPARPi cell line (A-F). We utilized whole-genome sequencing and epitope prediction tools to confirm the mutational changes. The KP2-OXPARPi clones are characterized by an increased mutational burden compared to the untreated KP2.0 cell line. Results: Each of the clones expresses a high number of HLA Class I (Kb,Db) and Class II (IAb) binding predicted neoantigens with the potential to generate a T cell-mediated immune response. To determine if the increase in mutational burden can lead to improved checkpoint immunotherapy efficacy, we treated subcutaneous KP2-OXPARPi tumor-bearing mice with anti-PD1 and anti-CTLA4 (4 doses only) to determine differences in tumor growth. Compared to KP2 tumors, we observed a significant reduction in tumor volume and weight in KP2-OXPARPi tumors following treatment with immunotherapy across multiple clones. Moreover, we also performed CD4+ and CD8+ T cell depletion in tumor-bearing mice, which significantly increased the tumor burden of KP2-OXPARPi tumors. The KP2.0 tumor growth remained unaffected by T cell depletion. Conclusion: Our data suggest that the KP2-OXPARPI tumors grow in a T cell-dependent manner and are sensitive to the effects of checkpoint immunotherapy, unlike KP2- tumors. In future studies, we plan to utilize this tumor model to evaluate the efficacy of novel T cell-based therapies, such as neoantigen vaccination.

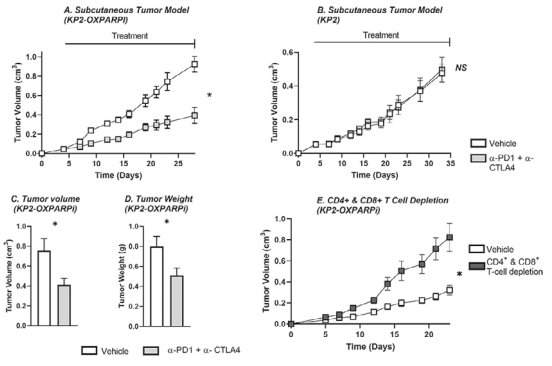
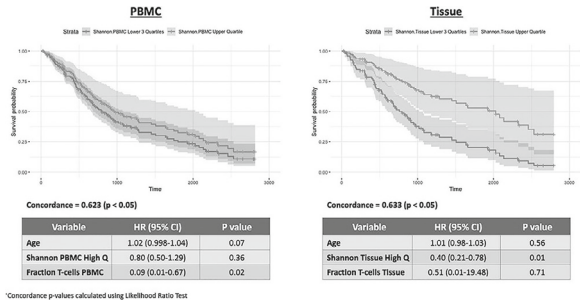


Figure1: (A,B) Tumor growth curve (XY graph) in KP2-OXPARPi & KP2 subcutaneous tumor models. (C,D) Tumor volume and tumor weights (Bar graph) measured following treatment with vehicle and α-PD1 + α-CTLA4 on Day 33. N=10/group. (E) Tumor growth curve (XY graph) following $CD4^+$ and $CD8^+$ T cell depletion in a subcutaneous KP2-OXPARPi tumor model. N=10/group. *p<0.05. NS-Not significant.

54

T-Cell Receptor Repertoire Analysis Reveals Positive Correlation Between Intra-tumoral Clonotype Diversity and Overall Survival in Patients with Pancreatic Ductal Adenocarcinoma V. Pothuri,* G.D. Hogg, L. Conant, A. James, G. Williams, D.G. DeNardo, R.C. Fields. *Washington University School of Medicine, St. Louis, MO.*

INTRODUCTION: Pancreatic ductal adenocarcinoma (PDAC) is a lethal malignancy that is refractory to immune therapy. Nevertheless, it is well established that intra-tumoral T-cell infiltration correlates with improved overall survival (OS). This highlights the importance of characterizing the global T-cell receptor (TCR) repertoire. We hypothesized that a more clonal TCR repertoire, suggestive of a primed tumor-specific T-cell response, would correlate with increased survival. METHODS: Our study included 162 patients diagnosed with PDAC that underwent surgical resection between 2011-2019. Matched peripheral blood mononuclear cells (PBMC) and tumor tissue were banked from 123 patients and PBMC alone from 39 patients. TCR CDR3 regions were sequenced, enabling identification and quantification of both intra-tumoral and circulating T-cell clonotypes. We analyzed two metrics of TCR repertoire diversity: richness (number of unique clonotypes) and evenness (distribution of clonotypes). RESULTS: In 114 matched samples, TCR repertoires in PBMC were significantly richer (Wilcoxon $p = 9.4e\text{-}13$) and more even (Wilcoxon $p = 0.0031$) than in tumor. When controlling for age and diversity in PBMC, fraction T-cells of nucleated cells positively correlated with increased OS (Multivariate Cox, $p < 0.03$). When controlling for age and fraction T-cells in tissue, richness or evenness in the upper quartile of the cohort is associated with increased OS compared to richness or evenness in the lower three quartiles of the cohort (Multivariate Cox, $p < 0.05$). CONCLUSIONS: Frequency of circulating T-cells, but not circulating TCR diversity, positively correlated with OS. Contrastingly, in tumors, TCR repertoire diversity, but not T-cell frequency, significantly correlated with OS. The intra-tumoral data indicates that a broader repertoire of TCRs within the tumor may offer a survival advantage. This offers insight into responses of PDAC to immunotherapy and emphasizes the importance of evaluating the tissue specific TCR repertoire, which may offer insights into patient outcome.



Variable	HR (95% CI)	P value
Age	1.02 (0.998-1.04)	0.07
Shannon PBMC High Q	0.80 (0.50-1.29)	0.36
Fraction T-cells PBMC	0.09 (0.01-0.67)	0.02

Variable	HR (95% CI)	P value
Age	1.01 (0.98-1.03)	0.56
Shannon Tissue High Q	0.40 (0.21-0.78)	0.01
Fraction T-cells Tissue	0.51 (0.01-19.48)	0.71

*Concordance p-values calculated using Likelihood Ratio Test

Multivariate cox regression models with age, Shannon Wiener Index (richness), and fraction T-cells of all nucleated cells in PBMC and Tumor Tissue. In PBMC, fraction T-cells positively correlates with OS when controlling for other variables (Left). In Tissue, richness in the upper quartile compared to the lower 3 quartiles is associated with a survival advantage when controlling for other variables (Right)

55

Is the Presence of Tumor Infiltrating Lymphocytes Prognostic in Melanoma Patients? S. Morrison,[1]* G. Han,[2] F. Elenwa,[2] J. Vetto,[1] S. Leong,[3] M. Kashani-Sabet,[3] B. Pockaj,[4] J.S. Zager,[5] V.K. Sondak,[5] N. Mozzillo,[6] S. Schneebaum,[7] D. Han.[1] *1. Oregon Health & Science University, Portland, OR; 2. Texas A&M University, College Station, TX; 3. California Pacific Medical Care and Research Institute, San Francisco, CA; 4. Mayo Clinic, Phoenix, AZ; 5. Moffitt Cancer Center, Tampa, FL; 6. Instituto Tumori Napoli, Napoli, Italy; 7. Tel-Aviv Sourasky Medical Center, Tel-Aviv, Israel.*

Introduction: The significance of tumor infiltrating lymphocytes (TIL) in melanoma is debated since studies have shown varying results. We present a large multicenter study assessing the prognostic value of TIL in melanoma. Methods: The Sentinel Lymph Node Working Group database was queried from 1993 to 2018 for cases with known TIL data. TIL were categorized as absent or present, which included non-brisk (NB), brisk (B), and present but unspecified TIL levels. Clinicopathologic factors were correlated with TIL, sentinel lymph node (SLN) status and melanoma-specific survival (MSS). Results: Overall, 3203 patients were included, and median follow-up was 25.2 months. Median thickness was 1.5 mm, and 14.6% of cases had a positive SLN. TIL were present in 2458 (76.7%) cases, with NB, B and unspecified TIL levels seen in 1691 (68.8%), 691 (28.1%) and 76 (3.1%) cases, respectively. On multivariable analysis, decreasing thickness, regression and lack of lymphovascular invasion (LVI) significantly predicted the presence of TIL and TIL level (NB, B; all $p<0.05$). SLN disease was inversely correlated with the presence of TIL ($p<0.05$). Multivariable analysis showed that younger age, male gender, leg primary, increasing thickness, LVI and microsatellitosis significantly predicted a positive SLN (all $p<0.05$). In contrast, head/neck primary and presence of TIL significantly predicted a negative SLN (all $p<0.05$). MSS was significantly better for cases with TIL compared with cases without TIL ($p<0.001$), with a 5-year MSS of 78.5% for absent TIL versus 85.4%, 90.9% and 89.5% for NB, B and unspecified TIL levels, respectively. On multivariable analysis, age, gender, thickness, mitotic rate, LVI and SLN status significantly predicted MSS (all $p<0.05$). However, when SLN status was excluded, presence of TIL significantly predicted a better MSS (HR 0.75, 95% CI 0.56-0.99, $p=0.045$). Conclusions: This is the largest study to evaluate TIL in melanoma, and the results show that melanomas that are thinner, have regression and have no LVI are more likely to have TIL. Importantly, our results suggest that TIL is a favorable prognostic marker because the presence of TIL predicts a negative SLN and better MSS.

56

A Novel C-terminal Hsp90 Inhibitor KU758 Synergizes with MEK and BRAF Inhibitors in Melanoma M.K. Chanda,[1] C. Subramanian,[1] j. Sanchez,[1] B.S. Blagg,[2] M.S. Cohen,[1] K. Spielbauer.[1]* *1. Surgery, University of Michgian, Ann Arbor, MI; 2. University of NotreDame, Notredame, IN.*

Introduction: Though targeted therapies, including BRAF and MEK inhibitors, are effective early on for the treatment of advanced melanoma, most patients will develop resistance within the first year of treatment. Heat shock protein 90 inhibitors (HSP90i) target simultaneously multiple resistant pathways associated with BRAF/MEK inhibitor resistance and C-terminal HSP90i do not upregulate the heat-shock response leading to dose escalation toxicities seen with N-terminal HSP90i. We hypothesize that a novel C-terminal HSP90i, KU758, targets BRAF/MEKi resistance pathways and can synergize with cobimetinib(Cb) and vemurafenib(Ve). Methods: Validated BRAF-mutant and wild type melanoma cells were treated with varying concentrations of KU758, Ve, and Cb for 24h alone or in combination. Viability was assessed by CellTiterGlo. Combination indicies(CI) were calculated using Chou-Talalay, and CI<1 were synergistic. Cell cycle(CC) was analyzed by flow(FC). Apoptosis and pathway protein targets were analyzed by western blot(WB). Boyden chamber assay was used to measure migration. Results: KU758 has a 24h IC_{50} value of 430, 360 and 390nM in BRAF mutant cells UACC257, UACC62 and SKMel19 respectively. IC_{50} values in SKMEL103 and SKMEL173 (BRAFwt) were 1300 and 1900 nM respectively. KU758(125 to 500nM) synergized (CIs<1) with IC_{50} values of Cb and Ve with several high synergy combinations(CI<0.5). CC analysis demonstrated G1 arrest($p<0.01$ vs control) with KU758 treatment(alone or in combination) and increase in G2 arrest in combination with Ve. PARP cleavage was observed in combination with Cb and Ve indicating apoptosis($p<0.01$ vs control). WB analysis of BRAF resistance pathways showed KU758 treatment alone or in combination downregulated expression of p-Akt and Raf by 68% and 28% vs control($p<0.01$ & $p<0.05$). Migration assays revealed KU758 significantly decreased migration when in combination with IC_{50} levels of Ve or Cb($p<0.01$). Conclusion: The novel C-terminal HSP90i KU758 synergizes potently with Ve and Cb in melanoma lines and downregulates pathways of MAPKi resistance. Further in vivo translation is warranted to identify combination strategies for potential clinical development.

57

Differences in Myeloid Derived Suppressor Cell Populations in Patients with Ulcerated vs Nonulcerated Melanoma Receiving Immune Checkpoint Blockade S.H. Sun,[1]* G. Lapurga,[1] B. Benner,[1] H. Savardekar,[1] M. DiVincenzo,[1] D. Abood,[1] A. Stiff,[1] M. Duggan,[1] E. Nagle,[1] J.H. Howard,[2] M. Shah,[1] K. Kendra,[1] W. Carson.[1] *1. General Surgery, Ohio State University, Columbus, OH; 2. University of South Alabama, Mobile, AL.*

Myeloid derived suppressor cells (MDSC) are a subset of cells that inhibit innate anti-tumor immunity and promote an immunosuppressive tumor microenvironment. MDSC quantity correlates with tumor burden and survival in cancer patients and contributes to immune therapy resistance. The purpose of this study is to highlight differences in MDSC populations in patients with melanoma as they receive immune checkpoint therapy for advanced disease. Patients with melanoma (n=128; 84 non-ulcerated, 44 ulcerated) were consented to participate in an IRB-approved clinical registry and provided blood samples. Sample timepoints were at the initiation of immune checkpoint therapy, and prior to receiving cycles 2 and 3. Samples were processed and analyzed for MDSC and subsets, monocytic (M-MDSC), granulocytic (PMN-MDSC), via flow cytometry. Patient demographics were compiled and correlated to the flow cytometry data. Statistical analysis was performed using unpaired and paired t tests across and within patient cohorts. Total MDSC percentages increased following immune checkpoint blockade (10 to 25%, $p<0.0001$). MDSC levels in patients who had complete or partial response began to taper (10% to 26% to 25%), whereas MDSC levels in those who had progressive disease on immunotherapy continued to increase (11% to 16% to 19%). Collectively, PMN-MDSC decreased after immunotherapy (19% to 10%, $p=0.0423$). PMN-MDSC levels decreased after two cycles of immune checkpoint blockade (17% to 7%, $p=0.0024$) in patients with nonulcerated melanoma, but not in patients with ulcerated melanoma (15% to 12%, $p=0.79$). Patients with an ulcerated primary and progressed while on immunotherapy had more M-MDSC over the course of immunotherapy (30% to 57%, $p=0.0023$), which was not seen in patients with non-ulcerated primaries (40% to 39%, $p=0.25$), or those who responded to immunotherapy. MDSC levels stabilize in responders but continue to rise in non-responders. Differences in MDSC levels are seen between those with ulcerated vs non-ulcerated tumors. Thus, the growth signals that underlie the ulcerated state may also affect the immune profile during immune therapy.

58

Utilization and Survival Benefit of Adjuvant Immunotherapy in Resected High-Risk Stage II Melanoma: A National Cancer Database Analysis

W.G. Wong,[1]* E. Olecki,[1] K. Stahl,[1] R. Perez Holguin,[1] C. Pameijer,[1] C. Shen.[2] *1. PennState Health Milton S. Hershey Medical Center, General Surgery, Hershey, PA; 2. PennState Health Milton S. Hershey Medical Center, Division Of Outcomes Research and Quality, Hershey, PA.*

Introduction: The risk of locoregional and distant recurrence of stage IIB/IIC cutaneous melanoma is high, and limited evidence exists on the clinical benefit of adjuvant immunotherapy (aIMT). This is the first retrospective study to evaluate the utilization patterns and survival benefit of aIMT for high risk stage II melanoma. Methods: In this large retrospective cohort study, the National Cancer Database (NCDB) was queried for stage IIB/IIC cutaneous melanoma patients who underwent resection between 2013-2017. Patients who received aIMT were identified. Chi-square tests and multivariate logistic regression assessed associations between utilization of aIMT and socioeconomic and clinical characteristics of the cohort. Kaplan-Meier method and Cox proportional hazards model were used to assess impact of aIMT on survival. Results: Of the 8,718 patients with stage IIB/IIC melanoma who had undergone surgical resection, 338 (3.8%) patients received aIMT. Females or patients 40-65 years old were more likely to receive aIMT than males or patients over 65 years old (OR=1.31, OR=2.56, respectively, P<0.05). Patients with pT4b disease or positive surgical margins were more likely to receive aIMT than patients with pT3b disease or negative margins (OR=2.87, OR=4.1, respectively, P<0.001). Patients who received aIMT showed significant improvement in 3-year overall survival compared to those who did not receive aIMT (82.5% vs 72.5%, P<0.001). The Cox proportional hazard model demonstrated that receiving aIMT was associated with better survival (HR=0.65, P<0.005). Survival disadvantages were noted in patients with government issued insurance (HR=1.5) and in the lowest income quartile (HR=1.27) compared to patients with private insurance and in the highest income quartile (all P<0.05). Conclusions: This large observational study demonstrates a significant survival advantage with immunotherapy, which should be considered for the post-operative treatment of stage IIB/IIC melanoma. In addition, socioeconomic differences in the care of patients with high risk stage II melanoma warrant further attention.

59

A Quest for the Lost Tribe: Surgical Management of AJCC IB Melanoma with the Advent of Adjuvant Systemic Therapy

M.D. Moncrieff,[1]* S. Lo,[2] R. Scolyer,[2] J. Nobes,[1] M. Heaton,[1] A. Snelling,[1] M.J. Carr,[3] J.S. Zager,[3] R. Kisyova,[4] J. Mason,[4] E. Wilson,[4] R. Wade,[5] H. Peach,[5] C. Nessim,[6] G. Nolan,[7] R. Pritchard-Jones,[7] R. Olofsson Bagge,[8] I. Johansson,[8] L. Wright,[9] N. Patel,[9] V.K. Sondak,[3] J.F. Thompson.[2] *1. Plastic & Reconstructive Surgery, Norfolk & Norwich University Hospital, Norwich, United Kingdom; 2. Melanoma Institute of Australia, Sydney, NSW, Australia; 3. Lee Moffitt Cancer Center, Tampa, FL; 4. North Bristol NHS Trust, Bristol, United Kingdom; 5. Leeds Teaching Hospitals NHS Trust, Leeds, United Kingdom; 6. Ottawa Hospital, Ottawa, ON, Canada; 7. Mersey Centre for Plastic Surgery & Burns, Liverpool, United Kingdom; 8. Sahlgrenska University Hospital, Gothenburg, Sweden; 9. United Hospitals of Leicester NHS Trust, Leicester, United Kingdom.*

Introduction: The outcomes of the MSLT-2 and DeCOG studies, in addition to the maturation of data from recent adjuvant systemic therapy trials, have embedded the role of sentinel node biopsy (SNB) for accurately staging cutaneous melanoma patients, whilst simultaneously shifting the treatment paradigm from identifying patients for surgical management of the regional lymph nodes to identifying those eligible for adjuvant systemic therapy. Adjuvant systemic therapy is usually not routinely recommended for AJCC IIIA melanoma. pT1b-pT2a melanoma patients who are SNB+ are mostly mapped to AJCC IIIA, which brings into question the role of SNB for these patients Methods: An international, multicentre retrospective cohort study identified 3515 patients from 10 cancer centers in 5 countries with AJCC 8th edition stage IB primary cutaneous melanoma. Patient demographics, primary tumour characteristics, SNB status/details and their association with survival outcomes were analysed. Results: The overall SNB+ rate was 11.5% (403/3515). Virtually all SNB+ patients (401/403; 99.5%) were AJCC IIIA. The 0.1mm difference in mean Breslow thickness between the SNB+ and SNB- was significant but not clinically relevant (p<0.001). A mitotic rate (MR) of ≥2/mm2 identified 67.5% of all SNB+ patients and 74.0% of all stage N2-N3 and/or extracapsular spread. The incidence of MR ≥ 2/mm2 was 55.8%. MR ≥2/mm2 was the only significant, independent predictor of relapse-free, distant disease-free, nodal relapse-free and disease-specific survival on multivariate analysis (hazard ratios 3.78, 3.35, 4.11 and 2.98, respectively; all p<0.0001). Discussion: Literature on SNB for early stage melanoma historically sought to include all patients who might require surgical management of the nodal basin. The results of this large cohort study would suggest that, with the new modern treatment paradigm, a proportion of pT1b-pT2a patients could potentially avoid SNB, since the management of these patients may remain unchanged, regardless of sentinel node status. A MR of ≥2/mm2 reliably targets patients with high-risk SNB+ disease. The role of SNB for MR≤1/mm2 tumours may merit further clarification.

Sentinel Node Status

Sentinel Node Status	Negative (n=3112; 88.5%)	Positive (n=403; 11.5%)	Total (n=3515)	p value
Age				< 0.0011
Mean (SD)	57.1 (14.2)	53.7 (14.6)	56.7 (14.3)	
Gender				0.1252
Female	1469 (47.1%)	174 (43.1%)	1643 (46.6%)	
Male	1649 (52.9%)	230 (56.9%)	1879 (53.4%)	
Primary Site				< 0.0012
Torso	1167 (37.4%)	181 (44.8%)	1348 (38.3%)	
Upper Limb	763 (24.5%)	59 (14.6%)	822 (23.3%)	
Lower Limb	781 (25.1%)	111 (27.5%)	892 (25.3%)	
Head & Neck	406 (13.0%)	53 (13.1%)	459 (13.0%)	
Breslow				< 0.0011
Mean (SD)	1.3 (0.3)	1.4 (0.3)	1.3 (0.3)	
Mitotic rate per mm2				< 0.0011
Mean (SD)	2.6 (3.2)	3.4 (3.7)	2.7 (3.2)	
Mitotic Rate Category				< 0.0001
≤1 per mm2	1422 (91.7%) (Of Total: 40.5%)	131 (8.9%) (Of Total: 3.7%)	1553(44.2%)	
≥2 per mm2	1690 (86.1%) (Of Total: 48.1%)	272 (13.9%) (Of Total: 7.7%)	1962 (55.8%)	
Vascular Invasion				< 0.0012
Absent	2889 (98.5%)	369 (95.6%)	3258 (98.1%)	
Present	45 (1.5%)	17 (4.4%)	62 (1.9%)	
Perineural Invasion				0.3752
Absent	1423 (98.8%)	203 (99.5%)	1626 (98.9%)	
Present	17 (1.2%)	1 (0.5%)	18 (1.1%)	
Ulceration				0.5482
Absent	3019 (97.0%)	393 (97.5%)	3412 (97.0%)	
Present	94 (3.0%)	10 (2.5%)	104 (3.0%)	

60

Prognostic Implications of Tumor-Positive Sentinel Lymph Node Drainage to Multiple Versus Single Basins in Melanoma

J. Ramiscal,* S. Stern, P. Lorimer, N. Lee, A. Wilson, R. Essner. *John Wayne Cancer Institute, Santa Monica, CA.*

Introduction: While the presence of multiple draining sentinel lymph node basins holds no prognostic value in melanoma, the significance of multiple tumor-positive sentinel lymph node basins (+SLNB) has not been determined. We sought to determine if survival was associated with a higher number of +SLNB in melanoma patients with multiple tumor-positive sentinel lymph nodes (+SLNs). Methods: Data was collected from two large prospective randomized trials of sentinel lymph node (SLN) biopsy in melanoma. Patients with advanced locoregional or distant metastases were not included. Cohorts were divided based on number of +SLNs and number of +SLNBs. Clinicopathologic characteristics and melanoma-specific survival (MSS) were compared. Results: From 1994-2014, 3882 patients participated in these randomized trials, 3085 (79%) underwent SLN biopsy, 1913 (49%) had at least one +SLN, and 627 (20%) had SLN drainage to more than one basin. Median follow up was 84.8 months. Of patients with +SLNs, 1518 (79%) had one +SLN and 395 (21%) had multiple +SLNs. For patients with multiple +SLNs, 321 (81%) had one +SLNB and 74 (19%) had multiple +SLNBs, and completion lymph node dissection was performed in 165 (51%) patients with one +SLNB and 40 (54%) patients with multiple +SLNBs. Compared to patients with multiple +SLNs draining to just one +SLNB, patients with multiple +SLNBs had a higher percentage of truncal melanomas (73% vs 42%), more tumors > 4mm

in depth (30% vs 22%). There was a significantly lower 5-year MSS at 59.0 ± 6.1% vs 70.8 ± 2.7% (p=0.048, HR=1.49 (95% CI 1.00-2.22)). Male gender, age > 60, increased Breslow depth, greater number of +SLNs and greater number of +SLNBs were associated with decreased MSS on multivariate analysis. Conclusion: Melanoma patients with multiple +SLNs draining to multiple basins had a worse prognosis than patients with multiple +SLNs draining to just one basin, controlled for total number of +SLNs. Although the biological basis behind this outcome is unknown, these results are important in identifying sentinel lymph node positive melanoma patients who may benefit from alternative surveillance or treatment strategies.

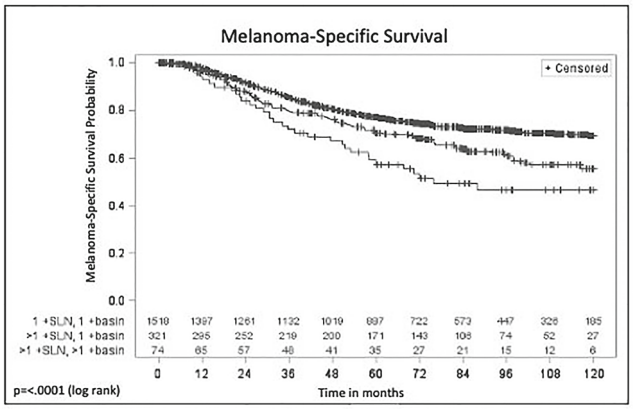


Fig 1. Kaplan-Meier curve for melanoma-specific survival comparing tumor-positive sentinel lymph node (+SLN) drainage of one +SLN to one basin, multiple +SLNs to one basin, and multiple +SLNs to multiple basins.

61

Metastatic Melanoma Patients with Progression on Checkpoint Inhibitors Respond to Hepatic Metastasis Directed Local Therapy

H.S. Quadri,[1]* J.S. Crystal,[1] M. Johnson,[2] Z. Zumsteg,[1] S.L. Shiao,[1] M.B. Faries,[2] O. Hamid.[2] *1. Cedars-Sinai Medical Center, Los Angeles, CA; 2. The Angeles Clinic, Los Angeles, CA.*

Introduction: Although immunotherapy with checkpoint inhibitors (CPI) has been revolutionary in metastatic melanoma (MM), patients with hepatic metastases (HMs) have been shown to have a worse overall response to therapy and overall survival. HMs are associated with reduced CD8+ T-cell infiltration suggesting a resistance to immune therapy with CPI. We reviewed patients with HMs whose CPI therapy was supplemented by focal radiation (XRT). We evaluated response in radiated and non-radiated HMs and overall outcome. Methods: Database search identified 25 patients with MM that were treated with both CPI and XRT for HMs at our institution between May 2011 and October 2020. Disease extent, demographic, pathologic, and treatment variables were recorded. Size of radiated and non-radiated HMs were quantified by sum of longest diameters. Prospective metastasis size measurements were used when available and new measurements were made when not previously recorded. Survival was assessed by Kaplan-Meier. Results: Of the 25 patients with progressive HMs on CPI, 16% (4/25) had complete regression of both the radiated lesion and unirradiated sites, rendering them with no evidence of disease. For complete response patients, hepatic regression was complete within 12 months and systemic resolution occurred within 5 years. Mean radiated metastasis size for the 25-patient cohort increased from 2.4 cm to 3.8 cm between initiation of CPI and start of XRT. Mean radiated metastasis size decreased gradually to 3.5 cm at 6 months and 3.2 cm at 12 months. At most recent follow up, mean radiated metastasis size was 2.8 cm. Conclusion: Metastasis-directed radiotherapy for patients with HMs is both feasible and well-tolerated. In this selected series the combination resulted in complete systemic response in one in six patients, suggesting an abscopal effect. Combined local/systemic approaches may be able to overcome the inherent resistance of HMs to CPI, and additional translational and clinical studies are warranted to explore this combination and others.

62

Predictors of False Negative Sentinel Lymph Node Biopsy in Clinically Localized Merkel Cell Carcinoma

R.J. Straker,[1]* M.J. Carr,[2] A.J. Sinnamon,[2] A.B. Shannon,[1] J. Sun,[2] K. Landa,[3] K. Baecher,[4] C. Wood,[1] K. Lynch,[5] H.G. Bartels,[6] R. Panchaud,[2] M.C. Lowe,[4] C.L. Slingluff,[5] M.J. Jameson,[6] K. Tsai,[2] M.B. Faries,[7] G.M. Beasley,[3] V.K. Sondak,[2] G.C. Karakousis,[8] J.S. Zager,[2] J.T. Miura.[8] *1. Department of Surgery, Hospital of the University of Pennsylvania, Philadelphia, PA; 2. Department of Cutaneous Oncology, Moffitt Cancer Center and Research Institute, Tampa, FL; 3. Department of Surgery, Duke University, Durham, NC; 4. Department of Surgery, Emory University, Atlanta, GA; 5. Division of Surgical Oncology, Department of Surgery, University of Virginia, Charlottesville, VA; 6. Division of Head and Neck Surgical Oncology, Department of Otolaryngology – Head and Neck Surgery, University of Virginia, Charlottesville, VA; 7. The Angeles Clinic and Research Institute, Cedars-Sinai Medical Center, Los Angeles, CA; 8. Division of Endocrine and Oncologic Surgery, Department of Surgery, Hospital of the University of Pennsylvania, Philadelphia, PA.*

Background: Sentinel lymph node biopsy (SLNB) is routinely recommended for clinically localized Merkel cell carcinoma (MCC). However, predictors for false negative (FN) SLNB in this group are not well established. Methods: Patients from six centers undergoing wide excision and SLNB for stage I/II MCC (2005-2020) were identified. True positive (TP) was defined as a SLN metastasis. FN was defined as a first recurrence in the same regional nodal basin after negative SLNB, and true negative (TN) as a negative SLNB with no regional nodal recurrence. Predictors of FN SLNB were identified, and 3-year regional nodal recurrence-free survival (RFS), disease-specific survival (DSS), and overall survival (OS) were estimated. Results: Of 525 patients, 28 (5.3%), 329 (62.7%), and 168 (32.0%) were classified as FN, TN, and TP, respectively, with a FN rate of 14.3% and negative predictive value of 92.2% for SLNB. Median follow-up time for the SLNB negative group was 27 months, and median time to nodal recurrence in the FN group was 7 months (with 96% of FN recurrence within 24 months). Male sex (HR 3.15, P=0.034) and lymphovascular invasion (LVI) (HR 2.22, P=0.048) were significantly associated with FN classification by multivariate analysis. Increasing age correlated with FN status, although this was not statistically significant (HR 1.04, P=0.067). Males >75 years of age with LVI had a 3-year regional nodal RFS rate of 78.5% compared to 97.4% for females ≤75 years of age without LVI (log-rank P=0.009)(Figure 1). TN patients had significantly improved 3-year DSS (95.3% vs. 76.0%, log-rank P<0.001), compared to FN. Conclusions: Failure to detect regional nodal microscopic disease by SLNB is associated with worse DSS in clinically localized MCC. Males, patients >75 years, and those with LVI may be at increased risk for FN SLNB; these patients should be recommended at minimum for close nodal surveillance following negative SLNB, and could be selectively considered for radiation to the nodal basin.

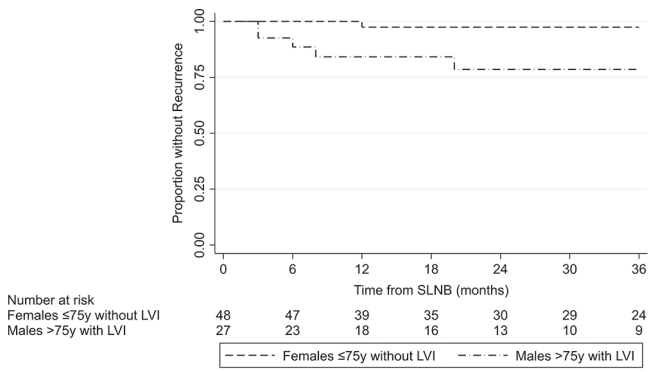


Figure 1. Kaplan-Meier estimate of 3-year regional nodal recurrence-free survival curve among SLNB negative patients comparing females ≤ 75 years without LVI to males >75 years with LVI.

63

A Validated Prognostic Risk-Score Model for Disease-Specific Survival in Clinical Stage I and II Merkel Cell Carcinoma

A.B. Shannon,[1]* M.J. Carr,[2] R.J. Straker,[1] J. Sun,[2] K. Landa,[3] K. Baecher,[4] K. Lynch,[6] H.G. Bartels,[7] R. Panchaud,[2] M.C. Lowe,[4] C.L. Slingluff,[6] M.J. Jameson,[7] K. Tsai,[2] M.B. Faries,[5] G.M. Beasley,[3] V.K. Sondak,[2] G. Karakousis,[1] J.S. Zager,[2] J.T. Miura.[1] *1. Division of Endocrine and Oncologic Surgery, Department of Surgery, Hospital of the University of Pennsylvania, Philadelphia, PA; 2. Department of Cutaneous Oncology, Moffitt Cancer Center, Tampa, FL; 3. Division of Surgical Oncology, Department of Surgery, Duke University Medical Center, Durham, NC; 4. Division of Surgical Oncology, Department of Surgery, Emory University School of Medicine, Atlanta, GA; 5. Division of Surgical Oncology, The Angeles Clinic and Research Institute, Los Angeles, CA; 6. Division of Surgical Oncology, Department of Surgery, University of Virginia, Charlottesville, VA; 7. Division of Head and Neck Surgical Oncology, Department of Otolaryngology, University of Virginia, Charlottesville, VA.*

Introduction: Merkel cell carcinoma (MCC) is a rare cutaneous malignancy for which prognostic factors predictive of disease-specific survival (DSS) are less defined. Methods: Patients who were treated at one of six centers for clinical stage I and II MCC from 2005-2020 were included in the study. Prognostic factors associated with DSS were identified using Cox proportional hazards regression. Risk-score modeling was established using multivariable regression on a training dataset and internally validated by point assignment to each variable within the risk-score model based on hazard ratio value. Results: Of 606 patients, 321 (53%), 97 (16%), and 188 (31%) had pathologic stage I, II, and III disease, respectively. The overall 5-year DSS rate was 90% with a median follow-up time of 20.5 months. Prognostic factors associated with worse DSS included age ≥75 years (HR 2.00, p 0.015), male sex (HR 2.59, p 0.013), immunocompromised state (HR 2.15, p 0.013), truncal (HR 2.71, p 0.018) or head and neck (HR 1.97, p 0.018) tumors, presence of microsatellitosis (HR 2.52, p 0.017), and regional nodal involvement (1 node: HR 2.18, p 0.015; 2 nodes: HR 2.64, p 0.021; ≥3 nodes: HR 4.05, p<0.0001). A validated risk-score model with these factors was developed with good performance (AUC 0.754). Patients in low-, intermediate-, and high-risk groups had a 5-year DSS of 96.6%, 92.7%, and 66.3%, respectively. Conclusions: A simple risk-score model, including both patient and tumor factors, can further prognosticate patients with clinically localized MCC. This can help inform surveillance strategies and patient selection for adjuvant therapy trials in this rare cancer.

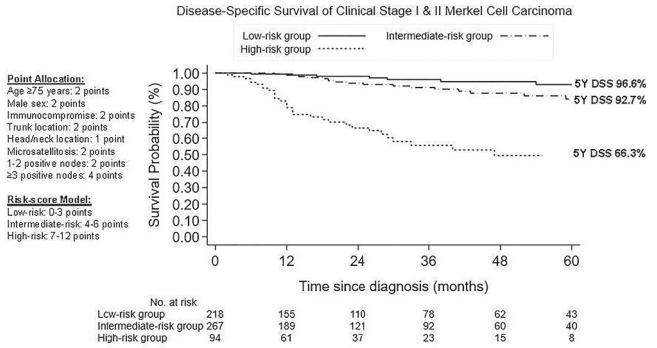


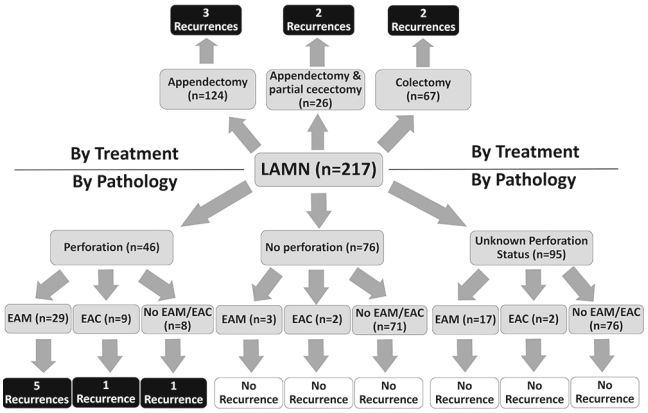
Figure 1. Disease-specific survival (DSS) over 5 years among low-risk (0-3 points), intermediate-risk (4-6 points), and high-risk (7-12 points) groups of patients with clinical stage I and II Merkel cell carcinoma treated from 2005-2020.

64

A Multi-Institutional Study of Peritoneal Recurrence Following Resection of Low-grade Appendiceal Mucinous Neoplasms

J.M. Baumgartner,[1]* A. Srivastava,[2] N. Melnitchouk,[2] M.G. Drage,[3] A.R. Huber,[3] R.S. Gonzalez,[4] P. Bell,[2] E. Wu,[5] M. Resnick,[5] K. Turaga,[6] E. Poli,[6] J. Esquivel,[7] J.L. Deneve,[8] K.J. Kelly,[1] J. Veerapong,[1] A. Lowy.[1] *1. Surgery, University of California, San Diego, La Jolla, CA; 2. Brigham and Women's Hospital, Boston, MA; 3. University of Rochester Medical Center, Rochester, NY; 4. Beth Israel Deaconess Medical Center, Boston, MA; 5. Warren Alpert School of Medicine, Brown University, Providence, RI; 6. University of Chicago, Chicago, IL; 7. Frederick Health Hospital, Frederick, MD; 8. University of Tennessee Health Science Center, Memphis, TN.*

Background Peritoneal dissemination of LAMN, sometimes referred to as pseudomyxoma peritonei, can result in significant morbidity and mortality. Little is known about the natural history of localized (non-disseminated) LAMNs. The goal of this study was to evaluate the risk of peritoneal recurrence in patients with localized low-grade appendiceal mucinous neoplasms (LAMN). Methods We performed a multi-institutional retrospective review of patients with pathologically-confirmed localized LAMNs. Baseline characteristics, pathology, and follow-up data were collected. The primary endpoint was the rate of peritoneal recurrence. Results We identified 217 patients with localized LAMN: median age of 59 years (11-95) and 131 (60%) were female. Surgical management included appendectomy for 124 (57.1%), appendectomy with partial cecectomy for 26 (12.0%), and colectomy for 67 (30.9%) patients. Pathology revealed perforation in 46 (37.7% of 122 with perforation status mentioned in report), extra-appendiceal acellular mucin (EAM) in 49 (22.6%), and extra-appendiceal neoplastic cells (EAC) in 13 (6.0%). Median follow-up was 51.1 months (0-271). Seven (3.2%) patients developed a peritoneal recurrence, with a median time to recurrence of 14.4 months (2.5-47.0). Seven (15.2%) patients with histologic evidence of perforation had recurrence versus none (0%) without perforation (P<0.001); five (10.2%) with versus two (1.2%) without EAM (P=0.007) and one (7.7%) with versus six (2.9%) without EAC (P=0.355) had recurrence (Figure). Conclusions This multi-institutional study represents the largest reported series of patients with localized LAMN. In the absence of perforation or extra-appendiceal mucin or cells, recurrence was extremely rare; however, patients with any of these pathologic findings require careful follow-up.



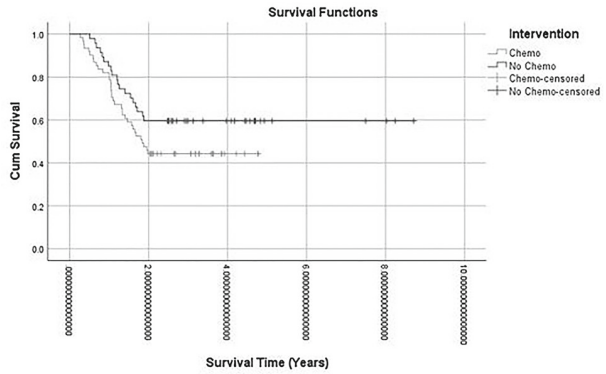
65

Utility of Neoadjuvant Chemotherapy for High-Grade Appendiceal Neoplasms Undergoing CRS-HIPEC C.W. Mangieri,* O. Moaven, C.D. Valenzuela, K.I. Votanopoulos, P. Shen, E.A. Levine. *Surgical Oncology, Wake Forest Baptist Health, Winston-Salem, NC.*

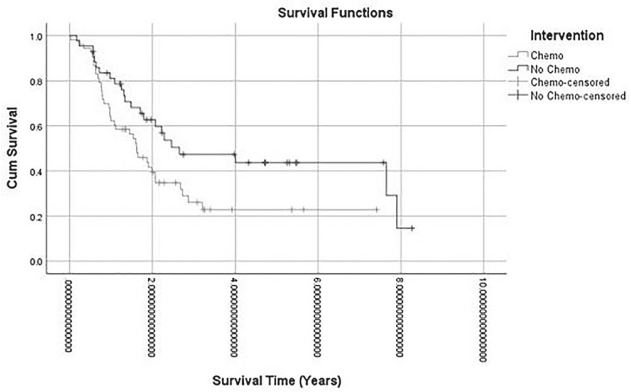
Introduction: Neoadjuvant chemotherapy (NAT) is frequently utilized prior to cytoreductive surgery and hyperthermic intraperitoneal chemotherapy (CRS-HIPEC). The rationale is to limit peritoneal and systemic progression of disease, evaluate response, facilitate complete cytoreduction, and provide a selection tool. However the current literature is unclear in regard to those proposed benefits. Methods: Retrospective review of our appendiceal CRS-HIPEC registry. Analysis was performed by selecting misdiagnosed cases, patients with actual high-grade disease but diagnosed and treated as

low-grade prior to referral for CRS-HIPEC. Primary outcomes were the effect of NAT on disease burden (PCI score), cytoreduction score, overall survival (OS), disease-free survival (DFS), and recurrence patterns. Results: 126 cases of misdiagnosed high-grade disease were identified. 73 cases received NAT prior to referral and 53 cases went directly to CRS-HIPEC. For those receiving, NAT 84% received a FOLFOX based regimen. The two cohorts were statistically similar in regard to demographics, comorbidities, functional status, and post-operative complications. Mean PCI scores were 16 and 16 (P= 0.84) and complete cytoreductions rates 80% and 75% (P=0.56) for NAT and no NAT cases respectively. NAT was associated with significantly decreased OS and DFS rates. Mean OS was 3.6 and 2.5 years (P= 0.005) with actual 5-year OS rates of 24.2% vs 5% (P= 0.017) for no NAT and NAT cases respectively. Mean DFS was 4.3 and 2.8 years (P= 0.029) with actual 5-year DFS rates of 35.7% vs 8.8% (P= 0.010) for no NAT and NAT respectively. Kaplan-Meier curves showed similar inferiority for OS and DFS with NAT (Figure 1). The use of NAT had no impact on recurrence patterns (P= 0.221). Conclusion: This is the largest study to evaluate utility of NAT for high-grade appendiceal neoplasms. NAT had no demonstrable impact in reducing PCI scores, facilitating complete cytoreductions, or limiting systemic recurrence. Utilization of NAT was associated with decreased OS and DFS. For patients with peritoneal carcinomatosis secondary to high-grade appendiceal neoplasms the routine use of NAT should be critically assessed.

Figure 1: Kaplan-Meier Survival Curves
•Overall Survival



•Disease-Free Survival



66

Is Omentectomy Necessary During Cytoreduction and HIPEC in the Absence of Visible Omental Metastases? N. Doan,* K.J. Kelly, J. Veerapong, A. Lowy, J.M. Baumgartner. *Surgery, University of California, San Diego, La Jolla, CA.*

Introduction Cytoreductive surgery (CRS) and HIPEC for peritoneal metastases traditionally includes omentectomy, even in the absence of visible omental metastases. The aims of this study were to determine the rate of occult histologic metastases in omentectomies performed during CRS/HIPEC and to compare morbidity in patients who underwent omentectomies versus those who did not. Methods All CRS/HIPEC procedures from 8/2007-8/2020 were included in this single-center retrospective cohort study. Procedures were divided into those which included greater omentectomy (OM) and those which did not (NOM). The incidence of occult histologic omental metastasis (OHOM) in the omentum was evaluated among the OM group with a grossly normal omentum. Multiple linear regression was performed for 60-day comprehensive complication index (CCI). Logistic regression was performed for incidence of ileus (> 7 days without flatus or bowel movement). Results Six hundred eighty-three CRS/HIPEC procedures were identified: 578 (84.6%) in the OM group, 105 (15.4%) in the NOM group. The OM group had higher OR time, EBL, PCI, number of visceral resections, and LOS (Table). In the OM group, 72 (12.5%) patients had a grossly normal omentum. Of these, 49 (68.1%) had no OHOM and 23 (39.1%) patients had OHOM; including 17 (23.6%) with acellular mucin, 4 (5.6%) with adenocarcinoma, and 2 (2.8%) with mesothelioma. Among those with grossly negative omentectomy (n=72), 7 of 22 (31.8%) with low-grade appendiceal malignancies, 11 of 24 (45.8%) with high-grade appendiceal malignancies, 2 of 18 (11.1%) with colorectal cancer, 2 of 3 (66.7%) with mesothelioma, and 1 of 3 (33.3%) with ovarian carcinoma had OHOM. Sixty-day CCI and the incidence of ileus were no different in the OM group than in the NOM group, when adjusted for PCI and number of visceral resections and anastomoses (p=0.859 and p=0.821, respectively). Conclusion Histologically occult metastasis was present in over one-third of patients undergoing omentectomy as part of CRS/HIPEC, and omentectomy did not increase the rate of overall morbidity or ileus. Thus, omentectomy is warranted in the absence of gross metastases during CRS/HIPEC.

Variable	Total (n=683) n (%)/median (range)	Omentectomy (n=578) n (%)/median (range)	No Omentectomy (n=105) n (%)/median (range)	P-value
Age (yrs)	54 (20-86)	55 (20-86)	52 (26-78)	0.1571 [1]
Primary/Histology				0.4492 [2]
Appendix – LG [3]	252 (36.9)	219 (27.9)	33 (31.4)	
Appendix – HG [4]	169 (24.7)	140 (24.2)	29 (27.6)	
Colorectal cancer	142 (20.8)	113 (19.6)	29 (27.6)	
Mesothelioma [5]	62 (9.1)	56 (9.7)	6 (5.7)	
Ovary	29 (4.2)	25 (4.3)	4 (3.8)	
Small bowel	9 (1.3)	8 (1.4)	1 (1.0)	
Gastric	6 (0.9)	5 (0.9)	1 (1.0)	
Other [6]	14 (2.0)	12 (2.1)	2 (1.9)	
OR time (min)	429 (194-935)	442 (194-935)	362 (194-876)	**<0.001** [1]
EBL	150 (0-4000)	200 (5-3500)	100 (0-4000)	**0.011** [1]
PCI	13 (0-36)	14 (0-36)	7 (0-25)	**<0.001** [1]
CC-Score				0.076 [2]
CC-0	531 (77.7)	448 (77.5)	83 (79.0)	
CC-1	127 (18.6)	113 (19.6)	14 (13.3)	
CC-2/3	24 (3.5)	16 (2.8)	8 (7.7)	
LOS (days)	9 (3-68)	9 (3-68)	7 (3-34)	**0.022** [1]
Nu. anastomoses	1 (0-6)	1 (0-4)	1 (0-6)	0.094 [1]
Nu. visceral resections	2 (0-10)	2 (0-7)	1 (0-10)	**<0.001** [1]

[1]By student's t-test
[2]By Chi-square test
[3]Includes low-grade appendiceal mucinous neoplasms and low-grade mucinous carcinoma peritonei
[4]Includes high-grade appendiceal mucinous neoplasms, adenocarcinoma, and signet ring cell carcinoma
[5]Includes malignant mesothelioma (n=56), well-differentiated papillary mesothelioma (n=4), and multicystic mesothelioma (n=2)
[6]Includes unknown primary (n=4), desmoplastic small round cell tumor (n=4), gallbladder carcinoma/cholangiocarcinoma (n=2), pancreatic adenocarcinoma (n=2), testicular cancer (n=1), and urachal carcinoma (n=1)
Abbreviations: LG – low grade, HG = high grade, EBL – estimated blood loss, PCI – peritoneal cancer index, CC – completeness of cytoreduction, LOS – length of stay

67

Goblet Cell Origins of Human Appendiceal Mucinous Neoplasms and Pseudomyxoma Peritonei Tumors C. Ayala-Navarro,* S. Grimes, A. Sathe, X. Bai, G. Poultsides, B. Lee, H. Ji. *Stanford University, Stanford, CA.*

Introduction: Pseudomyxoma peritonei (PMP) is characterized by rupture of an appendiceal mucinous neoplasm (AMN) and subsequent invasion of the abdominal cavity with mucin expressing cancer cells. Current mainstem

therapy consists of cytoreductive surgery and heated intraperitoneal chemotherapy using mitomycin C (MMC). However, the molecular identity and altered cellular pathways of the cancer cells responsible for PMP remains uncharacterized. Furthermore, whether MMC targets the cancer cells responsible for PMP has not been demonstrated. Methods: Patients were consented using IRB protocols for tissue collection. Surgically collected specimens were dissociated into single cells suspensions used to generate cDNA libraries (10X Genomics technology) that were sequenced followed by in-house pipeline processing of the data. Patient derived ascites was used for mass-spectrometry analysis. Dissociated omentum tissue was used for ex-vivo treatment with saline (mock) or Mitomycin C for 2 hours at 37 degree F. Results: Here we present single cell transcriptomic analysis of patients with AMN (n=5) and PMP (n=9) tumors. Following bioinformatics analysis, we identify goblet cells as the intestinal cell lineage responsible for pseudomyxoma peritonei development. We validate our findings using goblet cell markers for immunohistochemistry and mass-spectrometry analysis of patient derived ascites. Using inferCNV, we provide evidence for CNV differences between goblets cells of AMN and PMP patients. In addition, we show differences in the tumor-microenvironment composition between AMN and PMP patients with a diverse milieu of different cell types and cell-to-cell interactions. Last, we show that ex-vivo treatment of a dissociated omental PMP tumor (n=1) using MMC resulted in a reduction of lymphocytes and goblet cells while sparring mesothelial cells. Conclusion: We have leveraged single cell transcriptomic analysis to identify and characterize goblet cells as the cell of origin of AMN and PMP. In addition, we show differences in the tumor microenvironment of AMN and PMP tumors. Last, we show that current mainstem therapy, Mitomycin C, targets and destroy goblets cells.

68

Cytoplasmic Expression of XPO7 Distinguishes a Subset of Ovarian Carcinoma Vulnerable to SLK Inhibition T.M. Khan,* A. Rossi, E.A. Verbus, M. Teke, A. Saif, S. Rehman, H. Hong, A. Luna, S. Sinha, K. Remmert, S.M. Hewitt, A. Blakely, J.L. Davis, J. Hernandez.
Surgical Oncology Program, National Cancer Institute, Bethesda, MD.

INTRODUCTION: Ovarian cancer (OC) frequently metastasizes to the peritoneum and carries a 5-year overall survival rate of 30% for patients with metastatic disease. Identification of reliable biomarkers and novel therapeutic targets is of critical clinical importance to improve management and survival for this malignancy with otherwise limited systemic treatment options. We have previously shown that high cytoplasmic expression of the nuclear export protein, Exportin-7 (XPO7), identifies a subset of cholangiocarcinoma with aggressive behavior. XPO7 has also been reported to be overexpressed in some OC. Here, we investigate XPO7 role in OC pathobiology and identify its binding partner, the Ste-20 like kinase (SLK), as a novel target that can be exploited for therapeutic benefit in this disease. METHODS: An OC tumor microarray was evaluated for XPO7 expression by immunohistochemistry. XPO7 expression was correlated with overall survival to establish biomarker utility. OC cell lines were interrogated with immunoprecipitation-mass spectrometry to identify XPO7 binding partners. Cell lines from human and genetically engineered mouse models, as well as tumor tissue extracted from OC patient with metastatic peritoneal disease, were treated with small molecular kinase inhibitors against the XPO7 binding partner SLK to evaluate therapeutic efficacy. RESULTS: High cytoplasmic expression of XPO7 was observed in 28% of OC patients (n = 45/160) and correlated with worse disease outcomes (HR 3.12, range 1.57 – 6.17, p = 0.001). In human OC cell lines, immunoprecipitation-mass spectrometry identified SLK as a XPO7 binding partner. Treatment of XPO7:SLK expressing human and mouse OC cell lines with two kinase inhibitors with activity against SLK – tivozanib and gilteritinib – abrogated tumorsphere formation in vitro. Treatment of OC peritoneal metastasis tumor tissue with these drugs in an ex vivo system for 5 days also induced robust tumor cell death. CONCLUSIONS: We have identified XPO7 as a biomarker for aggressive disease in OC and provide evidence for therapeutic targeting of SLK with small molecule kinase inhibitors in XPO7 expressing tumors.

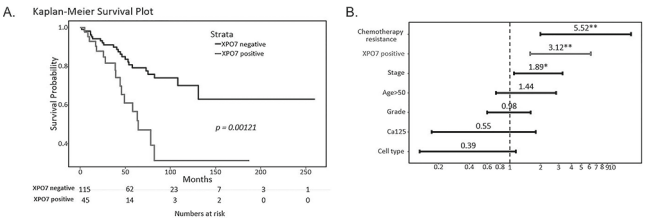


Figure 1: A. Kaplan-Meier plot demonstrating XPO7 expressing ovarian cancer patients have abbreviated survival. B. Multivariate analysis revealed XPO7 positivity as highly predictive of poor overall survival (second only to chemotherapy resistance).

69

Expression of PD-L1 in Malignant Peritoneal Mesothelioma (MPM) V.P. Gazivoda,[1]* A.W. Kangas-Dick,[1] J. Roshal,[3] A.A. Greenbaum,[1] V.A. Gall,[1] R.C. Langan,[1] M.S. Grandhi,[1] T.J. Kennedy,[1] D.A. August,[1] C.M. Minerowicz,[2] H.R. Alexander.[1] *1. Surgical Oncology, Rutgers Cancer Institute of New Jersey, New Brunswick, NJ; 2. Pathology, Rutgers Robert Wood Johnson Medical School, New Brunswick, NJ; 3. Rutgers Robert Wood Johnson Medical School, New Brunswick, NJ.*

Introduction: Recent Phase I and II studies have demonstrated anti-tumor activity in patients receiving PD-L1 blockade for malignant mesothelioma with PD-L1 expression. However, the number of patients with MPM in these studies was very small. Therefore, the frequency of PD-L1 expression and the possible role of checkpoint inhibition in MPM has not been characterized. The purpose of this study was to determine PD-L1 expression in MPM and to perform an exploratory analysis for any associations between PD-L1 expression and biological behavior in MPM. Methods: MPM specimens were obtained from an institutional biorepository for patients undergoing cytoreductive surgery and regional and/or systemic chemotherapy from January 2018 to June 2020. Clinical data was collected retrospectively. Specimens were stained with anti-PD-L1 antibodies (Dako 22c3) according to manufacturer specifications with appropriate controls. Samples were interpreted and scored by an experienced pathologist blinded to clinical data. Scoring was performed using both tumor proportion score (TPS) or combined positive score (CPS) with a threshold of ≥ 1% representing a positive score. Cox regression analysis was performed to determine factors associated with overall survival (OS). Results: Twenty-four total samples were obtained from 20 patients (M: 12; F: 8). Median age was 58 years (IQR 47-70). Nineteen of 24 (79%) tumor samples were CPS positive and 11/24 (46%) were TPS positive. Three patient samples had biphasic/sarcomatoid histology, known to be more aggressive, and had high CPS and TPS scores (CPS: 3, 75, 95%; TPS: 2, 60, 90%). Median OS from date of initial diagnosis was 110 months and there was no statistical difference in OS based on PD-L1 status. However, on exploratory analysis, as the CPS or TPS threshold increased, there was a trend towards shorter OS. With CPS or TPS scores >5% actuarial median OS was 49 months versus 110 months for PD-L1 scores < 5%. Conclusion: MPM has high frequency of PD-L1 expression which may be associated with more aggressive tumor biology. These data provide the foundation for a continued evaluation of checkpoint inhibition in patients with MPM.

70

Application of Immune-Enhanced Tumor Organoids in Establishing Immunotherapy Efficacy in Appendiceal Cancer S. Forsythe,[3] R.A. Erali,[2]* S. Sasikumar,[1] P. Laney,[1] E. Shelkey,[1] P. Shen,[2] E.A. Levine,[2] S. Soker,[4] K.I. Votanopoulos.[2] *1. Surgical Oncology, Wake Forest University, Winston-Salem, NC; 2. Department of Surgical Oncology, Wake Forest Baptist Health, Winston Salem, NC; 3. Comprehensive Cancer Center, Wake Forest Baptist Health, Winston Salem, NC; 4. Wake Forest Institute of Regenerative Medicine, Winston Salem, NC.*

Introduction Immunotherapy efficacy data on appendiceal cancer (AC) does not currently exist and is not expected to be generated through clinical trials due to a reported AC incidence of 0.97 per 100,000. The goal of this study was to explore the application of immunotherapy agents in treating appendiceal cancer in a personalized, patient derived, organoid model. Methods Tumor specimens were obtained from patients undergoing cytoreductive surgery under

a dedicated IRB protocol. Patient tumor organoids were fabricated using both unsorted tumor cells only (PTO) and after enrichment with patient matched immune components derived from either peripheral blood leukocytes or lymph nodes (iPTO). Organoids were cultured for 7 days, followed by treatment with immunotherapy (Pembrolizumab, Ipilimumab, Nivolumab). After treatment, organoids were assessed with live/dead, ATP assay and immunohistochemistry for treatment efficacy. Results Between September 2019 and September 2020, 18 patients were enrolled in the study. Adequate organoid numbers for immunotherapy studies were generated in 14/18 (78%) patients, with 11/14 (78.6%) and 3/14 (22.4%) patients having low grade (LGA) and high grade (HGA) primaries, respectively. Response to immunotherapy was exhibited in 6/14 (42.9%) of these patients, with two (66.7%) of the responders having HGA primaries and four (36.4%) LGA. Both HGA patients demonstrated iPTO treatment response to Pembrolizumab, with a viability less than 15% for each, compared to non-treated controls ($p < 0.05$, Figure 1). LGA iPTOs treatment responses were seen to Pembrolizumab (2/4) and Nivolumab (2/4) with viability ranging from 8% - 46.3% compared to controls. iPTOs treated with immunotherapy demonstrated increased expression of Granzyme B and decreased expression of CK20 positive cells. Conclusions Immunotherapy may be a treatment option for certain patients with appendiceal cancer. Immune system enhanced PTOs may be helpful to make this decision at a personalized level, bypassing the pitfalls of cohort analysis.

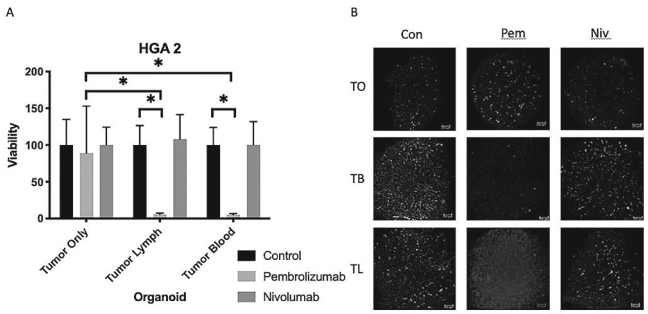
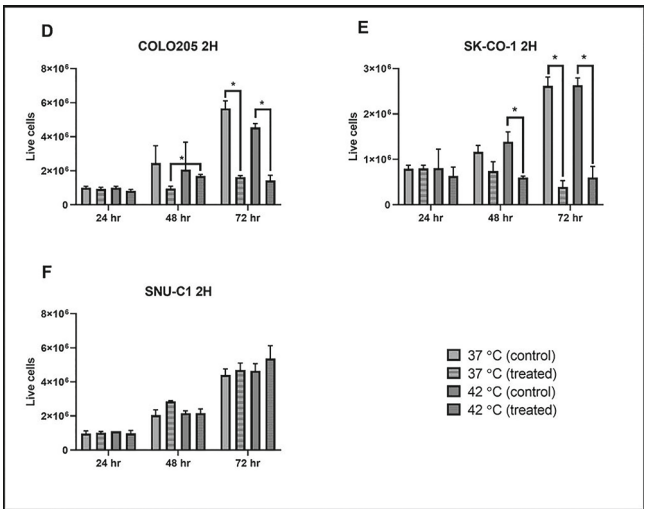


Figure 1: (A) Histogram comparison of viability between TO and immune-enhanced organoids (lymph and blood). (B) Live dead imaging for Pembrolizumab (Pem) and Nivolumab (Niv) treated organoids.

71

Effect of Colorectal Cancer Gene Mutations on Mitomycin Dose and Heat-Induced Augmentation of Cytotoxicity W.F. Morano,[1]* J. Kabagwira,[2] A.H. Choi,[1] M.E. Reeves,[1] M.J. Selleck,[1] M. Senthil,[3] N.R. Wall.[2] *1. Surgery, Loma Linda University Health, Loma Linda, CA; 2. Loma Linda University, Loma Linda, CA; 3. University of California-Irvine, Irvine, CA.*

Introduction: Mitomycin C(MMC) is one of the most common agents used in hyperthermic intraperitoneal chemotherapy(HIPEC) for colorectal peritoneal carcinomatosis. Current guidelines from American Society of Peritoneal Surface Malignancy (ASPSM) recommend standard dose of 40 mg in all patients without adjustments for molecular features; however, it has been shown that BRAF and KRAS mutated colon cancers are associated with poorer prognosis in the setting of peritoneal metastasis (PM). We investigated the influence of gene mutations on the effective dose of MMC and the augmentation of cytotoxicity by heat. Methods: Three colon cancer lines, developed from PM, were chosen to investigate effects of p53 (SNU-C1), KRAS (SK-CO-1), and BRAF (COLO205) mutations on MMC cytotoxicity. IC50 doses were identified via cell viability assessment at increasing concentrations. To study effect of hyperthermia, cell lines were treated for 1, 2, or 3 hours at 37°C (normothermia) or 42°C (hyperthermia). Next, cells were maintained at 37 °C for 24, 48, and 72 hours, then cell viability was assessed using Annexin V, trypan blue, and Hoffman microscopy. Results: Heat without MMC did not decrease cell viability until almost 6 hours of incubation. The IC50 of MMC for the three cell lines varied widely; SK-CO-1 and COLO205 were treated with 0.5 μM, and SNU-C1 with 2.5 μM. In BRAF and KRAS mutated cell lines (COLO205 and SK-CO-1) significant cytotoxicity was observed with MMC treatment. However, heat did not enhance cytotoxicity at 1, 2, and 3 hours of treatment. SNU-C1 remained resistant to treatment despite the addition of hyperthermia. On Annexin V assay, cells treated with MMC demonstrated increased apoptosis in COLO205 and SK-CO-1, but no effect on SNUC-1 despite treatment at 5-fold concentration of MMC. Conclusions: The effective dose of MMC and heat-augmented cytotoxicity varies significantly based on molecular features of colon cancer cells. These findings highlight the need for further investigation using in vivo PM animal models are necessary to understand the effect of colon cancer gene mutations on response to HIPEC, to inform the design of future clinical trials.



COLO205, SK-CO-1 and SNU-C1 were incubated at 37 °C (normothermia) or 42 °C (hyperthermia) for 1 hour, 2 hours (shown here), and 3 hours with MMC. COLO205 and SK-CO-1 cells were treated with 0.5 μM of MMC, while SNU-C1 cells were treated with 2.5 μM of MMC. At each time point, cells were removed from the hyperthermic incubator, treatment media was removed followed by PBS wash. Cells were returned to 37 °C incubator (time 0), after which cell viability was determined using trypan blue exclusion cell counting at 24, 48, and 72 hours. The student t-test was used for statistical analysis, *P<0.05.

72

Using Computational Flow Dynamics to Optimize Drug Delivery Technique in HIPEC T.J. Mouw,[1]* H. Frieboes,[2] J.W. Sebree,[2] O.S. Cooney,[2] E.R. Little,[2] R.C. Martin.[1] *1. University of Louisville Division of Surgical Oncology, Louisville, KY; 2. University of Louisville JB Speed School of Engineering, Louisville, KY.*

Introduction: HIPEC is a well-established technique with exceptional results in certain histologies. However, results in some histologies such as colorectal adenocarcinoma have been variable. Fluid distribution and flow may vary based on technique. The fluid physics of the abdominal cavity during HIPEC are poorly understood, but are likely to impact the pharmacokinetics and the efficacy of HIPEC agents. We aim to use computational fluid dynamics (CFD) modeling to simulate HIPEC for the purposes of optimizing drug delivery. Methods: The abdominal cavity was modeled using Computer-Aided Design (CAD) software. Simulated organs included the liver, stomach, transverse colon, small bowel, and mesenteries. Organ elasticity and buoyancy were simulated accurately represent the relevant treatment spaces. The tested HIPEC cycle parameters include catheter position, orientation, number, and flow rates (static and variable). Study endpoints include defining areas of mixing stagnation within the cavity and areas of poor heat transfer, and the development of a standardized technique which produces optimal homogeneity of tissue exposure. Results: After development of the model, the CFD experiment demonstrated significant heterogeneity in fluid mixing under organ mesenteries, in the lesser sac, and in the subdiaphragmatic spaces. Positioning of inflow above the liver had a detrimental effect on flow rates in the lesser sac (<0.06 – 0.17cm/s). Flow rates improved by 99.4% and flow volume increased 140.0% by positioning of the inflow in the inferior abdomen (0.17-0.33cm/s) without significant decrease in the maximal flow in the subdiaphragmatic space. Flow rate directly varied with temperature variation and degree of mixing within the model. Conclusions: CFD offers a unique ability to learn about the technical and physical properties of HIPEC. We demonstrated the variability in tissue surface exposure with simple manipulation of the HIPEC

circuit, catheter arrangement, and flow parameters. These data will be used to refine the model and with further testing this will produce an objective rationale for optimal cycle parameters and will minimize the effect of pharmacokinetics on future clinical trials.

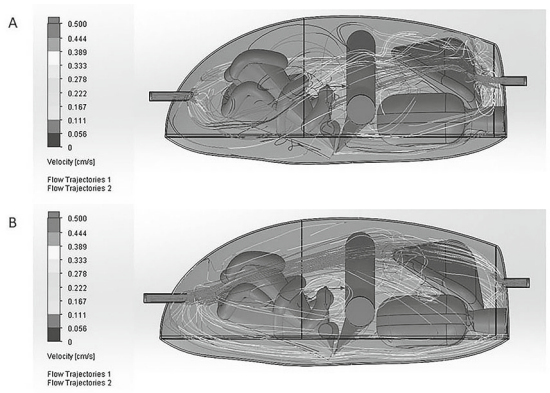


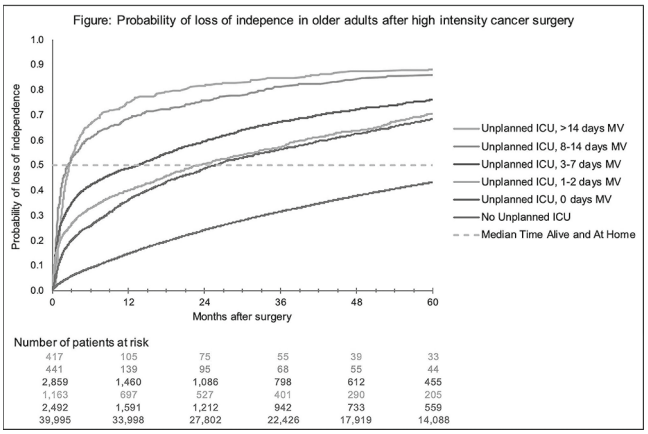
Figure 1: CFD model of simplified abdominal cavity during HIPEC. A) Suprahepatic inflow results in low flow and stagnation in lesser sac and under small bowel mesentery. B) Pelvic inflow results in substantially improved flow in these areas while preserving flow quality across abdomen

73

Long-term Outcomes of Older Adults Who Require Unexpected Admission to an Intensive Care Unit After Cancer Surgery

B. Tillmann,[1]* B. Haas,[1] M.P. Guttman,[1] N. Coburn,[1] A.L. Mahar,[2] V. Zuk,[1] W. Chan,[1] J. Hallet.[1] *1. University of Toronto, Toronto, ON, Canada; 2. University of Manitoba, Winnipeg, MB, Canada.*

Background: High intensity surgery for cancer is common in older adults. Compared to younger adults, a greater proportion of older adults require unexpected admission to an intensive care unit (ICU) after surgery. ICU admissions may impact long-term survival and functional recovery, but such outcomes are unknown. We evaluated the impact of unexpected ICU admission on long-term outcomes in older adults after high intensity cancer surgery. Methods: We performed a population-based retrospective cohort study of adults ≥ age 70 undergoing high intensity cancer surgery (2007–2017). The exposure was unexpected ICU admission, defined as an admission not related to routine post-operative monitoring. The primary outcome was loss of independence, defined as admission to nursing home, or death in the 5 years after surgery. Kaplan-Meier analysis estimated the probability of loss of independence and piecewise Cox proportional hazards models examined the independent association between unexpected ICU admission and loss of independence. Results: Of the 47,367 patients included, 7,372 (15.6%) had an unexpected ICU admission. Those patients had a significantly higher probability of losing independence at 5 years (73.8%; 95% CI 72.8–74.9%) compared to those without an unexpected admission (43.2%; 95% CI 42.6–43.7%). After adjustment, unexpected ICU admission remained associated with increased hazards of losing independence. Although highest in the first 30 days (HR 6.21; 95% CI 5.72–6.74), the elevated risk of loss of independence persisted beyond 1 year after surgery (HR 1.58; 95% CI 1.50–1.66). The need for, and duration of, mechanical ventilation (MV) was associated with the probability of losing independence (Figure). Conclusions: Older adults with unexpected ICU admission after high intensity cancer surgery are at increased risk for long-term loss of independence. However, even those receiving a week of ventilation spend over a year alive and at home. These findings suggest that there is a role for aggressive therapy and are important for counselling through the post-operative course as complications unfold and decisions regarding levels of support are made.

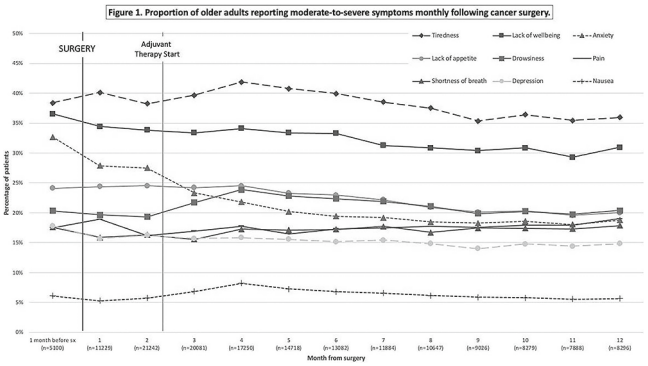


74

Patient-Reported Symptom Burden After Cancer Surgery in Older Adults: A Population-Level Analysis

J. Hallet,[1]* V. Zuk,[1] J. Zuckerman,[1] M.P. Guttman,[1] T. Chesney,[1] A.L. Mahar,[2] A. Hsu,[3] S. Sohail,[1] R. Vasdev,[1] I. Menjak,[1] W. Chan,[1] F. Wright,[1] N. Coburn.[1] *1. University of Toronto, Toronto, ON, Canada; 2. University of Manitoba, Winnipeg, MB, Canada; 3. University of Ottawa, Ottawa, ON, Canada.*

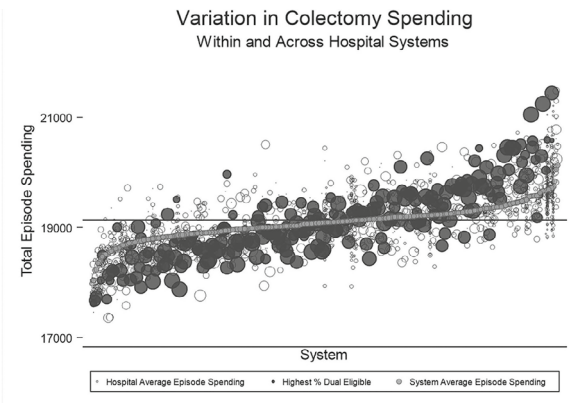
Background: Older adults illness experience differs from other groups. Understanding post-operative symptoms is necessary for management. We examined symptom trajectories and factors associated with high symptom burden after cancer surgery in older adults. Methods: We conducted a population-level study of patients >70 years old undergoing cancer surgery (2007-2018) using prospectively collected Edmonton Symptom Assessment System (ESAS) scores. The monthly prevalence of moderate-to-severe symptoms (ESAS>4) for anxiety, depression, drowsiness, lack of appetite, nausea, pain, shortness of breath, tiredness and poor wellbeing was computed over 1 year after surgery. Multivariable models assessed predictors of symptom burden. Results: Among 48,748 patients, 234,420 ESAS scores were recorded over 1 year after surgery. Moderate-to-severe tiredness (57.8%), poor wellbeing (51.9%) and lack of appetite (39.3%) were most common. The proportion of patients with moderate-to-severe symptoms was stable over 1 year after surgery (<5% variation for each symptom). Similar patterns were observed for all procedures, except for lung and upper gastrointestinal/hepato-pancreato-biliary resections, which showed an initial rise in symptoms 1 month after surgery, with resolution by 3 months. While tiredness, drowsiness, and nausea scores increased coinciding with median time to first treatment (64 days; IQR 48-87), compared to patients with surgery only, this was not clinically significant (<5% change) and resolved by the end of adjuvant therapy. Older age, female sex, lower socioeconomic status, frailty, high comorbidities, receipt of adjuvant chemotherapy within 2 weeks, and high intensity surgery were associated with higher risk of moderate-to-severe symptoms. Conclusions: Older adults have sustained moderate-to-severe symptoms after surgery, showing potential gaps in supportive care. There is no clinically significant increase in symptoms burden with adjuvant therapy. This information on symptom trajectory and predictors of symptom burden is pivotal to set expectations and improve counselling, recovery care pathways and proactive symptom management for older adults after cancer surgery.



75

Association of Medicaid Eligibility with Spending for Medicare Beneficiaries within Hospital Systems for Cancer Surgery A. Diaz,* K. Taylor, U. Nuliyalu, J. Dimick, H. Nathan. *Institute of Health Policy and Innovation, University of Michigan, Ann Arbor, MI.*

Dual eligibility has been used as a measure of social risk, as socially vulnerable patients have been shown to have worse outcomes and greater needs. This study aimed to assess spending variation by dual eligibility(DE) status across hospital systems and to investigate whether systems have leveraged their resources to mitigate the spending within this high-risk population. We identified Medicare patients and patients eligible for both Medicare and Medicaid undergoing elective colectomy for cancer from 2014-2016. We calculated risk-adjusted, price-standardized payments for the surgical episode from admission through 30 days post discharge. DE distribution between hospitals in a system was assessed using a Herfindahl-Hirschman Index-(HHI), in which higher values indicate greater concentration(max 10,000). We then assessed the reliability-adjusted variation in spending across and within systems. Overall 38,425 patients, of which 4,397(11.4%) were DE, underwent elective colon resection at 2,318 hospitals within 314 systems. Spending variation withinsystems was less among the lowest-spending systems [Medicare: $1,254 ($1,216-$1,291); DE: $939($840-$1,038)] than at the highest-spending systems [Medicare:$1,983($1,920-$2,047);DE: $1,426($1254-$1,598)]. Index hospitalization was a greater source of variation among DE(58%) compared with Medicare beneficiaries(43%). Within the lowest spending systems, DE's were more concentrated (HHI:2406) with 36.2% of the system's DE patients treated at the system's lowest spending hospital. Conversely, within the highest-spending systems, DE's were more scattered(HHI:1113) with only 20.4% of the system's DE patients treated at the system's lowest spending hospital. Across all systems, serious complication rates were significantly better at the lowest spending hospital compared to the highest spending (OR:1.6 95%CI 1.1-2.3) On average, DE's had greater average episode spending compared to Medicare beneficiaries, which was largely driven by variation in index hospitalization spending. This variation may represent an opportunity for systems to improve the quality of care for most medically and socially complex patients.

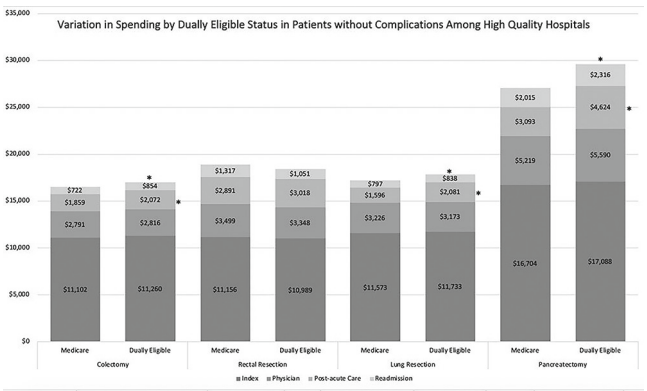


NOTES: FIGURE 1. Variation in colectomy spending within and across health systems. System and hospital average payments were price-standardized, winsorized to the 1st and 99th percentiles, and risk- and reliability- adjusted. The horizontal line represents the national average 30-d episode payment for colectomy. The small grey dots represent average episode payments at the system level; systems are arrayed from lowest to highest average spending. The bubbles represent average episode payments at the hospital level; larger bubbles represent higher-percent of dual eligible treated at that hospital. Bubbles within a vertical column represent hospitals within the same system. The solid circles represent the hospital that treated the largest % of that systems dual eligible patients.

76

Association of Medicaid Eligibility with Outcomes and Spending for Medicare Beneficiaries Among High Quality Hospitals for Cancer Surgery K. Taylor,* A. Diaz, U. Nuliyalu, J. Dimick, H. Nathan. *University of Michigan, Ann Arbor, MI.*

Introduction Patients who qualify for both Medicaid and Medicare (dually eligible, DE), are typically of lower income with higher social support needs. They tend to be treated at poor-quality hospitals, have poorer outcomes, and incur higher healthcare costs. This study aimed to assess whether treatment at high-quality hospitals mitigates DE-associated disparities in outcomes and spending for cancer surgery. Methods Using 100% Medicare claims data from 2014-2016, we identified patients undergoing 4 elective high-risk cancer operations. Patients were identified as DE versus Medicare alone. The highest-quality 20% hospitals were identified by risk- and reliability-adjusted rates of serious complications. Multivariable regression was used to analyze outcomes and spending, adjusted for demographics, comorbidities, hospital characteristics, and year. Results The study cohort included 53,751 patients who underwent colectomy, 13,705 rectal resection, 44,756 lung resection, and 2,877 pancreatectomy. Of these patients, 11% were DE. DE patients had modestly higher rates of serious complications for colectomy (0.7%) and rectal resection (2.3%). DE patients were less likely to be discharged home after colectomy (54% v 67%), rectal resection (29% v 35%), lung resection (52% v 65%), or pancreatectomy (28% v 36%); and more likely to be discharged with home health services or to a post-acute care facility. Differences in post-acute care utilization persisted even after accounting for postoperative complications, and contributed to variation in spending. Post-acute care spending for patients without complications was greater for DE than for Medicare patients undergoing colectomy (12%), lung resection (30%), and pancreatectomy (50%), but not rectal resection (Figure). Conclusions Even in high-quality hospitals, DE patients had higher episode spending. DE patients were less likely to be discharged home and therefore incurred higher post-acute care costs. Although high-quality hospitals have reduced differences in complication rates, they could further mitigate disparities by proactively addressing post-discharge support needs.



* indicates statistically significant difference between Medicare and dually eligible patients

77

Quality of the Surgical Episode Mediates a Large Proportion of Socioeconomic-Based Survival Disparities in Patients with Resected Stage I-III Colon Cancer D.S. Swords,* B. Bednarski, C.A. Messick, M.M. Tillman, G.J. Chang, Y. You. *The University of Texas MD Anderson Cancer Center, Houston, TX.*

Introduction: While low SES is associated with shorter overall survival (OS) in most cancers, the proportion of OS disparities mediated by treatment disparities have rarely been quantified. We aimed to understand the importance of various factors and the proportion of OS disparities mediated by treatment disparities in patients with resected stage I-III colon cancer. Methods: We examined patients ages 18-80 with stage I-III colon adenocarcinoma using the 2010-2016 National Cancer Database. Exclusions included neoadjuvant chemotherapy/radiation, missing data on SES or mediators, and chemotherapy contraindications. The exposure, zip code-level SES, was defined as low (quartile 1 income and education), high (quartile 4 income and education), and

middle. Post-surgery OS was the outcome. We performed causal mediation analyses using inverse odds ratio weighting to estimate the proportion mediated (PM) by 9 treatment factors. Low and middle SES patients were compared separately to high SES patients. Adjuvant chemotherapy use was considered as an additional mediator in subgroup analyses of stage III patients. Results: Among 171,009 patients, 5-year OS was 78.1% for high SES patients, 73.3% for middle SES, and 70.4% for low SES. The most important patient-level mediators were minimally invasive surgery use, number of examined nodes, and length of stay while margin status and unplanned readmissions played small to insignificant roles (Table). Traditional facility-level factors were not important mediators. Conversely, adjusted facility 90-day mortality rate was consistently the most important mediator. Overall, we estimated that approximately 60% of OS disparities were mediated by measured treatment factors. In stage III subgroup analyses, which included chemotherapy use as an additional mediator, PMs were 80-88%. Conclusions: Surgeons control key factors that mediate a substantial portion of socioeconomic-based OS disparities after curative-intent therapy for non-metastatic colon cancer. Initiatives that address treatment quality disparities have the potential to substantially improve OS of low-middle SES patients.

Results of Causal Mediation Analyses of the Individual and Collective Roles of Measured Treatment Factors in Mediating Socioeconomic-based Survival Disparities I

	Low SES (n=21,183) vs. High SES (n=31,329)		Middle SES (n=118,497) vs. High SES (n=31,329)	
	Stages I-III	Stage III subgroup (n=7,936/11,05)	Stages I-III	Stage III subgroup (n=42,521/11,050)
Adjusted HR (95% CI)	**0.62 (0.59, 0.65)**	**0.64 (0.58, 0.70)**	**0.79 (0.77, 0.82)**	**0.79 (0.75, 0.84)**
	Proportion mediated for individual mediators, % (95% CI) II			
MIS approach	**19.8 (11.3, 28.3)**	**24.9 (8.5, 41.4)**	**15.6 (10.2, 21.0)**	**14.4 (5.3, 23.5)**
No. lymph nodes examined	**10.1 (3.8, 16.4)**	**17.0 (2.0, 32.0)**	**5.7 (0.2, 11.2)**	6.2 (-1.7, 14.1)
Positive margins	**5.5 (0.001, 11.0)**	13.0 (-1.5, 27.5)	3.5 (-1.3, 8.2)	7.9 (-0.4, 16.1)
Length of stay quartile	**16.9 (9.4, 24.4)**	**25.7 (10.3, 41.1)**	**15.3 (9.3, 21.3)**	**15.1 (6.5, 23.7)**
Unplanned readmission	3.9 (-2.5, 10.3)	8.8 (-5.4, 22.9)	-0.1 (-5.5, 5.3)	0.1 (-7.3, 7.6)
Treatment at >1 CoC facility	3.2 (-3.2, 9.6)	9.0 (-5.2, 23.2)	2.5 (-4.6, 5.1)	1.8 (-5.7, 9.2)
Facility type	4.0 (-4.4, 12.4)	9.1 (-5.9, 24.2)	3.8 (-2.2, 9.7)	4.6 (-4.2, 13.4)
Facility volume quartile	2.5 (-3.6, 8.7)	8.6 (-5.6, 22.9)	**4.7 (0.5, 8.9)**	4.6 (-3.3, 12.4)
Adjusted facility 90-day mortality rate III	**34.1 (25.8, 42.4)**	**43.9 (22.1, 65.8)**	**34.2 (25.4, 43.0)**	**34.5 (20.9, 48.1)**
Adjuvant chemotherapy	---	**29.0 (13.5, 44.6)**	---	**15.6 (6.3, 24.9)**
	Collective proportion mediated, % (95% CI) IV			
	62.6 (49.6, 75.7)	**87.9 (55.9, 119.8)**	**57.1 (47.0, 67.1)**	**80.2 (61.7, 98.7)**

Abbreviations: SES, socioeconomic status; CI, confidence interval; HR, hazard ratio; MIS, minimally invasive surgery; No., number; CoC, Commission on Cancer.
I: These models adjusted for the following baseline covariates: sex, age, race/ethnicity, personal cancer history, Charlson-Deyo score, stage, tumor location, tumor size, grade, histology, lymphovascular invasion, and year of diagnosis.
II: The proportion mediated was calculated as: indirect effect / total effect. Bold values indicate that the calculated proportion mediated differs from zero at $p < 0.05$.
III: Adjusted facility 90-day mortality rates were calculated using risk- and reliability-adjustment. Risk-adjustment adjusts for differences in baseline covariates, and reliability-adjustment is a hierarchical modeling technique that shrinks observed variation towards the mean for facilities with fewer cases.
IV: The collective proportion mediated includes each of the individual mediators in a single model. Bold values indicate that the calculated proportion mediated differs from zero at $p < 0.05$.

78

Is Textbook Oncologic Outcome a Valid Hospital Quality Metric Following High-risk Surgical Oncology Procedures? C.T. Aquina,* A. Hamad, J. Cloyd, A. Tsung, T.M. Pawlik, A. Ejaz. *Surgery, Ohio State University Wexner Medical Center, Columbus, OH.*

Introduction: A "textbook oncologic outcome" (TOO) is a composite quality measure representing the "ideal" outcome for patients undergoing cancer surgery. This study sought to assess the validity of TOO as a hospital quality metric by evaluating the association between risk-adjusted hospital TOO rates and overall survival (OS). Methods: Patients who underwent curative-intent resection of lung, esophageal, gastric, pancreatic, colon, rectal, or bladder cancer were identified within the National Cancer Database (2006-2015). Organ-specific TOO was defined as: adequate lymph node yield, R0 resection, non-length of stay outlier, no hospital readmission, and receipt of guideline-concordant chemotherapy and/or radiation. Mixed-effects analyses estimated the risk-adjusted TOO rate for each hospital stratified by cancer type. The association between hospital risk-adjusted TOO rates and 5-year OS was assessed using mixed-effects Cox proportional-hazards analyses. Results: Among 502,173 cancer resections, the risk-adjusted TOO rate was 32.9% for lung cancer, 30.3% for esophageal cancer, 30.1% for gastric cancer, 23% for pancreatic cancer, 65.2% for colon cancer, 43% for rectal cancer, and 34.9% for bladder cancer. After characterizing hospitals into having very low, low, moderate, high, and very high risk-adjusted TOO rates based on quintiles, there was an incremental improvement in OS with higher risk-adjusted TOO rates (Table). Similarly, with the risk-adjusted hospital TOO rate entered as a continuous variable into multivariable analyses, there was a significant 5%-14% improvement in OS for every 10% increase in the hospital risk-adjusted TOO rate for lung (OR=0.95, 95%CI=0.94-0.96), esophageal (OR=0.93, 95%CI=0.91-0.96), gastric (OR=0.86, 95%CI=0.84-0.89), pancreatic (OR=0.89, 95% CI=0.86-0.91), colon (OR=0.94, 95%CI=0.93-0.95), rectal (OR=0.90, 95%CI=0.87-0.93), and bladder (OR=0.94, 95%CI=0.91-0.97) cancer resection. Conclusions: There is a direct association between risk-adjusted hospital TOO rates and OS following high-risk cancer procedures. TOO is valid hospital metric that can be used to compare the overall quality of cancer care across hospitals.

Table: Association Between Achievement of a Textbook Oncologic Outcome (TOO) and Overall Survival

Risk-Adjusted Hospital TOO Rate (Quintiles)	Odds Ratio (95% CI)*	P-Value
Lung Cancer Resection		
Very Low (< 14%)	Reference	Reference
Low (14%-19%)	0.96 (0.92-1.00)	0.07
Moderate (20%-25%)	0.98 (0.93-1.02)	0.31
High (26%-34%)	0.88 (0.84-0.93)	<0.0001
Very High (≥ 35%)	0.83 (0.80-0.87)	<0.0001
Esophageal Cancer Resection		
Very Low (< 10%)	Reference	Reference
Low (10%-13%)	0.96 (0.86-1.07)	0.43
Moderate (14%-19%)	0.95 (0.86-1.06)	0.35
High (20%-29%)	0.87 (0.78-0.96)	0.006
Very High (≥ 30%)	0.80 90.73-0.88)	<0.0001
Gastric Cancer Resection		
Very Low (< 14.5%)	Reference	Reference
Low (14.5%-17%)	0.92 (0.85-1.01)	0.08
Moderate (18%-21%)	0.82 (0.76-0.90)	<0.0001
High (22%-27%)	0.79 (0.73-0.87)	<0.0001
Very High (≥ 28%)	0.71 (0.66-0.78)	<0.0001
Pancreatic Cancer Resection		
Very Low (< 7.5%)	Reference	Reference
Low (7.5%-9%)	0.95 (0.87-1.03)	0.20
Moderate (10%-12%)	1.00 (0.92-1.09)	0.96
High (13%-18%)	0.87 (0.81-0.94)	0.0006
Very High (≥ 19%)	0.76 (0.70-0.82)	<0.0001
Colon Cancer Resection		
Very Low (< 59%)	Reference	Reference
Low (59%-65%)	0.95 (0.90-0.99)	0.03
Moderate (66%-70%)	0.94 (0.90-0.99)	0.03
High (71%-75%)	0.90 (0.86-0.95)	<0.0001
Very High (≥ 76%)	0.81 (0.77-0.85)	<0.0001
Rectal Cancer Resection		
Very Low (< 32%)	Reference	Reference
Low (32%-36%)	0.96 (0.88-1.05)	0.38
Moderate (37%-40%)	0.92 (0.84-1.00)	0.06
High (41%-45%)	0.90 (0.86-0.95)	<0.0001
Very High (≥ 46%)	0.81 (0.77-0.85)	<0.0001
Bladder Cancer Resection		
Very Low (< 22%)	Reference	Reference
Low (22%-24%)	0.97 (0.90-1.05)	0.47
Moderate (25%-27%)	0.96 (0.89-1.03)	0.25
High (28%-32%)	0.89 (0.83-0.96)	0.001
Very High (≥ 33%)	0.89 (0.83-0.95)	0.0005

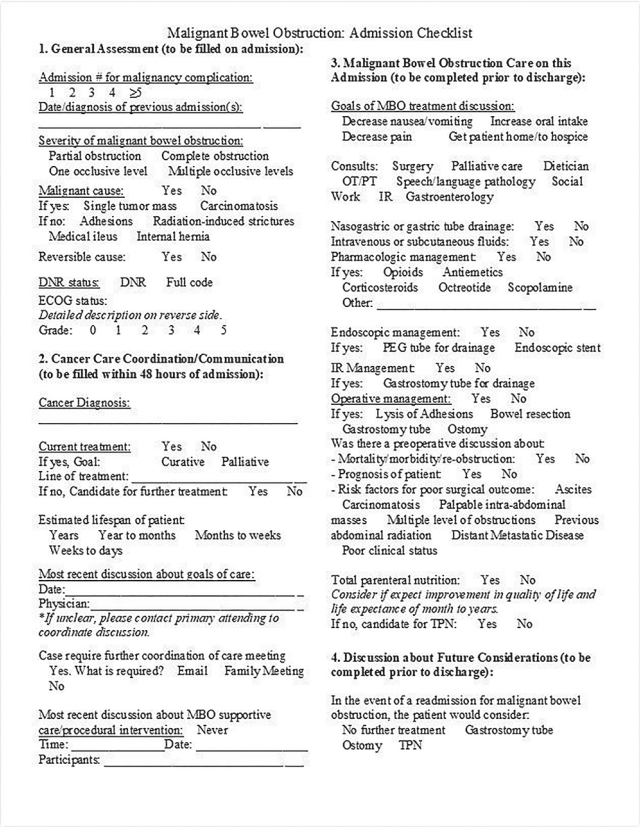
*Multivariable analyses control for age, sex, race, education status, income status, insurance type, distance from hospital, Charlson-Deyo comorbidity score, year of diagnosis, tumor grade, procedure type, and TNM pathologic stage

79

Novel Admission Checklist for Malignant Bowel Obstruction: A Quality Improvement Initiative G. Gauvin,* M.A. Moslim, C. Do-Nguyen, B. Egleston, E. Milano, M. Chwistek, M.E. Collins, C.S. Denlinger, M. Itzen, K.P. Patrick, J.M. Farma. *Fox Chase Cancer Center, Philadelphia, PA.*

Introduction: Malignant bowel obstruction (MBO) is a frequent presentation in advanced cancers. Despite its frequency, clinicians struggle to create a personalized, multidisciplinary care plan. To the best of our knowledge, no MBO admission algorithm exists to date. At our tertiary care center, we developed a discussion tool to ensure realistic prognostication and improve communication between the different services involved in the care of those patients. This study assesses feasibility of implementation of our MBO admission checklist. Methods: A multidisciplinary team composed of surgical

oncologists, medical oncologists, palliative care specialists, hospitalists, social workers, and nutritionists developed the MBO admission checklist. Patients were recruited prospectively at admission, and a retrospective case-match (1:1) based on age and primary site of cancer was performed to compare consultation patterns and outcomes as secondary endpoints. Results: Fifty patients with stage IV cancer were recruited for this study. Most patients (76%) were in their 6-7th decade of life, and the primary tumor was gastrointestinal in 64%, genitourinary in 28% and breast in 8%. An MBO admission checklist was successfully filled for all 25 patients in the intervention arm. When comparing MBO checklist patients with the control group, social work consultation was done in 48% vs 29%, nutritionist consultation was done in 76% vs 52%, and TPN was administered in 28% vs 43% of patients. Despite a poor prognosis, 76% of patients had full code status, and >90% underwent gastrostomy tube placement during their admission. Palliative care consultations were significantly higher in the MBO checklist group (p=0.002). Length of stay was similar in both groups (11 vs 13 days, p=0.6), and discharge to hospice was 14% vs 11%. Thirty-day readmission rate was 52% vs 29% (p=0.09). Expiration during the hospital stay was only seen in the control group (11%). Conclusion: Our discussion tool was successfully implemented in our local institution. The next step in our study will be a multi-site clinical trial to assess the impact of our checklist on patient quality of life and outcomes.



Malignant Bowel Obstruction: Admission Checklist

1. General Assessment (to be filled on admission):

Admission # for malignancy complication:
1 2 3 4 ≥5
Date/diagnosis of previous admission(s):
_____ _____
Severity of malignant bowel obstruction:
Partial obstruction Complete obstruction
One occlusive level Multiple occlusive levels
Malignant cause: Yes No
If yes: Single tumor mass Carcinomatosis
If no: Adhesions Radiation-induced strictures
Medical ileus Internal hernia
Reversible cause: Yes No
DNR status: DNR Full code
ECOG status:
Detailed description on reverse side.
Grade: 0 1 2 3 4 5

2. Cancer Care Coordination/Communication (to be filled within 48 hours of admission):

Cancer Diagnosis:
_____
Current treatment: Yes No
If yes, Goal: Curative Palliative
Line of treatment: _____
If no, Candidate for further treatment: Yes No
Estimated lifespan of patient:
Years Year to months Months to weeks
Weeks to days
Most recent discussion about goals of care:
Date:_____
Physician:_____
**If unclear, please contact primary attending to coordinate discussion.*
Case require further coordination of care meeting
Yes. What is required? Email Family Meeting
No
Most recent discussion about MBO supportive care/procedural intervention: Never
Time: _____Date: _____
Participants: _____

3. Malignant Bowel Obstruction Care on this Admission (to be completed prior to discharge):

Goals of MBO treatment discussion:
Decrease nausea/vomiting Increase oral intake
Decrease pain Get patient home/to hospice
Consults: Surgery Palliative care Dietician
OT/PT Speech/language pathology Social Work IR Gastroenterology
Nasogastric or gastric tube drainage: Yes No
Intravenous or subcutaneous fluids: Yes No
Pharmacologic management: Yes No
If yes: Opioids Antiemetics
Corticosteroids Octreotide Scopolamine
Other: _____
Endoscopic management: Yes No
If yes: PEG tube for drainage Endoscopic stent
IR Management: Yes No
If yes: Gastrostomy tube for drainage
Operative management: Yes No
If yes: Lysis of Adhesions Bowel resection
Gastrostomy tube Ostomy
Was there a preoperative discussion about:
- Mortality/morbidity/re-obstruction: Yes No
- Prognosis of patient: Yes No
- Risk factors for poor surgical outcome: Ascites Carcinomatosis Palpable intra-abdominal masses Multiple level of obstructions Previous abdominal radiation Distant Metastatic Disease Poor clinical status
Total parenteral nutrition: Yes No
Consider if expect improvement in quality of life and life expectance of month to years.
If no, candidate for TPN: Yes No

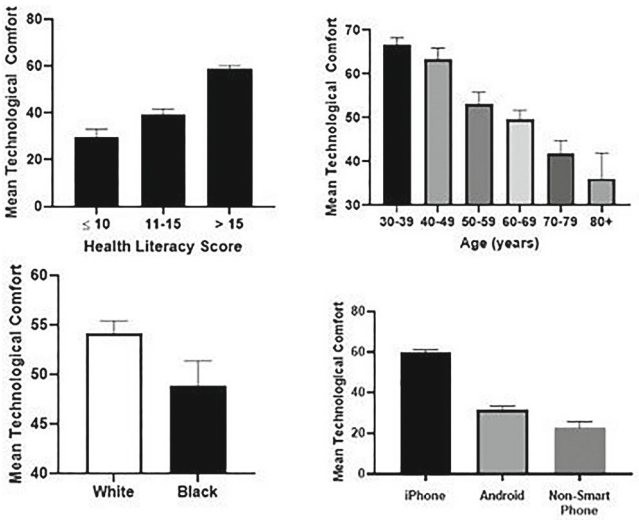
4. Discussion about Future Considerations (to be completed prior to discharge):

In the event of a readmission for malignant bowel obstruction, the patient would consider:
No further treatment Gastrostomy tube
Ostomy TPN

80

Leaving Those at the Greatest Risk Behind: Does Health Literacy Impact Technological Comfort? A. Irfan,* J. Lever, M. Fouad, B. Sleckman, D. Chu, S. Reddy. *Department of General Surgery, University of Alabama at Birmingham, Birmingham, AL.*

Introduction Prevention of crowded waiting rooms and limiting of unnecessary patient contact are key prevention strategies in the management of COVID-19. As healthcare systems have begun to adapt, there has been an increased need for telemedicine in the outpatient setting. However, not all patients have been comfortable with this transition. Health literacy has been linked to patient outcomes and patients with poor health literacy are less likely to engage with telemedicine. We sought to determine the relationship between health literacy and technological comfort in the cancer patient population. Methods We conducted a survey of patients that presented to surgical and medical oncology clinics at a single center over a 2-month period. Patients were given a survey during their visit which contained questions regarding demographics, health literacy and comfort with technology. Participation was voluntary and no identifying information was collected. Surveys were collected weekly and entered into a secure online database. Health literacy was assessed using the validated Brief Health Literacy Tool. Results 344 surveys were returned with a response rate of 64.3%. The median patient age was 61 years, 70% were female and the most common ethnicity was white (67.3%). A lower health literacy was the strongest predictive factor for reduced technological comfort (p<0.001, z-score 7.65). Additionally, older patients and males had lower technological comfort (p<0.001, z-score -5.85 and -4.18 respectively). Users of smartphones reported higher scores (p<0.001, z-score 4.06). When comparing White to African American patients, the former was found to express increased technological comfort (p<0.001). Conclusion As the shift to telemedicine continues, it is important that we engage all patients that require service. A lower technology comfort score was seen in patients with lower health literacy score, older and male patients, and those that use non smartphones. Our study demonstrates that cancer patients that would likely benefit the most from telehealth may be at risk of not engaging. It is important to identify these at-risk patients and assist them in utilizing telehealth services.

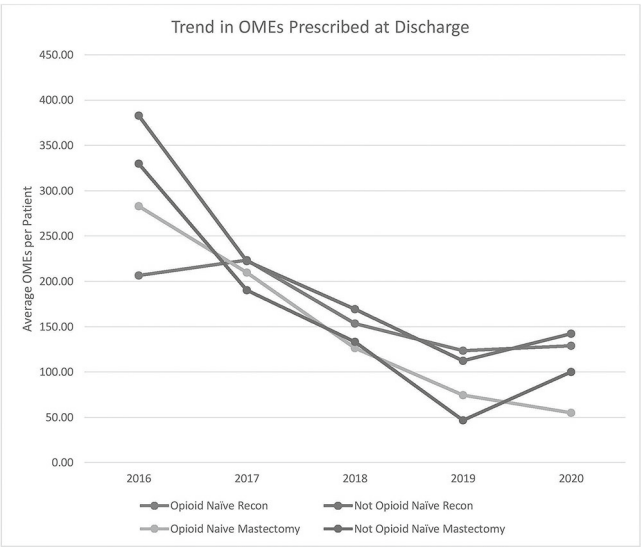


81

Impact of ERAS® on Opioid Prescribing Practices After Breast Surgery N. Gupta,[1]* K. Jogerst,[2] S. Abujbarah,[1] P. Cronin,[2] B. Pockaj,[2] C. Teven.[2] *1. Alix School of Medicine, Mayo Clinic, Scottsdale, AZ; 2. Mayo Clinic, Phoenix, AZ.*

Introduction: Data suggests breast surgery patients receive more opioid pain medications at discharge than needed. This study evaluates whether an ERAS® protocol leads to decreased opioid prescriptions in patients undergoing mastectomy with or without implant-based reconstruction (IBBR). Methods: A retrospective review of discharge opioid prescriptions and 90-day refills for patients who underwent mastectomy or mastectomy with IBBR between 1/1/2016 and 6/30/2020. ERAS® protocols were implemented February 2017 creating two cohorts: Pre-ERAS® and ERAS®. Opioid naïve patients did not have an opioid prescription within 12 months of surgery. Prescription data was converted to oral morphine equivalents (OMEs). Average OMEs were compared between ERAS® cohorts for opioid naïve and non-opioid naïve subgroups with unpaired student's t-tests. Results: 469 patients met inclusion criteria. Pre-ERAS®, 55 patients underwent mastectomy (71% opioid naïve) and 136 underwent mastectomy with IBBR (69% opioid naïve). Following ERAS®, 163 patients underwent mastectomy (70% opioid naïve) and 135 underwent mastectomy with IBBR (83% opioid naïve). For opioid naïve mastectomy patients, average discharge OMEs decreased from 279 to 129 post-ERAS® (p<0.001). For opioid non-naïve mastectomy patients, discharge OMEs decreased from 309 to 135 (p<0.001). For opioid naïve mastectomy patients undergoing IBBR discharge OMEs decreased 287 to 139 (p<0.001)

as did refill OMEs (p=0.017). 5.9% of opioid naïve mastectomy patients and 8.7% opioid tolerant mastectomy patients requested refills, while 31.5% of opioid naïve reconstruction patients and 42.4% of opioid tolerant reconstruction patients received refills. Each year following ERAS®, there was a decline in OMEs prescribed to opioid naïve patients (Figure 1). Conclusion: ERAS® protocols are effective at decreasing opioid prescriptions for patients undergoing mastectomy with or without IBBR. Given the low volume of requested refills, patients were likely receiving more opioids than necessary prior to ERAS® implementation. The steady decline in discharge OMEs each year following ERAS® suggests institutional prescribing behavior slightly lags behind protocol implementation.



Average discharge OMEs per patient decreased across the study period, but the decrease lagged behind the 2017 ERAS protocol implementation

82

Clinical Impact of Systemic Staging Studies in Secondary Breast Angiosarcoma K.E. Larson,[1]* B. Powers,[2] A.L. Amin,[1] L.J. Kilgore,[1] J.L. Wagner,[1] C.R. Balanoff.[1] *1. General Surgery, University of Kansas, Kansas City, KS; 2. University of Kansas, Kansas City, KS.*

Introduction: Patients with secondary breast angiosarcoma (SBA) often undergo systemic imaging studies at diagnosis (DX) and followup (FU). Data supporting this practice is lacking. Our goal was to evaluate the clinical impact of systemic staging in SBA. Methods: A single-site academic institution retrospective chart review for all SBA patients treated from 1/2007-7/2020. Clinicopathologic data was collected, including details of local and systemic imaging studies performed at SBA DX and FU. The clinical impact (defined as change in surgery or order of treatment) was evaluated. Results: Twenty SBA patients were included. All patients underwent lumpectomy and radiation for their initial breast cancer (BC). The mean interval between BC radiation and SBA DX was 10.6±6.7 years. No patients had SBA diagnosed on screening breast imaging. Diagnostic mammogram (77%), ultrasound (82%), and breast MRI (65%) were performed concurrently with DX but did not have a clinical impact for any patient. All underwent mastectomy for SBA surgical treatment. Routine systemic staging was performed in 80% at DX, most frequently CT (60%) concurrent with PET (35%). One asymptomatic patient (5%) had metastatic disease, which did not change surgery or order of treatment. One symptomatic patient had targeted imaging confirming metastatic disease, also without clinical impact. During FU, 74 routine systemic staging studies (mean 3.7/patient) were performed with a single study (1.3%) finding asymptomatic metastatic disease for which new systemic therapy was initiated. Two patients (10%) developed focal systemic symptoms, confirmed to be metastasis with targeted imaging. Six patients (30%) had local recurrence, all identified on clinical exam and all without new metastatic disease on staging. Conclusions: SBA patients in our cohort underwent extensive local and systemic staging studies at DX and FU; results rarely changed clinical management. Systemic imaging based on focal symptoms is warranted, but routine staging is not indicated as asymptomatic metastatic disease was rare. Our data is the first to assess the clinical impact of routine imaging and challenges the traditional recommendations for extensive staging in SBA.

Imaging studies obtained at diagnosis (DX) and during follow-up (FU)

	Timing: DX	Timing: FU
Local Regional Imaging		
Mammogram	13	0
Ultrasound	16	0
MRI	11	15
TOTAL	40	15
Systemic Imaging		
CT	12	57
CT Positive for Disease	1*	1* + 2
PET	7	13
PET Positive for Disease	1	0
CXR	2	4
CXR Positive for Disease	0	1
TOTAL	21	74

*indicates asymptomatic patient

83

Should Imaging Surveillance be Used in Cutaneous Leiomyosarcoma? L.L. Hoff,* C.A. Harter, A. Bhattacharya, E. Olsen, N. Mott, T. Hughes, C.V. Angeles. *Surgery, University of Michigan, Ann Arbor, MI.*

Background: Cutaneous leiomyosarcomas (cLMS) are rare tumors, thereby having sparse evidence to support treatment guidelines. While dermal cLMS has been shown to have lower recurrence than subcutaneous LMS (subLMS), the recurrence behavior of cLMS with subcutaneous extension is unclear. These differences are not always considered when generating surveillance plans. The purpose of this study is to evaluate the use of imaging and the incidence of recurrence with the goal of optimizing surveillance recommendations for cLMS. Methods: Retrospective chart review of patients with primary cLMS at a single, high-volume institution from 1995-2020. Patients were identified using the institutional cancer registry and Electronic Medical Record Search Engine (EMERSE). Patient characteristics, surgical date, pathological tumor details, post-operative imaging, and recurrence by imaging or other methods were collected using REDCap. Findings were analyzed using descriptive statistics comparing results for pure dermal cLMS versus cLMS involving the subcutis. Results: We identified 311 patients of which 128 were confirmed to have a primary diagnosis of LMS with reported subtype (78 dermal, 39 dermal with subcutaneous extension, and 11 subcutaneous). Median length of follow-up was 25 months (range 1-160 months). 58% (74/128) of all patients had any surveillance imaging: 53%, 62%, and 82% in dermal, dermal with subcutaneous extension, and subcutaneous, respectively. The average length of surveillance was 31 months (median 20, range 0.4-148). The majority of patients (92%) had CXR and/or CT chest imaging. 50% (37/74) of imaged patients had positive findings, the majority being incidental lung nodules requiring further imaging. 1% (1/78) of patients with dermal cLMS had imaging detected distant recurrence, compared to 8% (3/39) and 36% (4/11) of patients with cLMS with subcutis extension and subLMS, respectively. Conclusion: Chest imaging for pure dermal cLMS is overutilized and is unlikely to be necessary. cLMS with subcutaneous extension has a more aggressive biology, and this pathological distinction should be considered when determining a surveillance imaging plan.

84

Sarculator is a Good Model to Predict Survival in Resected, Primary U.S. Extremity and Trunk Sarcoma Patients R.K. Voss,[1]* D. Callegaro,[2] Y. Chiang,[1] M. Fiore,[2] R. Miceli,[2] E. Keung,[1] B.W. Feig,[1] K.E. Torres,[1] C. Scally,[1] K.K. Hunt,[1] A. Gronchi,[2] C. Roland.[1] *1. MD Anderson Cancer Center, Houston, TX; 2. Fondazione IRCCS Istituto Nazionale Tumori, Milan, Italy.*

Introduction: Sarculator is an online validated nomogram that predicts overall survival of resected primary extremity and trunk sarcoma patients created using mostly European patient data treated at high volume centers. However, its ability to accurately predict outcomes in U.S. sarcoma patients is unknown. We sought to compare Sarculator predicted OS (prOS) to actual overall survival (aOS) in U.S. patients using the National Cancer Data

Base (NCDB). Methods: Patients from the NCDB (2006-2016) with stage I-III primary extremity or trunk sarcoma who underwent R0/R1 resection and had completed demographic and treatment data were included. The prOS was calculated using the Sarculator algorithm which includes patient age, tumor size (cm), grade (I-III), and histology. The prOS was compared to the aOS, and the Harrell's C index was calculated to determine the discrimination of the Sarculator prOS model (0.7=good model, 0.8=strong model, 1.0=perfect model). Results: 9,738 patients were included. Undifferentiated pleomorphic sarcoma (17%), leiomyosarcoma 15.7%), and myxoid liposarcoma (10.9%) were the most common individual histologies. 8,829 patients (90%) underwent R0 resection, 1599 (16.3%) received chemotherapy, and 5,832 (59.5%) received radiation therapy. The 5-year prOS was 73.7% compared to an aOS of 68.9%. The C index for the entire cohort was 0.726 (Table 1). By stage, the C index was 0.730 for stage I, 0.708 for stage II and 0.679 for stage III. By histology, the C index was highest for leiomyosarcoma (0.745), myxoid liposarcoma (0.719), and other histologies (0.719), and it was lowest for malignant peripheral nerve sheath tumor (0.656), liposarcoma (0.679), and synovial sarcoma (0.694). Conclusion: Overall, Sarculator is a good predictor of aOS for U.S. primary extremity and trunk sarcoma patients. Sarculator performs slightly better for earlier stages (I/II) and best for leiomyosarcoma, myxoid liposarcoma, and other histologies. Sarculator is a good clinical tool for surgeons and oncologists to help with survival prognostication.

Table 1: Results showing the discriminatory ability of Sarculator in terms of the Harrell's C index by stage and histology

	N	C Index*
Total	9738	0.726
Stage I	1321	0.730
Stage II	2868	0.708
Stage III	5549	0.679
Histology		
Leiomyosarcoma	1536	0.745
Liposarcoma	894	0.679
Myxoid liposarcoma	1064	0.719
MPNST	383	0.656
Myxofibrosarcoma	179	0.715
Synovial	638	0.694
Vascular	179	0.703
UPS	1669	0.703
Others	3260	0.719

*The covariates in the model were age, tumor size, histology, and grade.

Table 1: Results showing the discriminatory ability of Sarculator in terms of the Harrell's C index by stage and histology

85

Sarcomas with Low Cancer-associated Fibroblasts (CAF) Associated with Worse Survival K. Chouliaras,* M. Oshi, K. Takabe. *Surgical Oncology Department, Roswell Park Cancer Institute, Buffalo, NY.*

INTRODUCTION Cancer-associated fibroblasts (CAFs) were shown to have pleiotropic actions and play an active role in the tumor microenvironment. Recent reports suggest that CAFs promote cancer by cytokine secretion, but others, including our group's, have shown that CAF-high tumors were associated with better survival. Here, we hypothesized that high CAF expression is associated with better survival in sarcoma. METHODS Two hundred fifty-two sarcoma cases were identified from the Cancer Genome Atlas Data Set (TCGA). Tumor infiltrating cells including CAFs were estimated by xCell algorithm and the group was dichotomized into CAF-low and -high groups based on the median. RESULTS Despite the highest expression of CAF among all tumor types in TCGA, none of the inflammation-related gene sets enriched in CAF-high sarcoma. We found that both silent and non-silent mutation rates as well as SNV neoantigen expression were significantly lower in the CAF-high group (p=0.04, p=0.029, and p=0.047, respectively), which suggest less immunogenicity, however, overall lymphocyte infiltration (p=0.027) and IFN-gamma response (p=0.023) were higher in CAF-high sarcomas. No immune cells except for M2 macrophages (p=0.023) were significantly infiltrated in the CAF-high group and there was no statistical difference in the cytolytic activity (p=0.363). In alignment with the mutation rate, both homologous recombination defects, intratumor heterogeneity as well as cell proliferation score were significantly higher in CAF-low sarcoma (p=0.003, p=0.005, p<0.001, respectively). Ki-67 was significantly elevated in CAF-low sarcoma with weak correlation (p<0.001, r=0.268). CAF-low sarcoma significantly enriched cell proliferation-related gene sets, such as MYC targets_V1, V2, E2F targets, Glycolysis and MTORC1 signaling (NES -1.88, -1.74, -1.52, -1.56, -1.72; FDR 0.11, 0.19, 0.23, 0.22, 0.14, respectively). Finally, worse progression-free survival (p=0.009), disease-specific (p=0.016) and overall survival (p=0.01) were found in CAF-low sarcomas. CONCLUSIONS CAF-low sarcoma was associated with enhanced cell proliferation but no significant differences in the immune microenvironment, yielding poor survival outcomes.

86

Extracellular Vesicle MDM2 DNA: A Biomarker for Retroperitoneal Liposarcoma? V. Grignol,* L. Casadei, P. Sarchet, F. Costas Casal de Faria, R. Pollock. *Surgery, The Ohio State University, Columbus, OH.*

Introduction Retroperitoneal liposarcoma (RLPS), a disease lacking biomarkers, is lethal in most patients (10% OS at 10 years) primarily due to uncontrolled locoregional recurrence; surgery remains the only reliable therapy. RLPS prognosis depends on timely detection of recurrences; however, imaging frequently cannot resolve recurrence vs postoperative scarring, delaying diagnosis and treatment. RLPS express high levels of MDM2 DNA. Extracellular vesicles (EVs) contain proteins and nucleic acids that can be oncogenic, they are secreted into the peripheral blood and easily retrieved. Previously we showed that RLPS EVs contain high levels of oncogenic MDM2 DNA. We sought to evaluate if EV MDM2 DNA could serve as a first-ever biomarker of RLPS recurrence. Methods RLPS patient sera (n=11) were collected before surgery and at 6-12 month post-surgical visits. Healthy individuals sera (n=15) were used as controls. EVs were isolated from the serum through precipitation technology (ExoQuick) and ultracentrifugation. EV DNA was then isolated and MDM2 DNA molecule numbers were meausured using Q-PCR. Wilcoxon signed-rank test was used to compare pre- and post-surgery samples. Imaging was reviewed for presence of disease recurrence post-surgery and compared to MDM2 DNA levels. Results The patient cohort included 5 well-differentiated, 3 de-differentiated and 3 mixed RLPS. Mean tumor size was 19cm (range 6.5-64cm). EV MDM2 DNA was detected in RLPS sera at significantly higher mean levels vs control (pre-surgery=74,434 [range 7,049-1,897,273]; control=10,146 [range 1,817-54,030] p= 0.0025). Mean EV MDM2 DNA was significantly decreased post-surgery (pre-surgery=74,434 [range as above]; post-surgery=13,879 [range=60,046-251,036] p=0.0048), approximating control levels (post-surgery vs control, p=0.47). Critical to biomarker applications, EV MDM2 DNA molecule levels began to increase post-surgery in patients prior to CT-scan evidence of recurrent RLPS (n=3). Conclusion EV MDM2 DNA can serve as a first-ever biomarker of RLPS persistent or recurrent disease, thereby promptly resolving diagnostic ambiguities to enable timely therapeutic interventions.

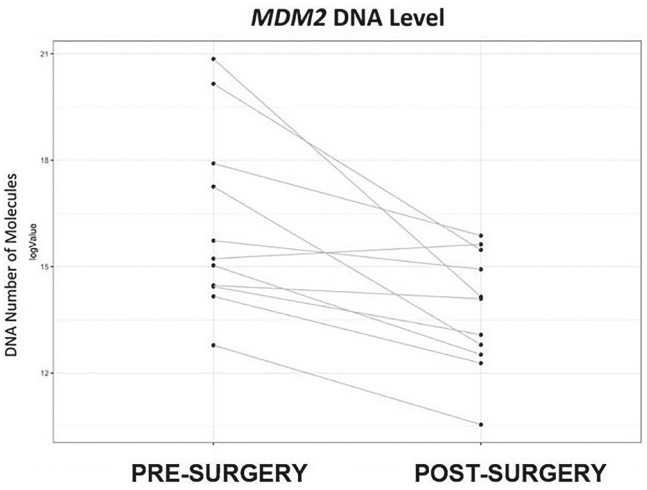


Figure 1. Pre-surgery vs post-surgery MDM2 levels in matched patient serum. MDM2 signfincantly decreased post-surgery (p=0.0048).

87

PD-L1 Immunostaining in Patients with Recurrent and Metastatic Gastrointestinal Stromal Tumors (GIST) J.S. Crystal,[2]* E. Makhoul,[1] B. Cox,[1] B. Balzer,[1] A. Gangi.[1] *1. Cedars Sinai Medical Center, Los Angeles, CA; 2. University of Miami, Miller School of Medicine, Miami, FL.*

INTRODUCTION: Checkpoint inhibitors block the programmed cell death 1/programmed cell death ligand 1 (PD-1/PD-L1) pathway of the immune response and are used to treat many malignancies. The significance of PD-1/PD-L1 expression in GIST tumors, particularly in the local or distant recurrence setting, has yet to be established and was evaluated in this case series. METHODS: Twenty seven patients with GIST were identified, 18 with locally recurrent and distant metastases (REC/MET), and 9 with disease confined to the primary site (LOC). Immunostaining for PD-L1 was performed using a monoclonal antibody. Two pathologists individually confirmed the diagnosis of GIST and scored PD-L1 staining using Combined Positivity Score (CPS) and another immune correlate, Tumor Infiltrating Lymphocytes (TIL). The clinicopathologic data were collected and analyzed. RESULTS: Out of the 27 patients, 52% were male. The average age was 61.4 years. The majority of GISTs were from the small intestine (51.9%), spindle cell type (66.7%), T2/T3 (each 40.7%), and N0 (96.2%). The majority (66.7%) of REC/MET tumors and minority of LOC tumors (33.3%) were high grade. PD-L1 staining of the primary tumor was low with an average CPS of 2 in the LOC group and 1.92 in the REC/MET group. The REC/MET tumors exhibited higher, but still weak PDL-1 staining with an average CPS of 3.3. There was a paucity of TIL in the primary tumors of the LOC or REC/MET patients, with 4% and 3% respectively and only 7% in the REC/MET tumors. The majority of REC/MET patients (83.3%) and the minority of LOC patients (33.3%) received Gleevec. At the end of the study, 11.1% (3/27) of patients were deceased, all were REC/MET patients who died from disease progression. Neither PD-L1 staining or TIL presence had a statistically significant association with survival (p= 0.435 and 0.122, respectively). CONCLUSIONS: PD-L1 staining is low in GIST tumors and did not correlate with presence of recurrence, metastases, or death from GIST tumors. Further studies are needed to determine if other immunotherapeutic markers can be used prognostically and if these findings have any implications for treatment with checkpoint inhibition.

88

Multi-Institution Validation of Prognostic Nomograms for Outcomes After Resection of Primary Retroperitoneal Sarcoma M.H. Squires,[1]* C.G. Ethun,[2] E. Donahue,[1] J.H. Benbow,[1] M.H. Jagosky,[1] C.J. Anderson,[1] W.A. Ahrens,[1] M. Livingston,[1] R. White,[1] N.L. Gower,[1] S. Trufan,[1] R.C. Fields,[3] B.A. Krasnick,[3] D.E. Abbott,[4] P.B. Schwartz,[4] T.C. Gamblin,[5] H. Mogal,[5] K.I. Votanopoulos,[6] K. Chouliaras,[6] V. Grignol,[7] K.K. Roggin,[8] J. Tseng,[8] G. Poultsides,[9] T. Tran,[9] J.S. Hill,[1] J.C. Salo,[1] K. Cardona,[2] H.J. Harrison.[7] *1. Atrium Health, Levine Cancer Institute, Charlotte, NC; 2. Emory University, Atlanta, GA; 3. Washington University School of Medicine, St. Louis, MO; 4. University of Wisconsin, Madison, WI; 5. Medical College of Wisconsin, Milwaukee, WI; 6. Wake Forest University, Winston Salem, NC; 7. The Ohio State University, Columbus, OH; 8. University of Chicago, Chicago, IL; 9. Stanford University, Stanford, CA.*

Introduction: Nomograms incorporating histology-specific variables have been developed to improve prognostic modeling for patients undergoing resection of retroperitoneal sarcoma (RPS). These include the Sarculator nomogram for 7-year disease-free (DFS) and overall survival (OS), and the Memorial Sloan Kettering (MSK) sarcoma nomogram for 4-, 8-, and 12-year disease-specific survival (DSS). We sought to validate the Sarculator and MSK nomograms within a large, modern, multi-institutional cohort of primary RPS patients undergoing resection. Methods: Patients who underwent definitive resection of primary RPS between 2000-2017 across 9 high-volume U.S. institutions were identified. Predicted 7-year DFS and OS and 4-, 8-, and 12-year DSS were calculated from the Sarculator and MSK nomograms, respectively. Nomogram-predicted survival probabilities were stratified in quintiles and compared in calibration plots to observed survival outcomes assessed by Kaplan-Meier estimates. Discriminative ability of nomograms was quantified by Harrell's concordance index (C-index). Results: 502 patients underwent resection of primary RPS. The most common histologies were leiomyosarcoma (30%), dedifferentiated liposarcoma (23%), and well-differentiated liposarcoma (15%). Median tumor size was 14.0cm (IQR, 8.5–21.0cm). Tumor grade distribution was: Grade 1 (27%), Grade 2 (17%), Grade 3 (56%). Median follow-up time was 33.8 months. Median DFS was 37.7 months, with 7-year DFS of 34%. Median OS was 93.8 months, with 7-year OS of 51%. The C-indices for 7-year DFS and OS by the Sarculator nomogram were 0.65 (95% CI:0.62-0.69) and 0.69 (95% CI:0.65-0.73); plots demonstrated good calibration for predicting 7-year outcomes. The C-index for 4-, 8-, and 12-year DSS by the MSK nomogram was 0.71 (95% CI:0.67-0.75); plots demonstrated similarly good calibration ability. Conclusion: In a diverse, modern cohort of patients with resected primary RPS, both Sarculator and MSK nomograms demonstrated good prognostic ability for survival and recurrence outcomes. External validation of the utility of these nomograms supports their ongoing adoption into clinical practice.

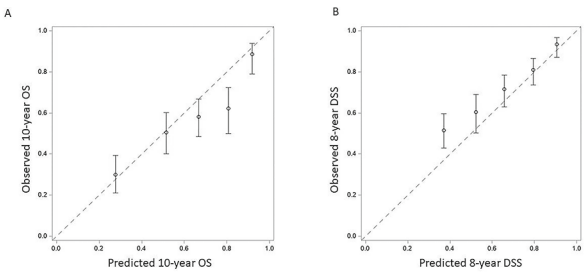


Figure: Calibration plots of A) observed vs. predicted 7-year overall survival (OS) using the Sarculator nomogram, and B) observed vs. predicted 8-year disease specific survival (DSS) using the Memorial Sloan Kettering sarcoma nomogram. Dashed 45-degree line represents reference line along which an ideal nomogram would lie.

Calibration plots of A) observed vs. predicted 7-year overall survival (OS) using the Sarculator nomogram, and B) observed vs. predicted 8-year disease specific survival (DSS) using the Memorial Sloan Kettering sarcoma nomogram. Dashed 45-degree line represents reference line along which an ideal nomogram would lie.

89

Data Dissemination of the Role of Neoadjuvant Radiation in Sarcoma S. Corn,[1]* C. Roland,[4] C. Nessim,[2] A. Gronchi,[3] C. Freeman,[1] S. Dumitra.[1] *1. Surgical Oncology, McGill University, Montreal, QC, Canada; 2. University of Ottawa, Ottawa, ON, Canada; 3. Istituto Nazionale Tumori, Milan, Italy; 4. University of Texas MD Anderson Cancer Center, Houston, TX.*

Introduction: Consensus guidelines for retroperitoneal sarcoma (RPS) call for complete surgical resection and consideration of neoadjuvant radiation for curative-intent treatment. STRASS (EORTC 62092) was a randomized controlled trial evaluating the impact of neoadjuvant radiation on abdominal recurrence free survival. Preliminary data were presented at ASCO 2019 with full publication 15-months later, creating a dilemma of how patients should be managed in the interim. This study aims to: (1) understand perspectives regarding neoadjuvant radiation for RPS during the interim period; (2) assess the process of knowledge dissemination and integration of data into practice; and (3) evaluate the impact of COVID on RPS management. Methods: A web-based survey of 15 questions was distributed to international organizations with membership of all specialties involved in RPS treatment (CTOS, CSSO). The results are presented as descriptive data and kappa coefficients were calculated. Results: Eighty respondents completed the survey including surgical (60.5%), radiation (21.0%), and medical oncologists (18.5%). There were low levels of agreement on a series of clinical scenarios querying individual recommendations before and after the abstract publication, indicating that changes in recommendations were common. Over 62% of respondents indicated a practice change, however most of these also noted discomfort in adopting changes without a manuscript available. Of 45 respondents indicating discomfort with practice change without a full manuscript, 28 (62%) indicated that their practice changed in response to the abstract. During the pandemic, 38% of respondents were more apt to include neoadjuvant radiation. Discussion: There was substantial variability in attitudes towards recommending neoadjuvant radiation from presentation to publication of the STRASS trial results. The difference in the proportion of clinicians describing comfort with changing practice based on an abstract alone versus those that had done so implies that we do not have a clear understanding of how to integrate impactful data into our practices. Endeavors to resolve this ambiguity and expedite availability of practice-changing data is warranted.

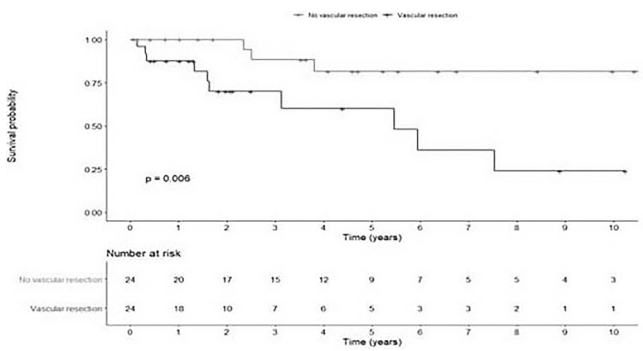
Recommendations for Neoadjuvant Radiation by Histology

Histology	Prior to presentation (%)	After presentation (%)	Kappa correlation coefficient
Well-differentiated liposarcoma	23 (28.8)	35 (43.8)	0.5248
De-differentiated liposarcoma	62 (77.5)	56 (70.0)	0.4231
Leiomyosarcoma	55 (68.8)	31 (38.8)	0.3545
Angiosarcoma	41 (51.3)	26 (32.5)	0.6283
Solitary fibrous tumor	39 (48.8)	28 (35.0)	0.5718

90

Oncological Outcomes After Major Vascular Resections for Primary Retroperitoneal Liposarcoma G. Spolverato,[1]* V. Chiminazzo,[2] G. Lorenzoni,[2] M. Fiore,[3] S. Radaelli,[3] R. Sanfilippo,[4] C. Sangalli,[5] M. Barisella,[6] D. Callegaro,[3] A. Gronchi.[3] *1. Department of Surgery, Oncology and Gastroenterology, University of Padova, Padova, Italy; 2. Unit of Biostatistics, Epidemiology and Public Health, Department of Cardiac, Thoracic, Vascular Sciences and Public Health, University of Padova, Italy, Italy; 3. Department of Surgery, Fondazione IRCCS Istituto Nazionale dei Tumori, Milan, Italy; 4. Department of Cancer Medicine, Fondazione IRCCS Istituto Nazionale dei Tumori, Milan, Italy; 5. Department of Radiation Oncology, Fondazione IRCCS Istituto Nazionale dei Tumori, Milan, Italy; 6. Department of Pathology, Fondazione IRCCS Istituto Nazionale dei Tumori, Milan, Italy.*

Background The surgical management of retroperitoneal sarcomas frequently involves complex multivisceral resections, however retroperitoneal liposarcomas (LPS) rarely invade major abdominal vessels. The aim of the study was to assess association of major vascular resections with outcome of primary LPS. Methods Between 2002 and 2019 425 patients who underwent resection for primary LPS were identified. Clinicopathological characteristics, operative details, and outcomes were stratified by operative approach (vascular resection or not). A propensity matched analysis was performed, adjusting the groups for the variables of Sarculator, to assess the effect of vascular resection on oncological outcomes. Results Overall 24 (5%) patients had vascular resection: 9 IVC, 6 right iliac vein, 2 left iliac vein, 1 right iliac artery and 2 left iliac artery, 3 left and 1 right combined iliac artery and vein resections. At final path 18 patients had vascular infiltration, 2 vascular encasement and 4 abutment without infiltration. Patients who underwent vascular resection were more likely to have right side tumors (71% vs. 50%; p=0.04). Vascular resection was associated with longer operative time (480' vs. 330'; p<0.001) and greater need for transfusions (4 vs. 0 units; p<0.001), it was burdened by a higher rate of major complication (54% vs. 25%; p=0.002) but was not associated with a higher reoperation rate or postoperative 30 and 90-days mortality. At a median follow up of 38 months, overall patients undergoing vascular resection had worse 5-y overall survival (60% vs. 70%; p=0.03), with a higher risk of cumulative incidence of local recurrence (38% vs. 23%; p=0.04) and distant metastases (20% vs. 8%; p=0.07). This difference in CI of LR and DM was confirmed in the matched population (both p<0.05) with a delta of 20% for OS (p=0.006). Conclusion Vascular resection is feasible and safe even in the context of multivisceral resection for primary retroperitoneal liposarcomas. However, the independent association between vascular involvement and a higher risk of LR, DM and death may imply a more aggressive biology, which should be factored in the initial management of these complex disease.



91

A Novel Imageable Patient-Derived Orthotopic Xenograft Model of Gastroesophageal Junction Adenocarcinoma Targeted with Fluorescent Antibodies to Carcinoembryonic Antigen-Related Cell Adhesion Molecules M.A. Turner,[1]* S. Amirfakhri,[1] T. Lwin,[1] H.M. Hollandsworth,[1] H. Nishino,[2] B.B. Singer,[3] T. Reid,[1] R.M. Hoffman,[4] M. Bouvet.[1] *1. University of California, San Diego, Carlsbad, CA; 2. VA San Diego Healthcare System, San Diego, CA; 3. University of Duisburg-Essen, Essen, Germany; 4. Anticancer, San Diego, CA.*

Introduction: Gastric cancer is the second most common cancer in the world. Surgical treatment of gastric cancer is challenging, especially gastro-esophageal junction (GEJ) adenocarcinoma. The margin status of GEJ is often difficult to determine during resection. To help meet the challenges of this disease, we established a patient derived orthotopic xenograft (PDOX) model of GEJ adenocarcinoma derived from a GEJ tumor of a 79 year-old male with stage IV disease. Methods: An anti-carcinoembryonic antigen-related cell adhesion molecule (CEACAM) antibody, SAB, was conjugated with IRdye800 to create SAB-IR800. The patient's tumor fragments were derived from endoscopic biopsy and implanted subcutaneously in a nude mouse. An orthotopic model was created by implanting subcutaneously grown tumor fragments on to the lesser curvature of the stomach. Tumors were allowed to grow for four weeks. Subcutaneous and orthotopic models were injected with 50 ug SAB-IR800 via their tail vein. Mice were imaged at 48 hours using the Pearl Trilogy Imager (LICOR, Lincoln, NE) with excitement at 800 nm. Results: GEJ PDOX models were successfully established from patient endoscopic biopsies. The SAB-IR800 brightly imaged the GEJ PDOX model. In-vivo imaging after 48 hours showed a tumor to background ratio of 3.29 in the subcutaneous model, and a TBR of 2.49 for the orthotopic model (Fig. 1A, B). Conclusions: Fluorescence imaging with anti-CEACAM antibody brightly visualized the GEJ adenocarcinoma. This model has potential to develop fluorescent guided surgery to GEJ cancer. Of high importance, the tumor fragments were obtained from endoscopy, suggesting that the PDOX models of GEJ tumors can be established from patients without undergoing surgical resection. This is the first PDOX model to be established of GEJ cancer which should be highly useful for developing diagnoses and therapeutics to this recalcitrant disease.

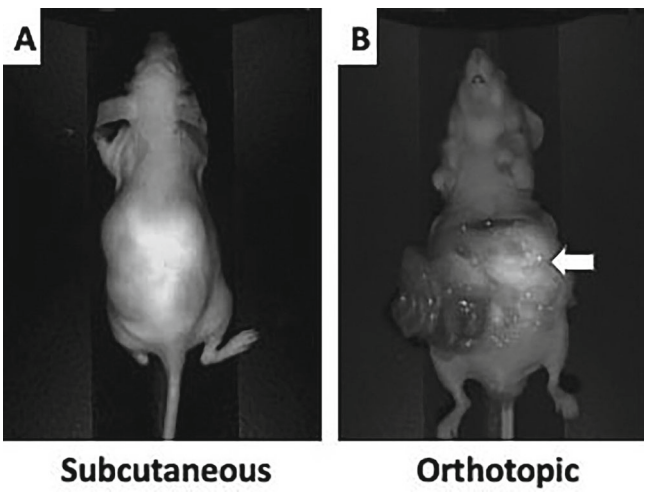


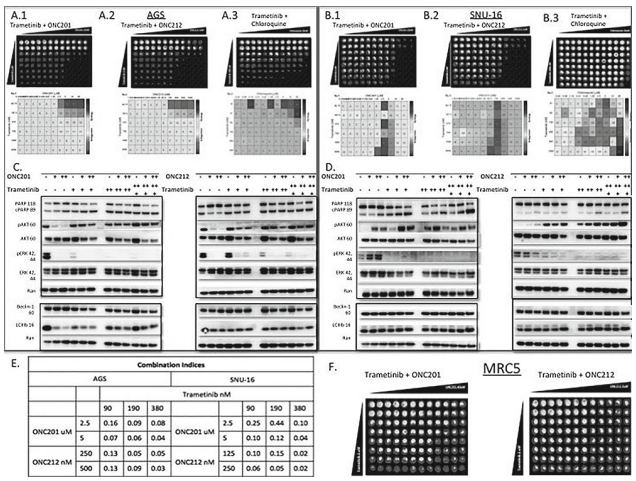
Fig 1: Targeting of SAB-IR800 to GEJ cancer growing subcutaneously (A) and orthotopically (B) in nude mice. Imaged with Pearl Trilogy Imager excited at 800 nm. White arrow indicates the location of the orthotopic tumor.

92

Combination Therapy with Imipridones and MEK Inhibitors Demonstrate Synergy in Gastric Adenocarcinoma Cell Lines

C.S. Parker,[1]* A. Raufi,[1] l. zhou,[2] W. El-Deiry.[1] *1. General Surgery, Brown University/Rhode Island Hospital, Providence, RI; 2. Brown University, Providence, RI.*

INTRODUCTION: The combination of the autophagy inhibitor chloroquine and the MEK inhibitor trametinib has been shown to exhibit synergy in KRAS-mutated pancreatic cancer cell lines and mouse models. Although less common, KRAS mutations have been described in gastric adenocarcinoma (GA). We examined the combination of trametinib and two small molecule imipridones discovered by our group, ONC201 and ONC212, in KRAS-mutant and wild type (wt) GA cell lines. METHODS: Using viability assays, we established sensitivity of two GA cell lines, AGS and SNU-16, as well as normal lung fibroblasts, MRC5, to ONC201, ONC212, trametinib and combinations of these agents. Results were analyzed using Compusyn and Combenefit. We performed Western Blotting on cell lysates after treatment for 48 hours with these agents. RESULTS: Trametinib exhibited strong synergy with both ONC201 and ONC212 in both GA cell lines with combination indices less than 0.6. Treatment of MRC5 did not significantly induce cell death, suggesting that the doses used were non-cytotoxic. The combination of trametinib and chloroquine also showed synergy in AGS, but displayed antagonism in SNU-16. Western blot analysis revealed increased cPARP/PARP with combination therapy across cell lines. We assessed markers of autophagy, including Beclin-1, LC3B, and key second messenger pathway activation/suppression via p-AKT and p-ERK. In AGS Beclin-1, LC3B and p-AKT were up-regulated with trametinib and subsequently decreased with ONC201. Similar results were seen with ONC212, except LC3B, which exhibited no change. SNU-16 cells expressed increased p-AKT with combination therapy while Beclin-1 and LC3B were stable across treatments. P-ERK expression decreased with Trametinib therapy in both cell lines. CONCLUSIONS: The combination of trametinib with ONC201 or ONC212 exerts a synergistic cytotoxic effect on tumor cells at doses that are non-toxic to control cells. In a KRAS-mutated GA cell line, this is likely related to reduction of autophagic flux. Similar synergistic effects were noted in a KRAS-wt GA cell line but with down-regulation of autophagy markers, suggesting an autophagy-independent mechanism.



A. AGS cell line treated with serial dilutions of ONC201 to 20 uM (1), ONC212 to 1uM (2) and Chloroquine to 20 uM (3) with Trametinib to 3 uM (1 and 2) and 500 nM (3) for 72 hours then evaluated using CellTiter-Glo viability assay (Top) and evaluated for synergy using Combenefit to calculate Loewe Synergy score (bottom) B. Experiments in (A) repeated for SNU-16 cell line C. Western blot of AGS cell lysates after 48 hour treatment with ONC201 (+) 2.5 uM, (++) 5uM, ONC212 (+) 250 nM, (++) 500 nM and Trametinib (+) 11 nM, (++) 23 nM, (+++) 45 nM D. Experiments from (C) repeated for SNU-16 cell line with the following doses ONC201 (+) 2.5 uM, (++) 5uM, ONC212 (+) 50 nM, (++) 100 nM and Trametinib (+) 50 nM, (++) 100 nM, (+++) 150 nM E. Combination indices calculated with data from CellTiter-Glo viability assays using Compusyn E. MRC5 normal lung fibroblasts treated with serial dilutions of ONC201 to 40uM (left) and ONC212 to 2uM (right) and Trametinib to 2 uM.

93

Serum Pepsinogen as a Biomarker for Gastric Cancer: A Nested Case-Control Study Using the Prostate, Lung, Colorectal and Ovarian (PLCO) Cancer Screening Trial Data

H. In,[1]* P. Friedmann,[1] M. Parides,[1] S. Sarkar,[1] P.E. Castle,[2] M. Epplein.[3] *1. Surgery, Montefiore Medical Center, Bronx, NY; 2. National Institutes of Health, Bethesda, MD; 3. Duke University, Durham, NC.*

Background Serum pepsinogen is a biomarker for atrophic gastritis, an intermittent phase in the development of gastric cancer (GC), and may be useful to detect persons at increased risk of GC. Method The Prostate, Lung, Colorectal and Ovarian (PLCO) Cancer Screening Trial is a large randomized trial conducted over 10 centers in the US in 1993-2001. Serum samples were collected at baseline and participants were followed for development of incident GC. ELISA-based pepsinogen tests were conducted on pre-diagnostic serum samples of patients who developed GC and age, sex, and race-matched controls. Pepsinogen negative (PG-) and positive (PG+) status was determined using pepsinogen I (PGI) and pepsinogen I to II ratio (PGR). Those with PGR< 3 and PGI ≤ 70μg/L were considered PG+. Cox proportional hazard models were used to determine the hazard ratio (HR) and 95% confidence intervals (95%CI) of PG+ for GC. Results Pepsinogen test results were available on 105 GC cases (70 non-cardia and 35 cardia) and 220 matched controls. Median and range of time from pepsinogen measurement to incident GC diagnosis was 78.6 and 3.0-152.2 months, respectively. GC patients were more likely to be PG+ (31.4% vs 5.5%, p<0.001) and current smokers (20.0% vs 7.7%, p=0.004) at baseline than controls. Compared to PG-, PG+ were at an increased risk of any GC (HR=3.77; 95%CI=2.50-5.71). After adjusting for family history of GC, smoking, and BMI, PG+ were still at a significantly increased risk of GC compared to PG- (adjusted HR=4.42; 95%CI=3.14-6.21). For 138 controls matched to 70 non-cardia cancers, PG+ were at an increased risk of non-cardia GC compared to PG- (HR=5.65, 95%CI=3.67-8.70; adjusted HR=7.26, 95%CI=4.84-10.90). For 70 controls matched to 35 cardia cancers, PG+ were not at greater risk of cardia GC compared to PG- (HR=1.79, 95%CI= 0.72-4.44; adjusted HR=1.95, 95%CI=0.81-5.37). Conclusion Pre-diagnostic serum pepsinogen levels predicted development of non-cardia GC but not cardia GC. PG is a potential risk biomarker to identify individuals at higher risk of non-cardia GC for targeted screening or interventions.

94

Adjuvant Nivolumab in Resected Esophageal or Gastroesophageal Junction Cancer Following Neoadjuvant Chemoradiation Therapy: First Results of the CheckMate 577 Study

R.J. Kelly,[1] J. Ajani,[2] J. Kuzdzal,[3] T. Zander,[4] E. Van Cutsem,[5] G. Piessen,[6]* G. Mendez,[7] J. Feliciano,[8] S. Motoyama,[9] A. Lièvre,[10] H. Uronis,[11] E. Elimova,[12] C. Grootscholten,[13] K. Geboes,[14] J. Zhang,[15] L. Zhu,[15] M. Lei,[15] K. Kondo,[15] J.M. Cleary,[16] M. Moehler.[17] *1. The Charles A. Sammons Cancer Center at Baylor University Medical Center, Dallas, TX; 2. The University of Texas MD Anderson Cancer Center, Houston, TX; 3. Department of Thoracic Surgery, Jagiellonian University, John Paul II Hospital, Krakow, Poland; 4. University Hospital of Cologne, Cologne, Germany; 5. University Hospitals Gasthuisberg, Leuven and KULeuven, Leuven, Belgium; 6. Univ. Lille, Department of Digestive and Oncological Surgery, Claude Huriez University Hospital, Lille, France; 7. Fundacion Favaloro, Buenos Aires, Argentina; 8. Johns Hopkins Sidney Kimmel Comprehensive Cancer Center, Baltimore, MD; 9. Akita University Hospital, Akita, Japan; 10. CHU Pontchaillou, Rennes, France; 11. Duke Cancer Institute, Durham, NC; 12. Princess Margaret Cancer Centre, Toronto, ON, Canada; 13. Netherlands Cancer Institute-Antoni van Leeuwenhoek Hospital, Amsterdam, Netherlands; 14. UZ Gent, Gent, Belgium; 15. Bristol Myers Squibb, Princeton, NJ; 16. Dana Farber Cancer Institute, Boston, MA; 17. Johannes-Gutenberg University Clinic, Mainz, Germany.*

Background: The risk of recurrence after neoadjuvant chemoradiation therapy (CRT) followed by surgery (trimodality therapy) remains high in esophageal or gastroesophageal junction cancer (EC/GEJC) and there is no established adjuvant treatment. CheckMate 577 (NCT02743494) is the first global, randomized, double-blind, phase 3 study to report the efficacy and safety of a checkpoint inhibitor in the adjuvant setting after trimodality therapy for EC/GEJC. Methods: Adults with resected (R0) stage II/III EC/GEJC who received neoadjuvant CRT and had residual pathologic disease

were randomized 2:1 to nivolumab 240 mg or placebo Q2W for 16 weeks, followed by nivolumab 480 mg or placebo Q4W. Maximum treatment duration was 1 year. The primary endpoint was disease-free survival (DFS). Results: 794 patients were randomized (nivolumab, 532; placebo, 262). Approximately 70% of patients had adenocarcinoma and almost 60% had a pathologic lymph node status ≥ypN1 in both groups. At a pre-specified interim analysis, adjuvant nivolumab showed a statistically significant improvement in DFS vs placebo (HR 0.69 [96.4% CI 0.56–0.86]; P = 0.0003); median DFS was doubled (22.4 vs 11.0 mo, respectively; Table). The majority of treatment-related adverse events (TRAEs) were grade 1 or 2. The frequency of serious TRAEs and TRAEs leading to discontinuation were ≤ 9% with nivolumab and 3% with placebo (Table). Data including DFS rate and an analysis of DFS across pre-specified subgroups will be presented. Conclusions: Adjuvant nivolumab is the first therapeutic to provide a statistically significant and clinically meaningful improvement in DFS vs placebo and a well-tolerated safety profile in patients with resected EC/GEJC, who have received neoadjuvant CRT. These results represent the first treatment advance in many years for these patients, potentially establishing adjuvant nivolumab as a new standard of care. Previously presented at ESMO Virtual Congress 2020, Sep 19 – 21, 2020, Abstract 2968, Kelly et al. Reused with permission.

Table

Efficacy	Nivolumab N = 532	Placebo N = 262
Median DFS, mo (95% CI)	22.4 (16.6–34.0)	11.0 (8.3–14.3)
HR (96.4% CI; *P* value)	0.69 (0.56–0.86; *P* = 0.0003)	
Safety, n (%)	**N = 532**	**N = 260**
Any-grade TRAEs	376 (71)	119 (46)
Grade 3–4	71 (13)	15 (6)
Serious TRAEs	40 (8)	7 (3)
Grade 3–4	29 (5)	3 (1)
TRAEs leading to discontinuation	48 (9)	8 (3)
Grade 3–4	26 (5)	7 (3)

95

Medicaid Expansion Is Associated with Earlier Diagnosis of Gastric Cancer C. Zhu,* G. Sandillos, R. Sensenig, J. Gaughan, F. Spitz, U. Atabek, Y. Hong. *General Surgery, Cooper University Health Care, Camden, NJ.*

Introduction: The 2014 Medicaid expansion was intended to improve patient access to care. Individual states elected to expand Medicaid, while others opted not to. We hypothesized that Medicaid expansion was associated with earlier diagnosis and improved outcomes in gastric cancer (GC). Methods: We selected patients with a new primary diagnosis of GC from the National Cancer Database between 2006 and 2016. We compared states that expanded Medicaid in 2014 to those that did not. We excluded states that expanded earlier or later than 2014 and patients older than 64 years. We compared the pre- and post-expansion intervals 2012-2013 and 2015-2016. Results: A total of 20639 patients were included. Expansion states (ES) demonstrated a significant reduction in uninsured patients from 7.0% to 2.7% [p<0.01], compared to non-expansion states (NES) (14.2% to 10.9% [p=n.s.]). There was an increase in patients diagnosed with stage 0-2 GC from 38% to 41.5% (p<0.01) in ES, but no change at 38.9% in NES. Patients 50 years old and older diagnosed with stages 0-2 GC increased in ES from 38.2% to 42.5% [p<0.01] and in NES from 39.3% to 39.9% [p=n.s.]. Uninsured and Medicaid patients diagnosed with stages 0-2 GC increased in ES from 32.4% to 37.8% [p=0.01] and decreased in NES from 29.7% to 27.3% [p=n.s.]. Patients receiving treatment rose from 91.6% to 92.2% in ES [p=0.01] and in NES 89.6% to 89.7 [p=n.s.]. Rates of treatment for uninsured and Medicaid patients rose in ES 87.0% to 90.3% [p=0.01] and in NES 83.9% to 84.9% [p=n.s.]. Twelve-month survival for ES rose from 68.1% to 70.6% [p=0.03] and in NES decreased 65.2% to 65.1% [p=n.s.]. Conclusion: Medicaid expansion caused a decrease in uninsured patients and led to an earlier diagnosis of gastric cancer with associated increase in 1-year survival. Increased healthcare access may be associated with a shift toward earlier diagnosis with improved outcomes in gastric cancer.

Demographics and Clinical Outcomes in Medicaid Expansion versus Non-Expansion States

	Expansion States			Non-Expansion States		
	2012-2013	2015-2016	p-value	2012-2013	2015-2016	p-value
Primary Payer, n (%)						
Not insured	270 (7)	106 (2.7)	<.01	607 (14.2)	509 (10.9)	0.21
Private	2441 (63.1)	2432 (61.4)		2411 (56.5)	2832 (60.7)	
Medicaid	633 (16.4)	842 (21.3)		477 (11.2)	500 (10.7)	
Medicare	394 (10.2)	457 (11.5)		477 (11.2)	593 (12.7)	
Other government	48 (1.2)	56 (1.4)		125 (2.9)	125 (2.7)	
Unknown	83 (2.1)	68 (1.7)		174 (4.1)	110 (2.4)	
Staging - all patients, n(%)						
Stage 0-2	1984 (38.0)	2157 (41.5)	<0.01	1633 (38.9)	1724 (38.9)	0.99
Stage 3-4	3238 (62.0)	3042 (58.5)		2563 (61.1)	2708 (61.1)	
Staging - age ≥ 50 years old, n(%)						
Stage 0-2	1615 (38.3)	1811 (42.5)	<0.01	1334 (39.3)	1432 (39.9)	0.60
Stage 3-4	2607 (61.7)	2455 (57.5)		2063 (60.7)	2159 (60.1)	
Staging - uninsured and Medicaid, n(%)						
Stage 0-2	264 (32.4)	324 (37.8)	0.01	293 (29.7)	248 (27.3)	0.28
Stage 3-4	551 (67.6)	533 (62.2)		692 (70.3)	660 (72.7)	
Treatment status - all patients, n(%)						
No treatment given	304 (8.0)	281 (7.2)	<0.01	419 (9.9)	457 (9.9)	0.76
Treatment given	3498 (91.6)	3605 (92.2)		3790 (89.6)	4147 (89.7)	
Active surveillance	17 (0.4)	24 (0.6)		20 (0.5)	18 (0.4)	
Treatment status - uninsured and Medicaid, n(%)						
No treatment given	153 (12.6)	115 (9.2)	0.01	175 (15.7)	153 (14.9)	0.52
Treatment given	1053 (87.0)	1123 (90.3)		938 (83.9)	870 (84.9)	
Active surveillance	4 (0.3)	6 (0.5)		5 (0.4)	2 (0.2)	
12-month outcome						
Survival	3603 (68.1)	1723 (70.6)	0.03	2705 (65.2)	1308 (65.1)	0.4
Failure	1767 (31.9)	807 (29.4)		1530 (34.8)	808 (34.9)	

96

Local Endoscopic Resection is Inferior to Gastrectomy for Early Clinical Stage T1a and T1b Gastric Adenocarcinoma: A Propensity-Matched Study S.K. Kamarajah,[2] S. Markar,[3] A.W. Phillips,[2] G.I. Salti,[1] F.S. Dahdaleh.[1]* *1. General Surgery/ Surgical Oncology, Edward-Elmhurst Health, Elmhurst, IL; 2. Northern Oesophagogastric Unit, Royal Victoria Infirmary, Newcastle University Trust Hospitals, Newcastle-Upon-Tyne, United Kingdom; 3. School of Medical Education, Newcastle University, Newcastle upon Tyne, United Kingdom.*

Introduction: The role of endoscopic resection (ER) in the management of early gastric adenocarcinoma is controversial. The aim of this study was to evaluate the outcome of ER versus gastrectomy in node negative cT1a and cT1b gastric adenocarcinoma. Methods: The National Cancer Database (2010-2015) was used to identify patients with clinical T1aN0 (n=2,927; ER, n=1,157; gastrectomy, n=1,770) and T1bN0 (n=2,915; ER, n=474; gastrectomy, n=2,441) gastric adenocarcinoma. Propensity score matching (PSM) and Cox multivariable analyses were used to account for treatment selection bias. Results: ER for cT1a and cT1b cancers was performed more frequently over time. Rates of node-positive disease in patients with cT1a and cT1b gastric adenocarcinoma were 5% and 18%, respectively. In the matched cohort, gastrectomy was associated with increased survival compared to ER for cT1a cancers (HR: 0.79, 95% CI: 0.66 - 0.95, p=0.013), and corresponding 5-year survival for gastrectomy and ER were 72% and 66% (p=0.013), respectively. For cT1b cancers, gastrectomy had a significantly longer survival compared to ER (HR: 0.77, 95% CI: 0.63 - 0.93, p=0.008) and the corresponding 5-year survival for gastrectomy and ER were 60% and 50% (p=0.013), respectively. Conclusion: This study demonstrates that ER was associated with inferior long-term survival for clinical T1aN0 and T1bN0 gastric adenocarcinoma, despite current recommendations for ER in cT1 gastric cancers. Future research should seek to identify the subset of T1a and T1b cancers at low risk of nodal metastasis and thus would maximally benefit from ER.

97

Determinants of Survival for Neoadjuvant-Treated Node-Negative Gastric Cancer D.J. Erstad,* M. Blum, J.S. Estrella, P. Das, B.D. Minsky, J. Ajani, P.F. Mansfield, B.D. Badgwell, N. Ikoma. *The University of Texas MD Anderson Cancer Center, Houston, TX.*

INTRODUCTION: In the modern era of multi-modal treatment for gastric cancer, we sought to determine prognostic markers for disease recurrence and survival in a cohort of neoadjuvant-treated, node-negative gastric cancer patients (ypT0-4N0M0). METHODS: Clinicopathologic data from patients treated with neoadjuvant therapy followed by curative-intent gastrectomy at the University of Texas MD Anderson Cancer Center from 1995-2017 was evaluated. Patients with AJCC TNM stage ypT0-4N0M0 were considered for analysis. RESULTS: Inclusion criteria were met by 229 patients. Mean age was 58.3 years, 61% were male, 55% were Caucasian, 88% received chemoradiation, and 12% chemotherapy. Median overall survival (OS) was 11.1 years (69% 5ys, 53% 10ys); 41.9% died with a median follow-up of 5.3 years. On multivariable analysis, ypT4-stage and nodal yield < 15 were significantly associated with reduced OS. ypT4 cancers had more aggressive biologic traits, including lymphovascular and perineural invasion, and were treated more aggressively with total gastrectomy and additional organ resection, though still had more frequent positive margins. Depth of invasion remained significantly associated with worse outcome after controlling for nodal yield and possible stage migration. Compared to ypT0-3 tumors, ypT4 cancers were associated with significantly more recurrences (15% vs. 45%, $p < 0.05$), and the primary modes of failure for ypT4 lesions were local recurrence and peritoneal metastases (78% of recurrences). CONCLUSIONS: Depth of primary tumor invasion and nodal yield were significantly associated with OS among ypT0-4N0M0 gastric cancer patients. Serosal invasion (ypT4) was associated with a high rate of peritoneal recurrence, and these patients should be considered for trials of intraperitoneal therapy.

98

Extent of Lymphadenectomy Following Neoadjuvant Chemotherapy in Patients with Gastric Cancer A.B. Shannon,[1]* R.J. Straker,[1] L. Keele,[1] D. Fraker,[2] J.T. Miura,[2] R. Roses,[2] G. Karakousis.[2] *1. Department of Surgery, Hospital of the University of Pennsylvania, Philadelphia, PA; 2. Division of Endocrine and Oncologic Surgery, Department of Surgery, Hospital of the University of Pennsylvania, Philadelphia, PA.*

Introduction: Lymph node metastases is an important prognostic factor for gastric cancer with ≥16 nodes retrieval recommended during surgical resection. The minimum nodal retrieval recommended following receipt of neoadjuvant chemotherapy (NACT) is less established. Methods: Patients diagnosed with clinical stage I-III gastric adenocarcinoma who received NACT and surgical resection were identified from the 2004-2015 National Cancer Database. Optimal nodal harvest number was calculated with Cox spline regression modeling; cohorts with nodal harvest above and below this number were 1:1 propensity score matched. Overall survival (OS) was analyzed using Kaplan-Meier survival estimates. Results: The optimal minimal nodal harvest in 4,337 patients after NACT was 23 nodes. Patients with ≥23 nodes examined (N=1,073, 24.7%) were more likely to be female (26.1% vs 22%, p 0.006) and non-White (29.3% vs 18.5%, p<0.0001), have Charlson Deyo score 0 (71.5% vs 66.8%, p 0.005), and undergo resection at an academic facility (67.9% vs 51.5%, p<0.0001). Patients with ≥23 nodes retrieved had higher proportions of high grade (62% vs 57.4%, p 0.030), pT3 or pT4 (56.3% vs 48.7%, p<0.0001) tumors in the body (21.3% vs 12.5%, p<0.0001) or antrum/pylorus (15.3% vs 11.4%, p<0.0001). Compared to patients with <23 nodes retrieved, patients with ≥23 nodes were more likely to have lymph node metastases present (61% vs 51%, p<0.0001). Patients with ≥23 nodes retrieved were less likely to receive either neoadjuvant (34.8% vs 55.4%, p<0.0001) or any radiation (48.9% vs 68.3%, p<0.0001) as compared to patients with <23 nodes retrieved. In a matched analysis, patients with ≥23 (N=990) nodes demonstrated improved 5-year OS (57.9% vs 49%, p 0.001) compared to patients with <23 nodes retrieved. Conclusions: Extent of lymphadenectomy during gastrectomy for gastric adenocarcinoma should not be reduced following NACT, as adequate lymph node retrieval remains important for prognostication in this patient population.

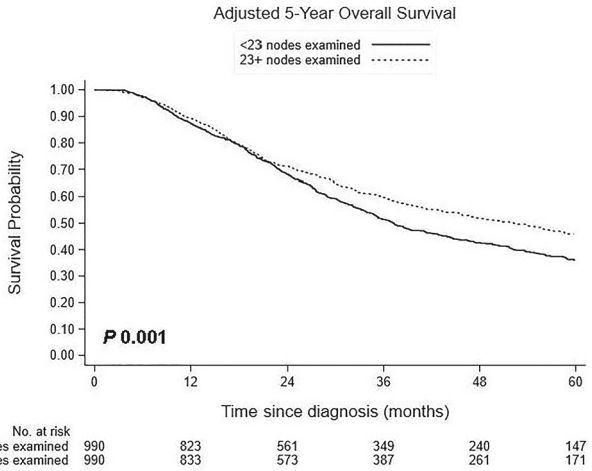


Figure 1. Adjusted 5-year overall survival (OS) of patients with gastric adenocarcinoma following receipt of neoadjuvant chemotherapy and gastrectomy with lymphadenectomy of <23 and ≥23 lymph nodes.

99

Comparison of Gastric and Gastroesophageal Junction Adenocarcinoma in 2,194 patients M. Nakauchi,[1]* E. Vos,[1] R. Carr,[1] A. Barbetta,[1] L. Tang,[2] M. Gonen,[3] A. Russo,[1] Y. Janjigian,[4] S. Yoon,[1] V. Rusch,[1] M. Bains,[1] D. Jones,[1] D. Coit,[1] D. Molena,[1] V. Strong.[1] *1. Department of Surgery, Memorial Sloan Kettering Cancer Center, New York, NY; 2. Department of Pathology, Memorial Sloan Kettering Cancer Center, New York, NY; 3. Department of Epidemiology and Biostatistics, Memorial Sloan Kettering Cancer Center, New York, NY; 4. Department of Medicine, Memorial Sloan Kettering Cancer Center, New York, NY.*

Background: Gastroesophageal junction (GEJ) and gastric cancer (GC) are frequently studied together as one disease. Although the treatment approach is often different, clinicopathological and oncological differences between the two cancers have not been fully evaluated. We therefore compared these 2 diseases to identify clinicopathological and oncological differences that can help guide treatment. Methods: We collected data from a prospectively maintained GEJ and GC database at our center from patients who underwent R0 resection between January 2000 and December 2016. GEJ cancer was defined as a tumor with the center within 5 cm proximal and distal of the anatomic gastroesophageal junction. Clinicopathological characteristics, disease specific survival (DSS), and site of first recurrence were compared between GEJ and GC patients. Results: A total of 2,194 patients who underwent curative resection for GEJ or gastric adenocarcinoma were analyzed; including 1,060 (48.3%) GEJ and 1134 (51.7%) GC patients. GEJ patients were younger (64 vs. 66 years, $p < 0.001$). Neoadjuvant treatment was administered in 70.8% and 30.1% of GEJ and GC patients; GEJ patients underwent more frequently neoadjuvant chemoradiotherapy (60.0 vs. 0.7%). GEJ patients had lower pathological T and N status. The 5-year DSS was 62.2% and 74.6% in GEJ and GC patients ($p < 0.001$). Stratified by pathological T and N status, GEJ patients had significantly worse DSS for each pT/N status except pT4. GEJ cancer was one of the independent predictors for worse DSS (HR 1.85, 95%CI [1.45-2.36], $p < 0.001$). The cumulative incidence of recurrence was approximately 10% higher in GEJ patients compared to GC patients ($p < 0.001$). The first site of recurrence was more likely to be hematogenous in GEJ patients (60.1 vs. 31.4%, $p < 0.001$), and peritoneal in GC patients (52.9 vs. 12.5%, $p < 0.001$). Conclusion: GEJ adenocarcinoma is a more aggressive tumor with a higher incidence of recurrence and worse DSS compared to gastric adenocarcinoma. There are distinct differences between GEJ and GC, especially in patterns of recurrence that may have potential implications in evaluating optimal treatment strategies.

ABSTRACTS

Accepted for
POSTER PRESENTATIONS

SSO 2021 – International Conference on Surgical Cancer Care
March 18-19, 2021
Virtual Meeting

P1

Can We Successfully De-Escalate Axillary Surgery in Women 70 Years or Older with DCIS or Early Stage HR+/HER2- Breast Cancer Undergoing Mastectomy? R. Matar,* A. Barrio, V. Sevilimedu, T. Le, A. Heerdt, M. Morrow, A. Tadros. *Memorial Sloan Kettering Cancer Center, New York, NY.*

Introduction Omission of sentinel lymph node biopsy (SLNB) in clinically node-negative women ≥70 years with hormone receptor positive (HR+) early stage breast cancer undergoing lumpectomy, where SLN metastases rates range from 15-30%, is accepted based on clinical trials showing low rates of locoregional recurrence (LRR). The safety of SLNB omission in older women undergoing mastectomy is unknown and may differ from lumpectomy due to extent of disease. Methods Patients with cTis-2N0 HR+/HER2- breast cancer treated with mastectomy and SLNB with or without completion axillary lymph node dissection from 2006 - 2018 were included. Rates of nodal positivity and its impact on the use of adjuvant therapy were examined. Results Of 451 patients, median age was 74 (range 70-90); 123 cases (27%) were cTis, 200 (44%) were cT1, and 128 (28%) were cT2. Among cTis patients, 38 upstaged to invasive carcinoma on final pathology, but less than 1% had SLN macrometastases and only 6 received chemotherapy, all due to HER2+ disease. A smaller proportion of cT1 than cT2 patients had SLN macrometastases (13% vs. 29%, respectively). On multivariable analysis, lymphovascular invasion (OR 2.2, 1.2-4.1, p=0.01) and higher cT stage (OR 5.4, 3.0-10.0, p<0.01) were associated with SLN macrometastases in cT1-2 patients. Among cT1 patients, 10.5% (21/200) received chemotherapy; only 32% of patients with SLN metastases received chemotherapy. Of the cT2 patients, 24% (31/128) received chemotherapy and the majority (84%; 26/31) had SLN metastases. At a median follow-up of 52 months, breast cancer-specific survival (BCCS) was similar among cT1 patients with or without nodal macrometastases; however, BCCS was worse among cT2 patients with nodal macrometastases. No differences in LRR were seen among either group. Conclusion Rates of nodal positivity in older women undergoing mastectomy for early stage breast cancer are comparable to rates reported for lumpectomy. SLNB omission in women ≥70 years old with cTis-1N0 HR+/HER2- disease undergoing mastectomy is unlikely to alter adjuvant therapy and should be considered, particularly in patients with co-morbidities.

Locoregional and systemic medical treatment received in cT1 and cT2, HR+/HER2- tumors based on pN stage.

	cT1, HR+/HER2-					cT2, HR+/HER2-				
	Overall (n = 200)	**pN0/i+** (n = 162)	**pN1** (n = 32)	**pN2-3** (n = 6)	**p-value**	**Overall** (n = 128)	**pN0/i+** (n = 75)	**pN1** (n = 43)	**pN2-3** (n = 10)	**p-value**
Adjuvant Medical Treatment					<0.001					<0.001
Chemo +/- Endocrine Treatment	21 (10.5%)	9 (5.6%)	7 (22%)	5 (83%)		31 (24%)	5 (6.7%)	18 (42%)	8 (80%)	
Endocrine Treatment Alone	155 (78%)	130 (80%)	24 (75%)	1 (17%)		89 (70%)	67 (89%)	20 (47%)	2 (20%)	
None	24 (12%)	23 (14%)	1 (3.1%)	0 (0%)		8 (6%)	3 (4.0%)	5 (12%)	0 (0%)	
Radiation Treatment	8 (4.0%)	0 (0%)	3 (9.4%)	5 (83%)	<0.001	19 (15%)	3 (4.0%)	8 (19%)	8 (80%)	<0.001

P2

Comparison of Outcomes for Classic-Type Lobular Carcinoma in Situ Managed with Surgical Excision Versus Core Biopsy Alone R. Matar,[1]* V. Sevilimedu,[1] A. Park,[1] T. King,[2] M. Pilewskie.[1] *1. Memorial Sloan Kettering Cancer Center, New York, NY; 2. Brigham and Women's Hospital, Boston, MA.*

Introduction Studies have reported low rates of upgrade with excision for classic-type lobular carcinoma in situ (LCIS) with radiologic-pathologic concordance. Thus, observation has become standard for LCIS without other high-risk lesions requiring excision, but long-term outcomes are lacking. We sought to compare outcomes of LCIS managed with or without excision. Methods Women with classic-type LCIS managed with excision without an upgrade or core biopsy only from 2013-2019 without a previous breast cancer history were identified from a prospectively maintained database. We compared rates and characteristics of subsequent breast cancers between the two cohorts. Results Among 439 women, 297 underwent surgical excision and 142 had core only. Reasons for excision included additional high-risk lesions, radiologic-pathologic discordance, mass/symptoms, prophylactic mastectomy or surgeon/patient preference. Among the excision group, 39 had concordant LCIS without other high-risk lesions. More women received excision in 2013-2016 vs. 2017-2019 (p<.01). At a median follow-up of 3.2 years, cancer developed in 18 women from the excision group (6.1%) and 11 from the core only group (7.7%). No difference in histology, receptor profile, TNM stage, cancer location relative to LCIS site, or median time to cancer existed between the excision and core only groups. On multivariable analysis, management choice (excision vs. core only) was not associated with cancer development (OR 1.04, 95% confidence interval [CI]: 0.5-2.3, p>0.9). When comparing concordant excised LCIS (n=39) to the core only group (n=142), there was no difference in the rate of cancer development (p=0.7) (Table). The 5-year rate of cancer development was 8.9% (95% CI: 2.3-31.6%) in the concordant excised LCIS group and 10.3% (95% CI: 5.6-18.6%) in the core only group. Conclusion There is no difference in breast cancer rates among women with concordant, classic-type LCIS managed with excision or core only. Given the known increased cancer risk associated with LCIS, it is appropriate to manage this lesion as a risk-factor, with consideration for chemoprophylaxis, rather than an indication for excision.

Clinicopathologic features in women who underwent excision compared to core only for concordant classic-type LCIS without other indications for surgical excision

	Overall (N = 181)	**Concordant Excised LCIS** (N = 39)	**Core Only** (N = 142)	**p-value**
Median follow-up time, years (IQR)	**3.07 (1.28-4.72)**	**4.70 (1.00-6.25)**	**2.82 (1.44-4.44)**	**0.13**
Median age at diagnosis (IQR)	**51 (46-57)**	**48 (44-53)**	**52 (47-58)**	**<0.01**
Race **White** **Asian** **Black** **Other** **Unknown**	**153 (88%)** **8 (4.6%)** **7 (4.0%)** **6 (3.4%)** **7**	**34 (94%)** **2 (5.6%)** **0 (0%)** **0 (0%)** **3**	**119 (86%)** **6 (4.3%)** **7 (5.1%)** **6 (4.3%)** **4**	**0.4**
Year of diagnosis **2013 - 2016** **2017 - 2019**	**107 (59%)** **73 (41%)**	**34 (87%)** **5 (13%)**	**73 (52%)** **68 (48%)**	**<0.01**
BMI, median (IQR)	**24.0 (21.4-27.4)**	**23.3 (21.1-28.2)**	**24.1 (21.9-26.9)**	**0.9**
Menopausal status **Pre/peri** **Post**	**108 (61%)** **69 (39%)**	**29 (74%)** **10 (26%)**	**79 (57%)** **59 (43%)**	**0.08**
Density (BIRADs category) **A** **B** **C** **D**	**1 (0.6%)** **18 (10%)** **117 (66%)** **42 (24%)**	**0 (0%)** **6 (16%)** **23 (62%)** **8 (22%)**	**1 (0.7%)** **12 (8.5%)** **94 (67%)** **34 (24%)**	**0.5**
Family history **First degree relative with breast cancer** **≥2 second degree relatives with breast cancer**	**49 (27%)** **18 (9.9%)**	**8 (21%)** **5 (13%)**	**41 (29%)** **13 (9.2%)**	**0.4** **0.5**
Chemoprophylaxis	**25 (14%)**	**7 (18%)**	**18 (13%)**	**0.6**
Screening **CEM** **MRI**	**54 (30%)** **71 (40%)**	**10 (26%)** **16 (42%)**	**44 (31%)** **55 (39%)**	**0.7** **0.9**
Status **Diagnosed with cancer** **No subsequent cancer**	**13 (7.2%)** **168 (93%)**	**2 (5.1%)** **37 (95%)**	**11 (7.7%)** **131 (92%)**	**0.7**

P3

Prospective Assessment of Lymphedema Rates After Axillary Lymph Node Dissection in Patients Treated with Neoadjuvant Chemotherapy G. Montagna,* J. Zhang, V. Sevilimedu, J. Charyn, K.T. Abbate, B. Mehrara, M. Morrow, A. Barrio. *Department of surgery, Memorial Sloan kettering Cancer center, New York, NY.*

Introduction Patients treated with neoadjuvant chemotherapy (NAC) often have greater disease burden than seen in primary surgery and may develop fibrosis of tumor filled lymphatics, potentially increasing the risk of lymphedema (LE). There is limited prospective data on LE rates in patients treated with NAC and axillary lymph node dissection (ALND). We sought to evaluate rates and predictors of LE after NAC using strict measurement protocols. Methods Breast cancer patients treated with ALND after NAC were enrolled in a LE screening trial and prospectively evaluated with arm volume (perometer) measurements at baseline, post-operatively and longitudinally every 6 months. LE was defined as a relative volume change (RVC) ≥ 10% from baseline. Groups were compared using Wilcoxon rank-sum and Fischer's exact tests. Univariate (UVA) and multivariable analysis (MVA) were used to calculate the odds ratio (OR) of developing LE. Results From 1/2017-1/2020, 172 patients had an ALND after NAC and at least 1 longitudinal measurement after baseline. Median age was 47 years and median BMI was 27.1, with 73% undergoing mastectomy. Of those undergoing mastectomy, 62% had reconstruction. Almost all patients (98%) received nodal RT (Table). Median follow-up was 1.1 yrs. The 12- and 18-month LE rates were 16% and 22%, respectively. On UVA, higher baseline BMI (OR 1.05, 95% CI 1-1.10 per

1-unit increase, p=0.045), Black race (OR 1.78, 95%CI 0.67-5.29, p=0.05), increasing number of lymph nodes (LNs) removed (OR 1.04, 95%CI 1.00-1.08, per 1 additional LN, p=0.03) and increasing number of positive LNs (OR 1.07, 95%CI 1.01-1.12, per 1 additional LN, p=0.01) were associated with a higher risk of developing LE. On MVA, increasing number of positive LNs remained associated with a higher likelihood of LE (OR 1.1, 95%CI 1.01-1.19, p<0.03). Conclusion In a prospectively screened cohort of patients treated with NAC, ALND and nodal RT, 18-month LE rates were 22%, which is higher than with upfront surgery. Increasing number of positive LNs was associated with increased odds of LE. Longer follow-up is needed to identify patients at the highest risk for LE after NAC.

Clinical Characteristics of study cohort

	Overall (n = 172)	RVC < 10% (n=144)	RVC ≥ 10% (n= 28)	P-value
Age (years)	47 (40, 57)	47 (39, 56)	48 (42, 60)	0.2
Baseline BMI (kg/m2)	27.1 (22.7, 32.0)	26.8 (22.7, 31.5)	29.0 (23.2, 33.4)	0.6
Race				0.8
White	101 (59)	85 (59)	16 (57)	
Black	37 (21.5)	29 (20)	8 (29)	
Asian	17 (9.9)	15 (10)	2 (7.1)	
Other*/Unknown	17 (9.9)	15 (10)	2 (7.1)	
cT 1/2	101 (58)	83 (58)	18 (64)	0.5
cT 3/4	71 (41)	61 (42)	10 (36)	
cN0	10 (5.8)	7 (4.9)	3 (11)	
cN1	139 (81)	119 (83)	20 (71)	0.2
cN2/3	23 (13.4)	18 (10.5)	5 (18)	
Subtype				0.3
HR+/HER2-	98 (57)	84 (58)	14 (50)	
HER2+	42 (24.4)	36 (25)	6 (21)	
HR-/HER2-	32 (18.6)	24 (17)	8 (29)	
NAC Regimen				0.6
AC-T based regimen	154 (90)	130 (90)	24 (86)	
Other#	18 (10)	14 (10)	4 (14)	
Type of Surgery				0.2
BCS	46 (27)	35 (24)	11 (39)	
Mastectomy	126 (73)	109 (76)	17 (61)	
Type of reconstruction†				0.2
None	48 (38)	41 (38)	7 (41)	
Autologous/flap	15 (12)	11 (10)	4 (24)	
TE/implant	63 (50)	57 (52)	6 (35)	
Total number of lymph nodes removed	18 (13, 23)	18 (13, 22)	21 (15, 26)	0.062
Total number of positive nodes	2 (1, 4)	2 (1, 4)	3 (1, 7)	0.2
Nodal RT	169 (98)	141 (98)	28 (100)	> 0.9

BMI, body mass index; HR, hormone receptor; HER2, human epidermal growth factor receptor 2; NAC, neoadjuvant chemotherapy; BCS, breast conserving surgery; TE, tissue expander
Frequency (column percent) reported for categorical variables and median (IQR) reported for continuous variables
*Other race, n = 15 (10 Hispanic, 5 non-Hispanic), unknown, n = 2
#Other TC (n = 10), CMF (n = 3), Taxol (n = 3), AC (n = 2)
† Applies to mastectomy patients only (n = 126)

P4

Use of PECS II Block in Partial Mastectomy for Improving Postoperative Pain Control and Mitigating Opioid Use

K. Kennard,[1]* S. Meske,[2] M. Buckley,[2] L.M. Sizer,[3] S. Larson,[2] S. Khojasteh,[1] T.G. Frazier,[3] R.M. Ciocca,[1] J.L. Sabol,[1] N.Z. Carp.[1]
1. Surgery, Lankenau Medical Center, Philadelphia, PA; 2. Center for Population Health at the Lankenau Institute for Medical Research, Wynnewood, PA; 3. Bryn Mawr Hospital, Bryn Mawr, PA.

Introduction: The pectoral nerve block II (PECS II) technique involves injection of local anesthesia between muscle groups of the chest. The purpose of our study was to evaluate PECS II block in a novel subset of breast cancer patients – partial mastectomy (PM) with or without sentinel lymph node biopsy. Methods: This was a prospective IRB approved patient blinded randomized control trial of female patients undergoing PM. Both the control group (CG) and PECS group (PECS) received general anesthesia and 10cc of 0.25% bupivacaine subcutaneously at incision sites. Prior to surgical incision, PECS group also received 20cc of 0.25% Marcaine between pectoralis major and minor and between pectoralis minor and serratus anterior on the affected side by the breast surgeon under ultrasound guidance. The primary outcome was postoperative (postop) pain using Visual Analog Score (VAS). Results: 130 patients were accrued to the study and randomized to CG(n=66) or PECS (n=64). The mean age was 59.8 in CG and 59.3 in PECS (p=0.842). The following were not significantly different between CG and PECS groups: rate of SLN (p=1), immediate postop median VAS score (p=0.128), intraoperative median morphine equivalents (MEQ) (p=0.533) adherence to acetaminophen (p=0.38) and ibuprofen regimen postop (p=1). Median VAS was significantly higher in CG versus PECS prior to discharge (3 vs 2, p<0.001), 24 hours postop (3 vs 1, p<0.001) and 72 hours postop (2 vs 0, p<0.001). CG were more likely to report pain as not well controlled (12.3% vs 3.1%). Median 24 hour and total postop MEQ was higher in CG versus PECS (2.3 vs 0, p=0.015). 69.7% of CG required opioids in the postop periods, but only 41.6% of the PECS group required this. Conclusion: PECS patients had significantly less pain and less opioid use. PECS II blocks hould be considered in all patients undergoing partial mastectomy with or without sentinel lymph node biopsy. Efforts should be directed at educating breast surgeons about the PECS II block to improve postoperative pain control with breast conservation therapy.

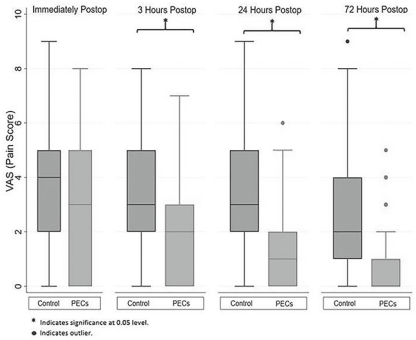


Figure 1.Postoperative Visual Analog Scores (VAS) immediately after surgery, 3 hours postoperatively, postoperative day 1 and postoperative day 3 visualized in the boxplots above. This shows the minimum, 25th percentile, median, 75th percentile and maximum VAS scores in the two cohorts at 4 different time points.

P5

Using the 21-Gene Recurrence Score as a Predictor of Response to Neoadjuvant Chemotherapy in Hormone Receptor Positive HER2 Negative Patients

K. Kennard,[1]* C.M. Johnson,[2] A. Yasin,[1] M. Buckley,[3] E.P. Lamb,[2] L.M. Sizer,[2] C.D. Carruthers,[2] T.G. Frazier,[2] W.B. Carter.[2] *1. Surgery, Lankenau Medical Center, Philadelphia, PA; 2. Bryn Mawr Hospital, Bryn Mawr, PA; 3. Lankenau Institute of Medical Research, Wynnewood, PA.*

Introduction: The 21-Gene Recurrence Score (RS) predicts benefit of adjuvant chemotherapy in patients with hormone receptor positive (HR+) HER2 negative (HER2-) breast cancer but has not been validated for use in neoadjuvant chemotherapy (NACT). Methods: This was an IRB approved retrospective review of patients who received NACT for HR+ HER2- breast cancer at a single institution. After NACT and surgical treatment were completed, initial diagnostic core needle biopsy specimen was tested for RS. Patients were grouped by RS: low (RS <11), intermediate (RS 11-25) and high (RS >25). Degree of response was categorized as clinical (comparing initial MRI and post-NACT MRI) and pathologic (comparing initial MRI and final pathology) response: complete response (CR) (100%), partial response (PR) (30-99%) and no response (NR) (<30%). The primary objective was to evaluate the degree of clinical and pathologic response by RS group. Results: A total of 76 patients were evaluated and grouped by RS cohort: low RS (15.8%), intermediate RS (39.5%), and high RS (44.7%). There was no difference among the three RS cohorts for race (p=0.129), histology (p=0.707), clinical stage (p=0.966) or surgery type (p=0.496). The low RS group had a significantly higher average age compared to the high RS cohort (59 vs 50.2; p=0.025). Post-NACT pathologic CR occurred in 17.1% of all patients. RS was predictive of clinical response with 0% of low RS cohort experiencing CR compared with 35.3% in high RS (p=0.041). RS demonstrated a trend toward pathologic response with 8.3% of low RS experiencing CR versus 26.5% in the high RS cohort (p=0.098). Median percent pathologic response was decreased in the low RS cohort at 22.5% percent pathologic response versus 72.5% in high RS (p=0.084). Clearance of axillary node occurred in 27.3% of the low RS cohort versus 54.6% of high RS (p=0.064). Conclusions: RS was predictive of clinical response to NACT and shows a trend toward predicting pathologic response. Based on this small sample we recommend RS testing on the core biopsy for HR+ HER2- patients to determine consideration for NACT.

Table 1.Clinical response and pathologic response after neoadjuvant chemotherapy (NACT) based on 21- Gene Recurrence Score cohort . Degree of response was categorized based on initial MRI to post NACT MRI for clinical response and initial MRI to final pathology for pathologic response: complete response (CR) (100%), partial response (PR) (30-99%) and no response (NR) (<30%).

	21- Gene Recurrence Score				
	<11	11 to 25	>25	p-value	Total
	(n = 12)	(n = 30)	(n = 34)		(n = 76)
Clinical Response[1], n (%)				**0.041**	
NR	4 (57.1)	1 (5.6)	3 (17.7)		8 (19.1)
PR	3 (42.9)	11 (61.1)	8 (47.1)		22 (52.4)
CR	0 (0.0)	6 (33.3)	6 (35.3)		12 (28.6)
Unknown	*5*	*12*	*16*		*33*
Pathologic Response, n (%)				0.098	
NR	7 (58.3)	9 (30.0)	8 (23.5)		24 (31.6)
PR	4 (33.3)	18 (60.0)	17 (50.0)		39 (51.3)
CR	1 (8.3)	3 (10.0)	9 (26.5)		13 (17.1)
CR + Cleared Axillary Node[2]	1 (9.1)	3 (11.5)	9 (27.3)	0.206	13 (18.6)
Percent Pathologic Response					
Median % Change (IQR)	22.5% (7.2-65.1)	45.9% (16.0-89.1)	72.5% (37.5-100)	0.084	56.8% (19.7-91)
Cleared Axillary Node[3], n (%)				0.064	
Yes	3 (27.3)	7 (26.9)	18 (54.6)		28 (40.0)
N0	8 (72.7)	19 (73.1)	15 (45.5)		42 (60.0)
N/A	*1*	*4*	*1*		*6*

IQR = Interquartile Range; N/A = Not Applicable
1. P-value excludes unknown group.
2. Among patients with nodal disease.
3. P-value excludes the N/A group.

P6

Safety of De-escalation of Surgical Intervention for Atypical Ductal Hyperplasia on Percutaneous Biopsy: One Size Does Not Fit All

J. Estrada,[1]* K.E. Larson,[2] J.L. Wagner,[2] O.D. Winblad,[3] L. Nye,[4] C.R. Balanoff,[2] L.J. Kilgore,[2] A.L. Amin.[2] *1. University of Kansas Medical Center, Kansas City, KS; 2. Surgery, University of Kansas Medical Center, Kansas City, KS; 3. Radiology, University of Kansas Medical Center, Kansas City, KS; 4. Internal Medicine, University of Kansas Medical Center, Kansas City, KS.*

Introduction: Although many institutions have shifted to omission of excision for atypical ductal hyperplasia (ADH), the safety of surgical de-escalation remains largely undefined. The purpose of this study was to assess the safety and oncologic outcomes of those offered observation of ADH identified on percutaneous biopsy (PB) compared to those requiring surgical excision using predefined low risk criteria (LRC). Methods: A retrospective review of women >18 years of age diagnosed with ADH on PB at a single institution from 10/2015-03/2020 was performed. Patients with concurrent ipsilateral breast cancer (BC) were excluded. LRC qualifying for observation included pure ADH, size <1cm, >50% removed by PB, <3 ADH foci, and no necrosis. Patients not meeting LRC were referred for excision. Categorical variables were analyzed using Chi-square and Fisher's exact tests and continuous variables using t-tests and Wilcoxon tests. Results: Inclusion criteria were met by 111 patients with a median imaging size of 1.0 cm. Imaging presentation and PB modality are listed in Table. LRC were met by 21 (19%), 3 of which elected for excision (0% upgrade). Only 2 have required additional PB, and no LRC patients have been subsequently diagnosed with BC over a median follow up of 22 months (IQR 11-34). Surgical excision was discussed with the remaining 90 (81%), of which 47 (52%) underwent excision. The overall upgrade rate was 24% [9 ductal carcinoma in situ (DCIS) and 3 invasive BC]. Of those without upgrade, 59 (60%) follow in high risk clinic, but only 6 accepted chemoprevention. In follow up, additional PB was performed in 18 (16%) at a median of 18.5 months (IQR 9-26), 17 with benign or additional ADH and a single contralateral DCIS diagnosed. Conclusions: This study demonstrates the safety of ADH observation after multidisciplinary review when specific LRC are met. No patient offered observation meeting LRC developed BC over the five year study period, despite low acceptation of chemoprevention, quelling the concern about missed BC. LRC can confidently be incorporated into practice eliminating the need for excision for all patients with ADH.

Variable	Entire cohort (n=111)	Met low risk criteria (n=21, 19%)	Recommended for excision (n=90, 81%)	p-value
Age (years, median, IQR)	59 (51-68)	59 (48-67)	59 (52-68)	1.0
Imaging presentation Calcifications Mass/distortion MRI enhancement	 63 (57%) 32 (29%) 16 (14%)	 19 (90%) 2 (10%) 0	 45 (50%) 29 (32%) 16 (18%)	0.01
Lesion size on imaging (cm, median, IQR)	1.0 (0.6-2)	0.6 (0.4-0.7)	1.2 (0.7-2.5)	0.002
PB modality Stereotactic US MRI	 68 (61%) 34 (31%) 9 (8%)	 20 (95%) 1 (5%) 0	 48 (53%) 33 (37%) 9 (10%)	0.003
Removed >50% by PB*	54 (49%)	21 (100%)	33 (37%)	<0.001
Contralateral malignancy	14 (13%)	1 (5%)	13 (14%)	0.23
Pathology findings <3 foci of ADH** Necrosis*** Papilloma/fibroadenoma/radial scar associated with atypia (not pure)	 60 (54%) 2 (2%) 43 (39%)	 21 (100%) 0 0	 39 (43%) 2 (2%) 43 (48%)	<0.001
Elected for observation	61 (55%)	18 (86%)	43 (48%)	0.002
Underwent excision	50 (45%)	3 (14%)	47 (52%)	0.002
Upgraded to malignancy	12 (24%)	0	12 (26%)	0.05
Accepted chemoprevention	6 (5%)	2 (10%)	4 (5%)	0.45
Required additional PB At ADH biopsy site Ipsilateral to ADH biopsy Contralateral to ADH biopsy	18 (16%) 3 (17%) 10 (56%) 5 (25%)	2 (10%) 0 1 (50%) 1 (50%)	16 (18%) 3 (19%) 9 (56%) 4 (25%)	0.36
PB identified subsequent malignancy	1 (1%)	0	1 (1%)	1.0

*6 with missing information
**21 with missing information
***31 with missing information

P7

Longitudinal Prospective Evaluation of Quality of Life After Axillary Lymph Node Dissection

J. Zhang,* G. Montagna, V. Sevilimedu, K.T. Abbate, J. Charyn, B. Mehrara, M. Morrow, A. Barrio. *Memorial Sloan Kettering Cancer Center, New York, NY.*

INTRODUCTION: Patients often fear axillary lymph node dissection (ALND) because of its associated complications; however, its effect on quality of life (QOL) is not well-described. We aimed to evaluate the effect of ALND on QOL over time and to identify predictors of worse QOL. METHODS: Breast cancer patients undergoing ALND were enrolled in a prospective lymphedema screening study and had arm volume measurements (perometer) and QOL questionnaires performed at baseline, post-operatively (PO), and at 6-month (mo) intervals. A relative volume change of ≥ 10% was diagnostic of lymphedema. The Upper Limb Lymphedema (ULL)-27 questionnaire was used to assess subjective arm swelling and its effect on QOL in 3 domains (physical, psychological, and social); a score of 100 signified no impairment while a lower score reflected worse QOL. Univariate (UVA) and multivariate regression analyses (MVA) were performed to assess predictors of QOL. RESULTS: From 12/2016-03/2020, 304 patients were enrolled; 242 patients with at least 2 measurements and 6 mo of follow-up were included. Median age was 48 years and median BMI was 25.9. Median follow-up was 1.2 years. Twelve- and 18-mo lymphedema rates were 13% and 16%, respectively. Overall, QOL scores in all 3 domains decreased in the PO period and improved over time (median physical score: 60 [PO] vs 88 [24 mo]; median psychological score: 82 [PO] vs 93 [24 mo]; median social score: 75 [PO] vs 100 [24 mo]) (Table). On MVA, higher baseline BMI (p = 0.003), Black (p = 0.03) or other race (p = 0.02), and higher clinical nodal stage (p <0.05) were associated with lower physical scores. Younger age (p = 0.03) and higher baseline BMI (p = 0.04) were associated with worse psychological scores; no factors were associated with social scores. No correlation was found between change in arm volume and QOL. CONCLUSIONS: Initial decrease in QOL scores after ALND showed improvement by 6 mo post-surgery and remained stable over time. We found no association between arm volume and QOL, suggesting QOL after ALND may be impaired even among patients without objective lymphedema. Weight loss should be encouraged as a potential method to improve QOL after ALND.

ULL-27 Quality of Life Scores Over Time After Axillary Lymph Node Dissection

TIME INTERVAL	PHYSICAL SCORE	PSYCHOLOGICAL SCORE	SOCIAL SCORE
BASELINE	98 (90, 100)	96 (86, 100)	100 (100, 100)
POST-OPERATIVE	60 (48, 73)	82 (61, 94)	75 (60, 95)
6 MONTHS	83 (63, 93)	89 (74, 100)	100 (75, 100)
12 MONTHS	87 (70, 93)	89 (68, 100)	100 (80, 100)
18 MONTHS	85 (67, 95)	91 (75, 100)	100 (80, 100)
24 MONTHS	88 (72, 97)	93 (82, 100)	100 (85, 100)

*All scores are reported as median (IQR).

P8

Is Heroic Mastectomy Effective in Maintaining Local Control for Classically Inoperable Breast Cancers? A. Mamtani,* V. Sevilimedu, A. Vincent, M. Morrow. *Department of Surgery, Breast Service, Memorial Sloan Kettering Cancer Center, New York, NY.*

Introduction: Despite advances in systemic therapy for breast cancer, some patients with aggressive T4 tumors fail to respond. Surgery is often undertaken in these cases, but the efficacy of "heroic" mastectomy in maintaining local control during a patient's lifetime is unclear. Methods: We identified consecutive patients with primary or recurrent T4 breast cancer, including those with metastases at presentation, who had tumor progression or stable disease (< 50% tumor shrinkage) on systemic therapy and underwent total mastectomy at our institution from 2007–2017. Clinicopathologic characteristics and locoregional recurrence (LRR) rates were examined. Results: Among 104 patients, 59 (57%) had primary T4M0, 12 (12%) had locally recurrent T4M0, and 33 (32%) had T4M1 disease. Median age was 58.5 years, and the majority were ductal cancers (85%) of high grade (74%); 45 (44%) were ER+/HER2–, 26 (26%) were HER2+, and 31 (30%) were triple negative (TN). Prior to surgery, 72 (69%) patients received chemotherapy, 14 (14%) had endocrine therapy, 7 (7%) had both, and 11 (11%) had neither. Radiotherapy was given to 71 (68%). Wound complications developed in 41 (39%) patients. At median follow-up of 37 months (range 1–142), 42 (40%) patients developed LRR, 83% involving the chest wall alone. Patients with LRR were more often TN, high grade, and had lymphovascular invasion (LVI; all $p < 0.05$, Table). On multivariable analysis, TN subtype (HR 6.1, 95% CI 2.8–13.4, $p < 0.001$) and LVI (HR 4.4, 95% CI 1.6–11.7, $p = 0.003$) were associated with LRR. The 3-year LRR rate was 66% (95% CI 48–83%) in TN, 47.5% (95% CI 29–70%) in HER2+, and 22% (95% CI 12–38%) in ER+/HER2– patients ($p < 0.001$). The 3-year overall survival (OS) was 30% (95% CI 14–47%) in TN, 75% (95% CI 53–88%) in HER2+, and 70% (95% CI 54–81%) in ER+/HER2– patients. Conclusion: LRR occurred in 40% of patients after heroic mastectomy in spite of a median OS of 3.8 years, and postoperative complications were frequent. The 3-year LRR rate of 66% in TN patients, a group with a 3-year OS of 30%, suggests that surgery is rarely beneficial in this subset. Careful patient selection is prudent when considering heroic mastectomy.

Clinicopathologic characteristics for the overall cohort and stratified by development of locoregional recurrence (LRR).

Characteristic	All Patients n = 104	Developed LRR n = 42	No LRR n = 62	p value
Age, years	58 (47–68)	60 (47–68)	53 (47–68)	0.76
Clinical N stage				0.93
N0	24 (100%)	9 (38%)	15 (62%)	
N+	80 (100%)	33 (41%)	47 (59%)	
Histology				0.62
Invasive ductal	88 (100%)	35 (40%)	53 (60%)	
Invasive lobular	8 (100%)	4 (50%)	4 (50%)	
Malignant phyllodes	2 (100%)	0 (0%)	2 (100%)	
Metaplastic	5 (100%)	2 (40%)	3 (60%)	
Neuroendocrine	1 (100%)	1 (100%)	0 (0%)	
Receptor status*				0.005
ER+/HER2-	45 (100%)	11 (24%)	34 (76%)	
HER2+	26 (100%)	12 (46%)	14 (54%)	
ER-/HER2-	31 (100%)	19 (61%)	12 (39%)	
Lymphovascular invasion	80 (100%)	37 (46%)	43 (54%)	0.047
Grade				0.049
Low	1 (100%)	0 (0%)	1 (100%)	
Intermediate	26 (100%)	6 (23%)	20 (77%)	
High	77 (100%)	36 (47%)	41 (53%)	
Pathologic tumor size, cm	5.3 (3.1–9.1)	6.3 (3.0–9.6)	4.7 (3.2–8.4)	0.48
Pathologic N stage				0.33
N0	17 (100%)	4 (24%)	13 (76%)	
N+	75 (100%)	33 (44%)	42 (56%)	
None removed	12 (100%)	5 (42%)	7 (58%)	

*Receptors not tested on the 2 malignant phyllodes cases.
ER, estrogen receptor; HER2, human epidermal growth factor receptor 2. Frequency (row percent) reported for categorical variables, and median (interquartile range) for continuous variables.

P9

Can Clinicopathologic Features Identify Patients with HR+/HER2- Tumors and Palpable Adenopathy Who Have Low Volume Axillary Disease? A. Crown,* V. Sevilimedu, M. Morrow. *Memorial Sloan Kettering Cancer Center, New York, NY.*

Background Palpable axillary metastases at presentation are an indication for neoadjuvant chemotherapy or axillary dissection (ALND). With nodal pCR rates of 20-30%, patients with hormone receptor positive (HR+)/HER2- tumors are at high risk for requiring ALND. Sentinel node biopsy (SLNB) +/- axillary radiation is accepted for cN0 patients with 1-2 nodal metastases based on ACOSOG Z0011 and AMAROS. The proportion of patients with HR+/HER2- tumors with palpable adenopathy and low volume axillary disease is unknown. Methods A prospective database was queried for patients with cT1-T3N1 HR+/HER2- tumors with palpable adenopathy treated with upfront surgery including ALND between 2007-2012. Clinicopathologic features were compared between patients with 1-2 positive nodes and those with >2 positive nodes at ALND. Univariate analysis was done by Fisher's test or Chi square test for categorical variables and Wilcoxon rank sum test for continuous variables. Multivariable analysis was done using logistic regression. Acceptable type I error rate was set to 0.05. Results Median patient age of the 180 eligible patients was 53 years (IQR 45-65). 78 patients (43%) had 1-2 positive nodes at ALND including 40 of 72 (56%) patients undergoing lumpectomy and 38 of 108 (35%) patients undergoing mastectomy. Lumpectomy, low cT stage, tumor size, 1 palpable node, <3 abnormal nodes on ultrasound (US), and unifocal tumor were associated with 1-2 positive nodes on univariate analysis (all $p<0.05$) (Table 1). On logistic regression, cT1-2 tumors ($p<0.001$) and <3 abnormal nodes on US ($p=0.002$) were independent predictors of low volume axillary disease. Of 39 patients with cT1N1 disease and 1 abnormal node on US, 31 (79%) had 1-2 positive nodes at ALND in contrast to 4 of 34 (12%) patients with cT2N1 disease and >1 abnormal node on US. Conclusions Among women with cT1-3N1 HR+/HER2- tumors with palpable adenopathy, a substantial minority (43%) have only 1-2 positive nodes. Number of abnormal nodes on US and cT stage identify patients with low volume nodal disease who may be suitable for upfront SLNB as a strategy to avoid ALND. Prospective studies are warranted.

Table 1. Clinicopathologic features associated with low volume axillary disease.

Feature	Overall N = 180 N (column %)	1-2 positive nodes N = 78 N (row %)	>2 positive nodes N = 102 N (row %)	P
Median Age, years (IQR)	53 (44-65)	53 (45-64)	54 (43-66)	0.98
BMI, kg/m2 (IQR)	27.1 (22.9-31.8)	27.0 (23.1-32.7)	27.1 (22.9-34.1)	0.70
cT stage				
cT1 cT2 cT3	69 (38%) 80 (44%) 31 (17%)	40 (58%) 34 (43%) 4 (13%)	29 (42%) 46 (58%) 27 (87%)	<0.001
Median cT size, mm (IQR)	25 (20-39)	20 (16-30)	28 (20-50)	<0.001
Breast Surgery				
Lumpectomy Mastectomy	72 (40%) 108 (60%)	40 (56%) 38 (35%)	32 (44%) 70 (65%)	0.011
Focality				
Unifocal Multifocal/centric	112 (62%) 68 (38%)	58 (52%) 20 (29%)	54 (48%) 48 (71%)	0.005
Histology				
Invasive Ductal Carcinoma Invasive Lobular Carcinoma Mixed Carcinoma Other	145 (81%) 23 (13%) 8 (4.4%) 4 (2.2%)	67 (46%) 6 (26%) 2 (25%) 3 (75%)	78 (54%) 17 (74%) 6 (75%) 1 (25%)	0.11
Differentiation				
Well Moderate Poor Unknown	1 (0.6%) 27 (15%) 133 (74%) 19 (11%)	1 (100%) 9 (33%) 62 (47%) 6 (32%)	0 18 (67%) 71 (53%) 13 (68%)	0.23
Palpable Nodes				
1 >1	145 (81%) 35 (19%)	70 (48%) 8 (23%)	75 (52%) 27 (77%)	0.011
Abnormal nodes on US				
1 2 >2 Unknown	95 (53%) 23 (13%) 57 (32%) 5 (2.8%)	62 (65%) 11 (48%) 4 (7%) 1 (20%)	33 (35%) 12 (52%) 53 (93%) 4 (80%)	<0.001

IQR: interquartile range; BMI: body mass index

P10

Timing of Presentation and Outcomes of Women with Stage 4 Pregnancy Associated Breast Cancer (PABC) R. Matar,[1]* A. Crown,[2] V. Sevilimedu,[1] S. Goldfarb,[1] M.L. Gemignani.[1] *1. Surgery, Memorial Sloan Kettering Cancer Center, Brooklyn, NY; 2. Swedish Medical Center, Seattle, WA.*

Introduction PABC and concomitant, or early development, stage 4 disease is uncommon. Given the rarity of PABC and complexities surrounding pregnancy, data are limited regarding treatment and outcomes. We sought to examine timing and outcomes of women with stage 4 PABC, including obstetric and fetal outcomes. Methods Retrospective review of an institutional database identified women with stage 4 PABC from 1998-2018. PABC was defined as diagnosis during pregnancy or ≤1 year postpartum. Clinicopathologic, treatment and outcomes variables for those diagnosed during pregnancy (PRE) or postpartum (PP) were compared using Cox proportional hazard models. Kaplan-Meier method estimated overall survival (OS). Results We identified 77 women with median age of 35 years (range 23-44); 73 (95%) had infiltrating ductal carcinoma with 17 (22%) hormone receptor positive (HR+)/HER2 negative, 41 (53%) HER2+, and 19 (25%) triple-negative (TN) tumors. PP group had 51 (66%) women and PRE group had 26 (34%) women including 9 with therapeutic or spontaneous abortion. Of 17 women who continued pregnancy, none had an obstetric complication and 71% delivered by c-section ≥37 weeks gestation (range 32-41). In 13 pregnancies with available data, no fetal complications were noted. Clinicopathologic and treatment variables did not differ between groups. All received chemotherapy, including 9 pregnant women. Median time to stage 4 diagnosis was significantly shorter in PP compared to PRE group (15 vs. 95 days, respectively; p=0.046); first distant site was similar between groups (p=0.4) (Table). Of 43 women dead of disease, 15 were TN tumors with median OS of 14 months (range 5-39); OS was associated with HR+ and HER2+ tumors (p<0.01). At a median follow-up of 31 months (range 0-137), the 5-year OS rate was 34% (95% confidence interval: 21-46%) and did not differ among PRE and PP groups (p=0.2). Conclusion Women with stage 4 PABC have a high mortality rate despite multimodality therapy, especially in TN tumors. Timing of presentation did not affect management decisions or OS, even in women who completed pregnancy. Further research to understand the biology of PABC, focusing on TN tumors is warranted.

Clinicopathologic features and treatment among women diagnosed with PABC during pregnancy or postpartum with concomitant, or early development, of stage 4 disease.

	Overall (n = 77)	Pregnant (n = 26)	Postpartum (n = 51)	p-value
Age at diagnosis, median (IQR)	35 (32-37)	35 (32-37)	35 (32-37)	0.6
Race White Black Asian	 68 (88%) 6 (7.8%) 3 (3.9%)	 21 (81%) 4 (15%) 1 (3.8%)	 47 (92%) 2 (3.9%) 2 (3.9%)	0.2
Receptor Status HR+/HER2- HR+/HER2+ HR-/HER2+ HR-/HER2-	 17 (22%) 16 (21%) 25 (32%) 19 (25%)	 5 (19%) 6 (23%) 7 (27%) 8 (31%)	 12 (24%) 10 (20%) 18 (35%) 11 (22%)	0.8
1st Distant Location Bone Only Other Viscera	 32 (42%) 45 (58%)	 13 (50%) 13 (50%)	 19 (37%) 32 (63%)	0.4
M1 known prior to surgery (if patient received surgery)	17 (42%)	7 (41%)	10 (43%)	>0.9
Type of Surgery Lumpectomy Mastectomy No Surgery Salvage Mastectomy	 13 (17%) 24 (31%) 34 (44%) 6 (7.8%)	 7 (27%) 9 (35%) 8 (31%) 2 (7.7%)	 6 (12%) 15 (29%) 26 (51%) 4 (7.8%)	0.3
Received Chemotherapy	77 (100%)	26 (100%)	51 (100%)	>0.9
Received Targeted HER2 Therapy	36 (47%)	14 (54%)	22 (43%)	0.5
Received Radiation Therapy	48 (62%)	20 (77%)	28 (55%)	0.1
Received Endocrine Therapy	37 (48%)	12 (46%)	25 (49%)	>0.9
Ovarian Suppression	28 (36%)	10 (38%)	18 (35%)	>0.9
Bilateral Salpingo-oopherectomy	11 (14%)	3 (12%)	8 (16%)	0.7

P11

Is Locoregional Recurrence Higher Among Patients Who Downstage to Breast Conservation After Neoadjuvant Chemotherapy? A. Mamtani,* V. Sevilimedu, T. Le, M. Morrow, A. Barrio. *Department of Surgery, Breast Service, Memorial Sloan Kettering Cancer Center, New York, NY.*

Introduction: In early studies, rates of locoregional recurrence (LRR) were higher in patients treated with neoadjuvant chemotherapy (NAC) compared to upfront surgery. Modern outcomes are uncertain, particularly among those who are initially ineligible for breast-conserving surgery (BCSi) and downstage to BCS-eligible (BCSe). Methods: Consecutive patients with cT1-3N0-3 breast cancer treated from May 2014 to Dec 2018 who were BCSe after NAC were identified. Eligibility for BCS pre- and post- NAC was determined by the operating surgeon. Clinicopathologic characteristics and LRR rates were compared between BCSe patients at presentation and BCSi patients who downstaged to BCSe. Results: Among 685 patients, 243 (35%) were BCSe pre- and post-NAC and had BCS, 282 (41%) were BCSi pre-NAC/downstaged to BCSe and had BCS, and 160 (23%) were BCSi pre-NAC/downstaged to BCSe and chose mastectomy. Median age was 52 years, and most cancers were cT1-2 (84%), cN+ (61%), and HER2+ (38%) or triple-negative (34%). Those who were BCSe pre-NAC had lower cT stage and were less often poorly differentiated, while those who chose mastectomy were younger (all $p < 0.05$, Table). NAC was ACT-based in 635 (92%) cases, and all HER2+ patients received dual HER2-targeted therapy. Nearly all (518; 99%) patients undergoing BCS received adjuvant radiation. At a median follow-up of 35 months, 23 (3.4%) patients developed LRR, 18 involving the breast/chest wall only. The actuarial 4-year LRR rate was 4.0% (95% CI 2.6–5.1) and was similar between groups: 1.9% (95% CI 0.7–5.1) among pre- and post-NAC BCSe who had BCS, 6.3% (95% CI 3.5–11.3) among pre-NAC BCSi/post-NAC BCSe who had BCS, and 3.4% (95% CI 1.4–8.1) among pre-NAC BCSi/post-NAC BCSe who had mastectomy ($p = 0.21$). On multivariable analysis, only breast pathologic complete response was independently associated with LRR (HR 0.19, 95% CI 0.04–0.81, $p = 0.03$). Conclusion: Rates of LRR are low after NAC and BCS, even among initially BCSi patients who downstage with treatment and are not improved in those who opt for mastectomy. Mastectomy can be safely avoided in BCSi patients who downstage with NAC.

Clinicopathologic characteristics and locoregional recurrence rates

Characteristic	All patients n = 685	Had BCS		Pre-NAC BCS-ineligible, downstaged to BCS-eligible, chose mastectomy n = 160	p
		Pre-NAC BCS-eligible n = 243	Pre-NAC BCS-ineligible n = 282		
Age, median, years	52 (25 – 82)	56 (30–82)	51 (25–82)	44 (26–72)	< 0.001
Clinical T stage					< 0.001
1	114 (16.6%)	82 (33.7%)	21 (7.4%)	11 (6.9%)	
2	459 (67.0%)	156 (64.2%)	200 (70.9%)	103 (64.4%)	
3	112 (16.4%)	5 (2.1%)	61 (21.6%)	46 (28.8%)	
Clinical N stage					0.3
0	267 (39.0%)	79 (32.5%)	121 (42.9%)	67 (41.9%)	
1	372 (54.3%)	145 (59.7%)	142 (50.4%)	85 (53.1%)	
2	23 (3.4%)	10 (4.1%)	9 (3.2%)	4 (2.5%)	
3	23 (3.4%)	9 (3.7%)	10 (3.5%)	4 (2.5%)	
Histology					0.073
Invasive ductal	645 (94.2%)	223 (91.8%)	273 (96.8%)	149 (93.1%)	
Invasive lobular	33 (4.8%)	15 (6.2%)	8 (2.8%)	10 (6.3%)	
Other	7 (1.0%)	5 (2.1%)	1 (0.4%)	1 (0.6%)	
Receptor status					0.3
ER+/HER2-	196 (28.6%)	81 (33.3%)	70 (24.8%)	45 (28.1%)	
ER+/HER2+	164 (23.9%)	52 (21.4%)	78 (27.7%)	34 (21.3%)	
ER-/HER2+	94 (13.7%)	30 (12.3%)	39 (13.8%)	25 (15.6%)	
ER-/HER2-	231 (33.7%)	80 (32.9%)	95 (33.7%)	56 (35.0%)	
Lymphovascular invasion	161 (23.5%)	56 (23.0%)	61 (21.6%)	44 (27.5%)	0.9
Differentiation					0.04
Well	6 (0.9%)	3 (1.2%)	2 (0.7%)	1 (0.6%)	
Moderate	167 (24.4%)	73 (30.0%)	54 (19.1%)	40 (25.0%)	
Poor	512 (74.7%)	167 (68.7%)	226 (80.1%)	119 (74.4%)	
Breast pCR (ypT0)	220 (32.1%)	73 (30.0%)	92 (32.6%)	55 (34.4%)	0.6
Breast pCR (ypT0/Tis)	272 (39.7%)	93 (38.3%)	116 (41.1%)	63 (39.4%)	0.8
Positive final margin	1 (0.1%)	0 (0%)	1 (0.4%)	0 (0%)	> 0.9
Developed LRR	23 (3.4%)	5 (2.1%)	13 (4.6%)	5 (3.1%)	0.3

BCS, breast-conserving surgery; NAC, neoadjuvant chemotherapy; ER, estrogen receptor; HER2, human epidermal growth factor receptor 2; pCR, pathologic complete response; LRR, locoregional recurrence

P12

Reconstruction in Women with T4 Breast Cancer After Neoadjuvant Chemotherapy: When is it Safe? K.R. Pawloski,[1]* M.L. Gemignani,[1] V. Sevilimedu,[2] T. Le,[1] J. Dayan,[3] M. Morrow,[1] A. Tadros.[1] *1. Breast Service, Department of Surgery, Memorial Sloan Kettering Cancer Center, New York, NY; 2. Biostatistics Service, Department of Epidemiology and Biostatistics, Memorial Sloan Kettering Cancer Center, New York, NY; 3. Plastic and Reconstructive Surgical Service, Department of Surgery, Memorial Sloan Kettering Cancer Center, New York, NY.*

Introduction: Immediate reconstruction (IR) is increasingly offered to women with T4 breast cancer (BC) following neoadjuvant chemotherapy (NAC) despite limited data regarding morbidity and oncologic safety. Optimal timing for reconstruction is unclear. We compared prognostic characteristics and outcomes between T4 patients who had reconstruction vs. no reconstruction. Methods: Women with T4 BC treated with NAC, mastectomy and radiation (PMRT) from 2007-2019 were retrospectively identified. We compared women with IR, DR (delayed reconstruction, >6 months after mastectomy), and NR (no reconstruction), and assessed rates of complications requiring operative intervention and outcomes between groups. Results: 269 women were identified; median age was 52 years (IQR 45-62). 105 women (39%) had T4a-c tumors and 164 (61%) were T4d. 45 women (17%) had IR, 41 (15%) had DR and 183 (68%) had NR. Women with IR were younger vs. those with DR or NR ($p<0.001$) and were more likely to have T4a-c tumors (71% vs. 27-34%; $p<0.001$). Breast pCR was more common in DR vs. NR or IR groups (49% vs. 28-29%; $p=0.03$). On multivariable analysis, reconstruction (IR or DR) was associated with T4a-c disease (OR 2.38; 95% CI 1.32-4.35, $p=0.01$) and was less common among older women (OR 0.90; 95% CI 0.87-0.93; $p<0.001$). Complications were more frequent after IR compared to DR or NR (20% vs. 2.4% vs. 0.5%; $p<0.001$). (Table). 67% (6/9) of women with T4d tumors had complications after IR. Median time to PMRT was longer after IR vs. DR or NR ($p<0.001$). No difference in local recurrences (LR) or LR-free survival was observed between those with or without IR at a median follow-up of 48.7 months ($p=0.5$). Among patients with known recurrences (33%, 89/269), median time to any recurrence was 18 months (range 1-134 months) and did not differ between groups ($p=0.13$) at median follow-up of 48 months. Conclusions: IR is associated with increased risk of complications and longer time to PMRT in women with T4 BC. IR should be avoided in patients with T4d disease. Delaying reconstruction for ≥18 months allows for prompt completion of adjuvant therapy and identification of patients at highest risk for early recurrence.

Rates of surgical complications and time to PMRT in patients with and without breast reconstruction

Variable	Overall (N=269)	Immediate (N=45)	Delayed (N=41)	None (N=183)	p-value*
Complications	11 (4.1%)	9 (20%)	1 (2.4%)	1 (0.5%)	<0.001
TE infection requiring removal	3	3	0	0	
Mastectomy skin flap tissue loss	4	4	0	0	
Hematoma	3	2	0	1	
Autologous donor site infection	1	0	1	0	
Time to PMRT, days (median, IQR)	50 (41, 62)	60 (47, 71)	42 (39, 53)	49 (60, 61)	<0.001

*Statistical tests performed: Wilcoxon rank-sum test; chi-square test of independence; Fisher's exact test

P13

Ex-Vivo Expansion and Characterization of Tumor Infiltrating Lymphocytes from Core Needle Biopsies of Triple Negative Breast Cancers J. Le Blanc,[2]* L. Andreveja,[1] M. Coman,[3] L. Pusztai,[4] A. Bersenev,[5] D. Krause,[5] N. Joshi,[6] T. Park.[2] *1. Yale School of Medicine, Department of Radiology and Biomedical Imaging, New Haven, CT; 2. Yale School of Medicine, Department of Surgery, New Haven, CT; 3. Yale School of Medicine, New Haven, CT; 4. Yale School of Medicine, Department of Medical Oncology, New Haven, CT; 5. Yale School of Medicine, Department of Laboratory Medicine, New Haven, CT; 6. Yale School of Medicine, Department of Immunobiology, New Haven, CT.*

Introduction Adoptive transfer of ex-vivo expanded tumor infiltrating lymphocytes (TILs) is a type of immunotherapy that has shown long-term durable responses in metastatic cancer. TIL expansion, however, requires surgery and anesthesia for tumor resection and occasionally are not amenable for surgery due to location. The purpose of this study was to assess the feasibility of obtaining tissue via core needle biopsy (CNB) to expand TILs without the need for surgery in patients with triple negative breast cancer (TNBC). Methods CNBs were obtained under HIC#1310012919 (Title: Prospective Collection of Tissue Specimens and Blood from Stage I-IV breast cancers for molecular analysis). Ten patients were included: 3 surgically resected; 7 CNBs. After initial expansion in IL-2 growth media for 14 days, 3 samples were processed for clinical grade rapid expansion. All samples underwent analysis to assess percentage of CD3, CD8, CD4 T-cells. Results All ten patients included in this study were relatively healthy females (ages 31-86). Of the CNB cohort: 57% were African American, two were Caucasian, and one was Hispanic. 69% of the patients in the CNB cohort had tumors with poorly-differentiated histology. After obtaining tumor specimens via CNB, cell counts after the initial expansion ranged from $1.6x10^4$ to $1.0x10^7$. For the one CNB patient who had a rapid expansion post-initial expansion, the final yield was a $1.0x10^9$ (1295-fold expansion) with an increase in CD8 population to 46.1% from 37.5%. The surgery specimens yields after rapid expansion were $1.7x10^{10}$ and $2.2x10^{10}$ (3400 and 2206-fold increase, respectively). Conclusions We report the feasibility of isolation and expansion of TILs from CNBs in largest breast cancer cohort of TNBCs to date. We showed comparable results between CNB and surgery as adequate and sufficient tools for TIL expansion. This demonstrates the feasibility of CNBs as an alternative and less invasive technique for obtaining adequate tumor tissue for TIL growth in clinically relevant numbers for adoptive cell transfer. This could increase the patient population who can undergo ACT therapy with ex-vivo expanded TILs.

Patient ID	Sex	Age	Race	Biopsy Method	Pathology	Clinical Stage	Cell Count after Initial Expansion
1	F	64	C	CNB; 14G needle; 2 passes with needle	Poorly differentiated, necrotic, and contains lymphoplasmacytic infiltrate	T2N0M0	4.0x10^6 cells
2	F	43	AA	CNB; 14G needle; 2 passes with needle	Solid, poorly differentiated, no necrosis or microcalcifications	T2N0M0	1.6x10^4 cells
3	F	40	AA	CNB; 14G needle; 2 passes with needle	Poorly differentiated, necrosis and microcalcifications present	T2N0M0	2.1x10^5 cells
4	F	59	AA	CNB; 14G needle; 2 passes with needle	Poorly differentiated, no necrosis or microcalcifications	T1N0M0	1.0X10^7 cells
5	F	68	C	CNB; 14G needle; 2 passes with needle	Solid papillary carcinoma	T1N0M0	2.5x10^6 cells
6	F	50	AA	CNB; 14G needle; 2 passes with needle	Poorly differentiated, no necrosis or microcalcifications	T2N1M0	2.15x10^6 cells
7	F	45	H	CNB; 14G needle; 1 pass with needle	Poorly differentiated, invasive ductal carcinoma	T2N1M0	No yield
8	F	86	C	Surgery	Poorly differentiated, invasive ductal, negative margins	T2N0M0	1.0x10^7 cells
9	F	74	C	Surgery	Poorly differentiated, invasive ductal, negative margins, high nuclear grade	T3N1M1	7.5x10^7 cells
10	F	68	H	Surgery	Poorly differentiated, invasive ductal, negative margins	T2N1M0	8.8x10^5 cells

Caucasian-C; African American-AA; Hispanic-H; female-F

P14

Discordance in Oncotype DX Breast Recurrence Score Results for Bilateral Breast Cancer J.A. Bloom,* Y. Sekigami, Y. Cao, R.J. Buchsbaum, S.P. Naber, A. Chatterjee. *Tufts Medical Center, Boston, MA.*

Introduction The Oncotype DX Breast Recurrence Score® assay is a clinically useful tool helping oncologists determine the benefit of chemotherapy in the treatment of early-stage, hormone positive breast cancer. Bilateral breast cancer is found in ~5% of patients presenting with breast cancer, and there are limited data regarding discordance of Oncotype DX® results between bilateral breast cancers defined by current TAILORx subgroups. Our goal was to study the rate of differing Oncotype DX® results in patients with bilateral breast cancers, and to investigate whether such differences can affect chemotherapy treatment discussions. Methods Patients with bilateral breast cancer were identified in US samples submitted to Genomic Health for 21-gene testing between 1/2019 – 7/2020 using ICD-10 codes. Variables analyzed included age, receptor status, Oncotype DX® result, nodal status, and risk categories for each paired breast cancer. The risk categories were defined as 0-25 and 26-100 as well as 0-17, 18-30, and 31-100 for all patients. A subgroup analysis was also performed for node-negative women age <50 with recurrence score results of 0-15, 16-20, 21-25, and 26-100. Results 944 patients with known nodal status (702 node-negative, 242-node positive) were identified and included in the analysis. Among node negative patients age >50, the contralateral breast cancer was in a discordant risk group (0-25 and 26-100) in 4.2% (n=25) of patients. For node-negative patients age <50, the risk group was discordant < 3% when considering the risk grouping of 0-25 and 26-100. However, upon subgroup analysis, the discordance was 48.1% in these younger patients (n=50) (Table 1). Among all node-positive patients, there was a 6.2% discordance in risk groups 0-25 and 26-100 and a 33% discordance in risk groups 0-17, 18-30, and 31-100. Conclusions This study shows that there is a clinically relevant rate of discordance in Oncotype DX® results in patients with bilateral breast cancer when considering age, nodal status, and risk category which may impact medical decision-making regarding the use of chemotherapy.

	RS Left	RS Right	N	%
Node negative, age < 51			**104**	**100**
Same Recurrence Score Risk Group			**54**	**51.9**
Both 0-15	0-15	0-15	46	44.2
Both 16-20	16-20	16-20	5	4.8
Both 21-25	21-25	21-25	2	1.9
Both 26-100	26-100	26-100	1	1.0
Different Recurrence Score Risk Group			**50**	**48.1**
L < R	0-15	16-20	14	13.5
L < R	0-15	21-25	4	3.8
L < R	16-20	21-25	3	2.9
L > R	16-20	0-15	16	15.4
L > R	21-25	0-15	5	4.8
L > R	21-25	16-20	5	4.8
L > R	26-100	0-15	2	1.9
L > R	26-100	16-20	1	1.0

Table 1. Recurrence Score (RS) categorization among node negative patients age 50 or younger.

P15

Do Local Anesthetics Reduce Opioid Requirement and Pain Scores After Lumpectomy and Sentinel Node Biopsy with Multimodal Analgesia? K.R. Pawloski,[1]* V. Sevilimedu,[2] R. Twersky,[3] A. Tadros,[1] L. Kirstein,[1] H. Cody,[1] M. Morrow,[1] T. Moo.[1] *1. Breast Service, Department of Surgery, Memorial Sloan Kettering Cancer Center, New York, NY; 2. Biostatistics Service, Department of Epidemiology and Biostatistics, Memorial Sloan Kettering Cancer Center, New York, NY; 3. Department of Anesthesiology and Critical Care Medicine, New York, NY.*

Introduction: Multimodal analgesia (MMA) during ambulatory breast surgery is associated with reduced postoperative opioid use and pain scores, but the relative effect of intraoperative local anesthetics on these outcomes is unclear, as is dosing for optimal pain control. Here we examine the association between surgeon-administered local anesthetics and a) postoperative opioid use and b) pain scores in patients having lumpectomy/sentinel node biopsy (L/SLNB) under MMA. Methods: We retrospectively identified L/SLNB patients treated between 1/2019 and 4/2020 under a routine MMA protocol, including IV ketorolac, acetaminophen, limited opioids, plus local injection of 1% lidocaine (lido) and 0.5% bupivacaine (bupiv). Outcomes were opioid requirement in morphine milligram equivalents (MME) and maximum reported pain scores in the postoperative anesthesia care unit (PACU), assessed with univariate and multivariable models. Results: 1603 patients with a median tumor size of 14 mm were included. Patient and treatment characteristics are shown in the Table. 37% (594/1603) of patients had no pain, 20% (331/1603) had mild pain, and 42% (678/1603) had moderate-severe pain. Median PACU opioid MMEs were 0 (IQR: 0-5; range 0-42.5). After adjusting for intraoperative opioids, ketorolac, acetaminophen, anesthesia type and BMI, increasing doses of lido and bupiv were associated with lower PACU opioid requirement (p=0.014 and p=0.008, respectively) and, for bupiv, the odds of no pain increased with higher doses (OR 1.03, 95% CI 1.01-1.05; p=0.001). For patients with T1 tumors (74%; 1199/1603), when compared to infiltration of <10 ml of local, infiltration of >10 ml was associated with lower mean opioid MMEs (lido p=0.018 and bupiv p=0.007) and, for bupiv, a lower frequency of moderate-severe pain (39% vs. 46%; p=0.01). Conclusions: Infiltration of higher doses of lido and bupiv were significantly associated with lower PACU opioid requirement and pain scores. Local dosing should be standardized and maximized within weight-based limits, as this represents a low-risk, cost-effective pain control strategy that can be used in diverse practice settings.

Clinicopathologic and anesthetic management factors associated with opioid consumption (MMEs) in the PACU

	Overall (N=1603)	Univariate analysis			Multivariable analysis †		
Variable		β	95% CI	p-value	β	95% CI	p-value
1% Lidocaine, median (IQR), ml	13 (10, 20)	-0.05	-0.09, -0.01	0.008	-0.05	-0.08, -0.01	0.014
0.5% Bupivacaine, median (IQR), ml	10 (10, 20)	-0.05	-0.08, -0.01	0.006	-0.04	-0.08, -0.01	0.008
Age, median (IQR)	59 (51, 67)	-0.02	-0.05, 0.00	0.09			
T size, median (IQR), mm	14 (8, 20)	-0.02	-0.05, 0.00	0.056			
BMI (kg/m^2), n (%)							
<18.5	20 (1.2)	-2.20	-4.60, 0.17	0.07	-2.00	-4.40, 0.35	0.1
18.5-24.9	516 (32)	-1.60	-2.30, -1.00	<0.001	-1.60	-2.20, -0.95	<0.001
25.0-29.9	496 (31)	-0.30	-0.95, 0.35	0.4	-0.26	-0.90, 0.39	0.4
≥30.0	567 (35)	ref	-	-	ref	-	-
ASA score (median, IQR)	2 (2, 3)	0.30	-0.20, 0.82	0.2			
Anesthesia type, n (%)							
MAC	1236 (77)	-0.89	-1.50, -0.26	0.006			
GEN	367 (23)	ref	-	-			
Intraoperative acetaminophen, n (%)							
Yes	1564 (98)	-0.39	-2.10, 1.30	0.7			
No	39 (2)	ref	-	-			
Intraoperative ketorolac, n (%)							
25-30	310 (19)	-0.24	-0.97, 0.49	0.5	-0.26	-0.98, 0.47	0.5
15	599 (37)	-0.85	-1.60, -0.11	0.02	-0.77	-1.50, -0.04	0.04
0	694 (43)	ref	-	-	ref	-	-
Intraoperative opioids, median (IQR), MME	20 (10, 20)	0.05	0.02, 0.08	<0.001	0.04	0.01, 0.06	0.012

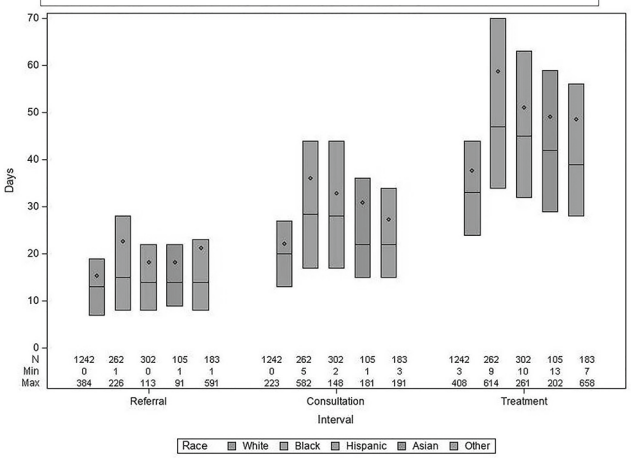
†Multivariable linear regression model adjusted for 1% lidocaine, 0.5% bupivacaine, BMI, anesthesia type, intraoperative ketorolac, acetaminophen, and opioids (MMEs). Final variables in the model were selected using backward elimination.

P16

Racial Disparities in Time to Treatment Persist in the Setting of a Multidisciplinary Breast Center S. Zaveri,[1]* D. Nevid,[2] M. Ru,[3] E. Moshier,[3] K. Pisapati,[2] S. Reyes,[2] E.R. Port,[2] A. Romanoff.[4]
1. Department of Surgery, Icahn School of Medicine at Mount Sinai, New York, NY; 2. Dubin Breast Center, Icahn School of Medicine at Mount Sinai, New York, NY; 3. Department of Population Health Science and Policy, Icahn School of Medicine at Mount Sinai, New York, NY; 4. Global Health and Health System Design, Icahn School of Medicine at Mount Sinai, New York, NY.

Introduction: Racial disparities in breast cancer care have been linked to treatment delays. We explored whether receiving care at a comprehensive breast center could mitigate disparities in time to treatment. Methods: Retrospective chart review identified all women with non-metastatic breast cancer who underwent surgery from 2012 to 2018 at a single National Cancer Institute-designated breast center. Time to treatment intervals were compared among races by negative binomial regression models. Results: 2094 women met inclusion criteria: 1242 (59%) white, 262 (13%) Black, 302 (14%) Hispanic, 105 (5%) Asian, and 183 (9%) other. Black and Hispanic patients more often had Medicaid insurance, higher ASA scores, advanced stage breast cancer, mastectomy, and additional imaging after breast center presentation, $p<0.05$. Time from diagnosis to treatment was shorter in white patients (33 days) compared to Black (47 days), Hispanic (45 days), Asian (42 days) and other patients (39 days), $p<0.0001$. Time from initial breast center visit to treatment was also significantly shorter in white patients versus non-white patients, $p<0.0001$. After controlling for other variables, non-white patients had consistently longer intervals to treatment, with Black women experiencing the greatest disparity (IRR 1.42). Non-white race, Medicaid insurance/being uninsured, older age, earlier stage, higher ASA score, undergoing mastectomy, having reconstruction, and requiring additional pre-treatment work-up (imaging, biopsy or genetic testing) after presentation to the breast center were associated with a longer time from initial breast center visit to treatment on multivariable analysis, $p<0.05$. Conclusion: Non-white women have significant delays in time to treatment even when receiving care at a comprehensive breast center. Influential factors include insurance delays and necessity of additional pre-treatment work-up. Specific programs and policies are needed to address health system barriers in treatment access.

Figure 1. Box plots of delay intervals by race.



Referral interval= time from diagnosis to initial breast center visit

Consultation interval= time from initial breast center visit to start of treatment

Treatment interval= time from diagnosis to start of treatment

P17

Quality of Life After Nipple Sparing Mastectomy in Breast Cancer Patients: Does Timing of Chemotherapy Matter? Results from the INSPIRE International Registry A.J. Esgueva,[1]* I. Noordhoek,[2] E. Meershoek-Klein Kranenbarg,[2] M. Espinosa-Bravo,[3] Z. Matrai,[4] A. Zhygulin,[5] A. Irmesj,[6] C. Mavioso,[7] F. Meani,[8] E. Gonzalez,[9] M. Ozdemir,[10] T. Allweis,[11] K. Rogowski,[12] C. Rodrigues dos Santos,[13] H. Mora,[14] R. Ponzone,[15] D. Samorani,[16] C. van de Velde,[2] R. Audisio,[17] I.T. Rubio.[1]
1. Breast Surgical Unit, Clinica Universidad de Navarra, Madrid, Spain; 2. Leiden University Medical Center, Leiden, Netherlands; 3. Breast Surgical Unit, Hospital Universitario Vall d'Hebron, Barcelona, Spain; 4. National Institute of Oncology, Budapest, Hungary; 5. Breast Unit, LISOD, Hospital of Israeli Oncology, Kiev, Ukraine; 6. Pauls Stradins Clinical University Hospital, Riga, Latvia; 7. Centro Clinico Champalimaud, Lisboa, Portugal; 8. Centro di Senologia della Svizzera Italiana, Ente Ospedaliero Cantonale, Ticino, Switzerland; 9. Instituto de Oncología Ángel H. Roffo, Buenos Aires, Argentina; 10. Ege Universitesi, Izmir, Turkey; 11. Kaplan Medical Center, Rehovot, Israel; 12. Bialostockie Centrum Onkologii, Bialystok, Poland; 13. IPO Francisco Gentil, Lisboa, Portugal; 14. Centro Hospitalar de Sao Joao, Porto, Portugal; 15. Candiolo Cancer Institute, FPO - IRCCS, Candiolo, Italy; 16. AUSL Romagna, Rimini, Italy; 17. Sahlgrenska Universitetssjukhuset, Gotenburg, Sweden.

Introduction: Nipple sparing mastectomy (NSM) is being increasingly used for breast cancer (BC) patients, either before or after systemic treatments (NAT). The aim of the study was to compare health related quality of life (HRQoL) in BC patients with NSM undergoing preoperative vs. postoperative chemotherapy. Methods: INSPIRE (International Nipple Sparing Mastectomy Registry) is a prospective database including women undergoing NSM and immediate reconstruction from 29 centers in 18 countries. HRQoL was measured using EORTC QLQC30 and BR23 before surgery and after 1yr. Results: 664pts were registered, 537 (80.9%) with BC and 127 (19.1%) with risk reducing surgery. Of the BC patients, 288 (53.6%) underwent chemotherapy, NAT in 182 (63.2%) pts and 106 (36.8%) pts as adjuvant (AT). Questionnaires were filled by 151 (83%) pts in the NAT group and 82 (77%) receiving AT. There were no significant differences in age, BMI or comorbidity between both groups. Women receiving NAT were significantly more likely to present with larger tumor size, clinically positive nodes and ER-/PR-. No significant difference was found for radiotherapy (p=0.08), surgical complications (p=0.35), or reconstruction type (p=0.15). Prior to surgery, patients in the NAT group scored significantly lower on functions (physical, role, cognitive, social) ($p<0.001$) and symptoms (fatigue, nausea, pain, insomnia, constipation and diarrhea) ($p<0.001$) compared to AT group. No differences were found at after 1yr where levels returned to baseline values (Fig 1). Regarding BR23 variables, patients in the NAT group scored significantly worse in body image, sexual functioning/enjoyment, future perspective, systemic therapy and hair loss ($p<0.001$). No difference was found at 1 year between groups, although levels did not completely return to baseline. Conclusions: In patients undergoing NSM, chemotherapy affects HRQoL irrespective of time of surgery. Variables in function and symptoms returned to baseline levels after 1yr, while BR23 variables remain below baseline in both groups at 1yr. Further research is warranted to facilitate return to baseline levels.

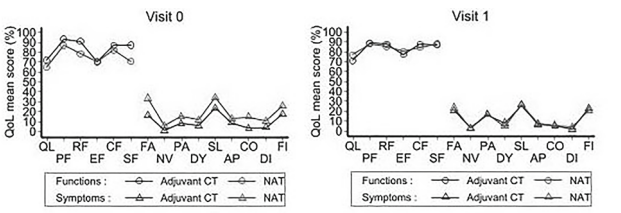


Fig. 1: Comparison of QoLC30 between patients neoadjuvant and adjuvant treatments. QL: Global Health Status, PF: Physical Functioning, RF: Role Functioning, EF: Emotional Functioning, CF: Cognitive Functioning, SF: Social Functioning, FA: Fatige, NV: nausea/Vomiting, PA: Pain, DY: Dyspnea, SL: Insomnia, AP: Appetite loss, CO: Constipation, DI: Diarrhea, FI: Financial difficulties.

P18

Pathologic Complete Response and Survival After Neoadjuvant Chemotherapy in cT1-T2/cN0 HER2 Amplified Breast Cancer

S.J. An,* E.D. Duchesneau, P.D. Strassle, K. Reeder-Hayes, K.K. Gallagher, D.W. Ollila, S. Downs-Canner, P.M. Spanheimer.
Surgery, University of North Carolina, Chapel Hill, NC.

Introduction: Recent clinical trial results show women with small HER2+ breast cancers may have an excellent prognosis with adjuvant single agent taxol chemotherapy and HER2 targeted therapy, avoiding the toxicity of multi-agent platinum- or anthracycline-based regimens. The role of de-escalated therapy in the neoadjuvant setting, however, remains uncertain. Methods: Adult women with T1-2/cN0 HER2+ breast cancer from 2013 to 2016 in the National Cancer Database treated with NAC and HER2 targeted therapy were included. Risk factors for pCR were identified using logistic regression. Kaplan Meier analysis and Cox regression were used to assess 5-year overall survival (OS), stratified by pCR, stage, and type of NAC. Results: In total, 6,994 patients were included, 32% cT1 and 68% cT2. Fifty percent of patients received mastectomy and 50% lumpectomy. Multi-agent NAC was given for 90% and single agent 10%. pCR was achieved in 46% of cT2 patients and 43% of cT1 (p=0.3), and in 46% of patients treated multi-agent vs 38% single-agent (p<0.01). Higher grade (p<0.01) and later year of diagnosis (p<0.01) were associated with increased pCR. Five-year OS in patients with pCR was 97% vs 93% in patients with residual disease (p<0.01). In multivariable survival analyses stratified by pCR status, node positive (p<0.01), hormone receptor negative (p<0.01), and older age (p<0.01) were associated with shorter survival among patients with residual disease, but cT stage (p=0.4) and type of NAC (p=0.1) did not predict survival. Similarly, among patients with pCR, cT stage (p=0.4) and NAC type (p=0.6) were not associated with survival, figure. Conclusions: In patients with cT1-2/N0 HER2-amplified breast cancer receiving NAC, multi-agent compared to single agent chemotherapy with HER2 targeted therapy was not associated with improved survival after adjustment for other clinical factors in either complete responders or those with residual disease. While this requires confirmation in randomized studies, de-escalated neoadjuvant chemotherapy might be safe in women who are candidates for adjuvant taxol while providing biologic risk stratification based on response.

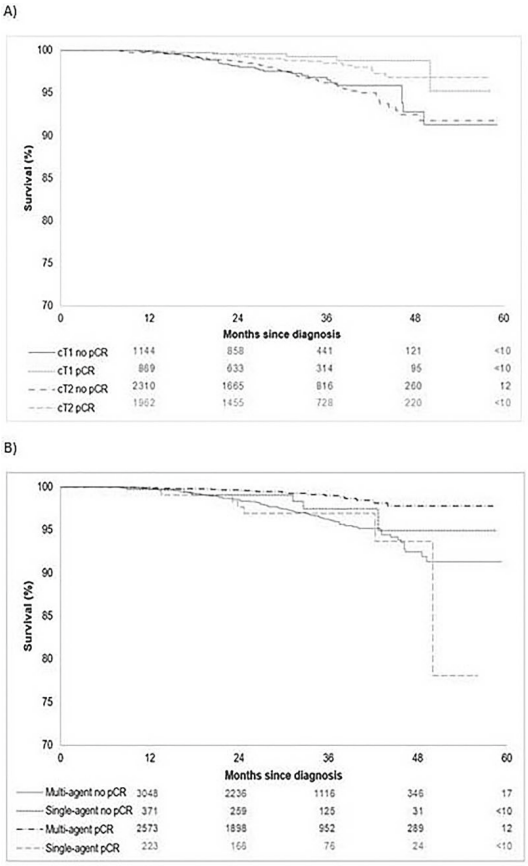


FIGURE: Overall survival in patients with HER2 amplified breast cancer stratified by pCR and A) clinical T stage, and B) single or multi-agent chemotherapy

P19

Residual Cancer Burden After Neoadjuvant Chemotherapy in Breast Cancer Patients

E.A. Elder,[1]* C. Livasy,[2] E. Donahue,[1] B.J. Neelands,[1] A. Patrick,[1] M. Needham,[1] T. Sarantou,[1] L. Hadzikadic-Gusic,[1] R. White.[1] *1. Levine Cancer Institute, Charlotte, NC; 2. Atrium Health, Charlotte, NC.*

Introduction: Pathologic response to neoadjuvant chemotherapy (NAC) is associated with overall survival (OS) as well as risk of relapse and has become a driver for future course of treatment. Residual cancer burden (RCB) index was created to inform prognosis post NAC and has been demonstrated to correlate with survival outcomes. We sought to determine the applicability in our patient cohort. Methods: This is a single institution retrospective review of patients from 2010 to 2016 who completed at least 75% NAC. RCB index was calculated and survival end points of relapse free survival (RFS), distant relapse free survival (DRFS) and OS were analyzed using Kaplan Meier (KM) and Cox Proportional Hazards methods. Results: 546 women were included in analysis. Median follow up was 61 months (50, 74). 61% were White, 35% African-American, 2% Asian and 2% other. 84% were over the age of 40. Median tumor size was 22mm. Phenotypic subtype distribution was 37% HR+/HER2-, 36% HER2+ and 27% TNBC. 52% had clinical N1 disease. The most common breast surgical procedure was lumpectomy, 57%. RCB distribution was RCB-0 23%, RCB-1 13%, RCB-2 41% and RCB-3 23%. RCB-0 was achieved in 35% TNBC, 30% HER2+ and 8% HR+/HER2-. RCB-3 was identified in 34% HR+/HER2-, 19% TNBC, and 14% HER2+. Within the TNBC subset, 44% White compared to 26% African-American patients achieved RCB-0 (p=0.18). Local recurrence was identified in 28 patients (5%). 92 patients (17%) had a distant recurrence. A new breast primary occurred in 10 patients (2%). Death occurred in 16% of patients. KM 5-year survival estimates were 84%, 78%, and 83% for OS, RFS, and DRFS, respectively. There is a statistically significant difference across RCB classes in OS, RFS, and DRFS (Figure). When compared within phenotypic subtype, OS was significantly different between RCB-0 and RCB-3 in HER2+ (p=<0.01) and TNBC (p<0.01). RFS and DRFS was significantly different between RCB-0 and RCB-2 or RCB-3 in HER2+ and TNBC. Conclusions: In this large single institution study, RCB was prognostic of OS, RFS and DRFS. RCB was not able to discriminate between groups in the HR+/HER2- population for which overall event rate was low.

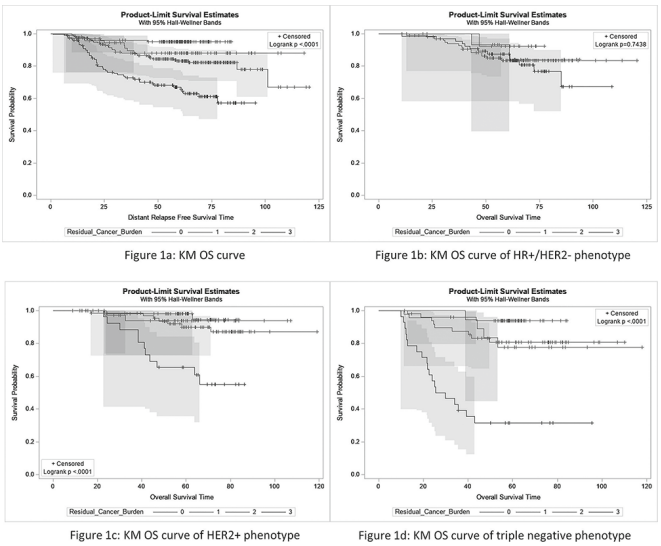


Figure 1a: KM OS curve

Figure 1b: KM OS curve of HR+/HER2- phenotype

Figure 1c: KM OS curve of HER2+ phenotype

Figure 1d: KM OS curve of triple negative phenotype

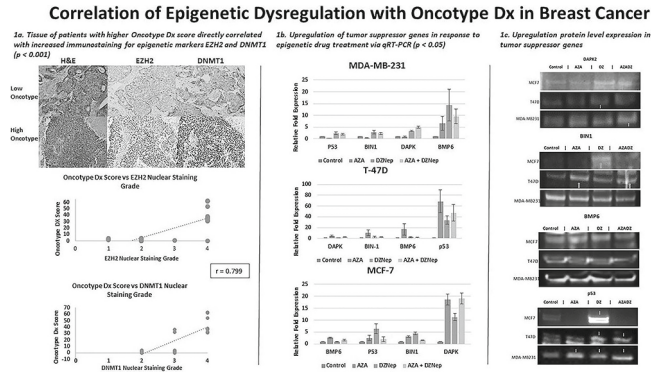
Figure 1: Kaplan-Meier Overall Survival Curves

P20

Epigenetic Dysregulation Correlates with Oncotype Dx Score: Novel Implication for Adjuvant Therapy in Breast Cancer

R. Platoff,[1]* J. Badach,[1] A. Lin,[1] C. Zhu,[1] Y. Li,[2] P. Zhang,[1] N.K. Acharya,[3] X. Zhang,[1] S. Li,[2] F. Spitz,[1] U. Atabek,[1] R.C. Martin,[2] Y. Hong.[1] *1. Surgery, Cooper University Hospital, Philadelphia, PA; 2. University of Louisville School of Medicine Department of Surgery, Louisville, KY; 3. Rowan School of Osteopathic Medicine, Stratford, NJ.*

Epigenetic dysregulation has proven to be an essential factor in breast cancer progression, with EZH2 and DNMT1 shown to methylate tumor-suppressor genes. We hypothesize that EZH2 and DNMT1 will correlate with breast cancer prognosis via Oncotype Dx score, a gene-based predictor of breast cancer recurrence response to chemotherapy. Tumor specimens were obtained from 38 breast cancer patients who had resection and Oncotype Dx testing from 2009-2013. Representative slides were stained for EZH2 and DNMT1 and evaluated for immunostaining intensity by a board-certified pathologist. Breast cancer cells MDAMB231, MCF7, and T47D were treated with EZH2 inhibitor 3-Deazaneplanocin A (DZNep) and DNMT1 inhibitor 5-aza-2'-deoxycytidine (5-AZA) at 5 uM for 72 hours and assessed for viability with Nucleocounter NC-200TM and for tumor suppressor gene expression via PCR and Western blot. Tumors with high Oncotype scores (n=18) had greater nuclear immunostaining than tumors with low Oncotype score (n=20) for both EZH2 (mean score 4 vs. 2.1, $p < 0.001$) and DNMT1 (3.8 vs. 2.4, $p < 0.001$) and Oncotype score was directly correlated with both markers ($p < 0.001$). Treatment of MDAMB231, MCF7 and T47D with 5-AZA and DZNep given alone or together reduced cell proliferation by 55.3% ($p < 0.001$), 34.9% ($p = 0.002$), and 62.5% ($p < 0.001$), respectively. In all cell lines, tumor suppressor genes p53, BIN1, and DAPK, were upregulated in response to epigenetic therapy ($p < 0.05$), and in MDAMB231 and MCF7, BMP6 was upregulated with epigenetic therapy ($p < 0.001$). Western blot demonstrated increased p53 and DAPK expression in all cells treated with epigenetic drugs and increased expression of BIN1 in MCF7 and T47D cells treated with epigenetic drugs. Epigenetic dysregulation appears to correlate directly with higher Oncotype Dx scores. Epigenetic therapy can modulate tumor suppressor gene expression previously silenced by epigenetic dysregulation to potentially mitigate the risk of breast cancer in high-risk patients. These clinically available therapies warrant consideration in the setting of a clinical trial to reduce recurrence in patients with early-stage breast cancer.



P21

Despite Equivalent Outcomes, Men Receive Neoadjuvant Chemotherapy Less Often than Women for Node-Positive Breast Cancer L. Cao,* J.J. Hue, M. Freyvogel, P. Li, L. Rock, A. Simpson, J. Dietz, R. Shenk, M.E. Miller. *University Hospitals Cleveland Medical Center, Cleveland, OH.*

Background: Neoadjuvant chemotherapy (NAC) downstages breast cancer and provides prognostic information. Based on prior studies demonstrating males with breast cancer receive less treatment and have poorer outcomes than females, we hypothesized that males would be less likely to receive NAC. Methods: Patients with a primary diagnosis of cN1-3 invasive breast cancer were identified in the National Cancer Database 2004-2016. Multivariable logistic regression determined the association of NAC and sex, and the relationship between sex and NAC response, controlling for demographic and tumor factors. Overall survival was analyzed using a multivariable Cox proportional hazards model. Results: 190,601 patients (188,696 females, 1,905 males) met inclusion criteria. Males were older at diagnosis than females (62 vs 55 years, $p<0.001$) and had greater co-morbidity (Charlson-Deyo score ≥1 23% vs 15%, $p<0.001$). A significantly greater proportion of males underwent mastectomy (80% vs 61%, $p<0.001$), and axillary lymph node dissection (ALND) (81% vs 78%, $p=0.004$). Overall fewer men received chemotherapy than women (72% vs 83%, $p<0.001$); men also received NAC at a significantly lower rate (26% men vs 45% women, $p<0.001$). After accounting for demographic and oncologic factors including hormone receptor (HR) subtype, females remained more likely to undergo NAC (OR 1.74, $p<0.001$). Among NAC patients, more men than women had HR+/HER2- tumors (62% vs. 42%, $p<0.001$). On multivariable analysis, sex was not associated with pathologic response. For HR+/HER2- patients, those with poorly differentiated tumors, lymphovascular invasion, and lower T-stage were more likely to achieve a pathologic complete response. For NAC patients, sex was not associated with overall survival. Conclusion: Sex was not associated with complete pathologic response or overall survival after NAC, yet males with node-positive breast cancer received less NAC and more aggressive surgery than females. These data suggest men can achieve outcomes comparable to women with cN1-3 disease and NAC should be used in appropriate male patients to downstage the breast and axilla.

P22

Effect of Return of Variants of Unknown Significance on Surgical Decision Making in Women with Invasive Breast Cancer A. Vargason, C. Turner, C. Shriver, R. Ellsworth.* *Murtha Cancer Center, Windber, PA.*

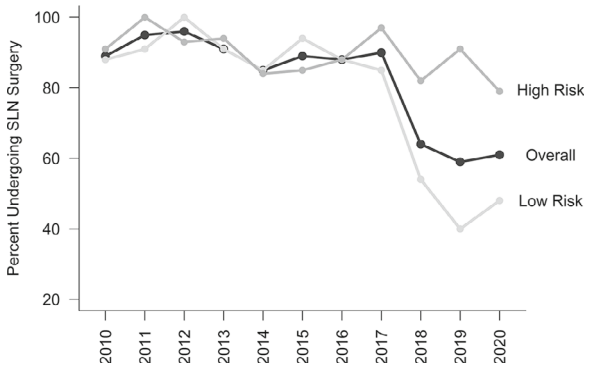
Background While clinical management should not be influenced by a return of a variant of uncertain significance (VUS), uncertainty may influence surgical decision making of women with invasive breast cancer. We thus evaluated whether surgical choices differed between women with pathogenic, VUS and benign genetic test results. Methods Germline test results and all surgical procedures were extracted for women who had clinical testing within one year of diagnosis (n=620). Results were classified as pathogenic/likely pathogenic (15.8%), VUS (18.4%) or benign/likely benign (65.8%). Data were analyzed using chi-square tests with $p<0.05$ defining significance. Results Women with mutations were significantly ($p<0.001$) more likely to undergo prophylactic removal of the unaffected breast (PRUB, 70.3%) and oophorectomy (16.7%) than women with VUS (29.9% and 2.9%) or benign variants (32.6% and 5.3%). PRUB was significantly higher ($p<0.001$) in women with mutations in BRCA1/2 (80.6%) compared to those with VUS (27.8%) or benign variants (32.6%). In women with mutations in 17 genes for which data has been deemed insufficient to recommend risk-reducing mastectomy, PRUB was higher in patients with mutations (63.6%) compared to those with VUS (28.6%) or benign variants (32.6%), however PRUB in this same group of women did not differ significantly ($p=0.443$) compared to those with BRCA mutations (80.6%). Oophorectomy was significantly higher ($p<0.001$) in both women with mutations (26.3%) and VUS (11.1%) in BRCA1/2 genes compared to those with benign variants (5.3%) but not between those with pathogenic mutations and VUS ($p=0.094$). Conclusion While overall surgical choices for women with a VUS were more similar to those from women without mutations, women with pathogenic mutations in 17 genes for which insufficient evidence exists for the benefit of risk-reducing mastectomy were significantly more likely to elect prophylactic removal of the unaffected breast. Thus, while the management of women with VUS is in agreement with ACMG guidelines, patients with mutations in other cancer genes demonstrate a preference for more aggressive breast surgeries.

P23

Recent Changes in Use of Sentinel Lymph Node Surgery in Women Over 70 Years Old with Hormone Receptor Positive Disease and Impact on Adjuvant Therapies J.E. Tonneson,* T. Hoskin, D.M. Durgan, J. Boughey. *General Surgery, Mayo Clinic, Rochester, MN.*

INTRODUCTION: Society of Surgical Oncology Choosing Wisely guidelines recommend against routine SLN surgery in women ≥70 years old with hormone receptor positive (HR+) cN0 breast cancer. We previously identified a subgroup of women at low risk of nodal positivity in whom SLN may be omitted (grade 1, cT1mi-T1c, or grade 2, cT1mi-T1b). This study evaluates the impact of these guidelines on our practice. METHODS: Retrospective chart review of all women ≥70 with HR+ cN0 invasive breast cancer treated at our institution from 2010 to 2020. We compared SLN use before (2010-2016) and after (2017-2020)

guideline release and looked at the clinical low-risk (LR) and high-risk (HR) patients to assess SLN use and impact on adjuvant therapy. RESULTS: 1016 breast cancers in 988 women were identified. Overall SLN surgery rate was 91% across 2010-2016, 90% in 2017 to 61% in 2020, p<0.001. This trend was driven by breast conserving surgery (BCS), with SLN rates of 88% in 2010-2016 and 45% in 2020, while >90% of mastectomy patients had SLN each year with no real change post-guidelines, p=0.68. In the 2017-2020 period, 62% were LR and 38% were HR. SLN use was 58% in LR and 88% in HR. SLN use in LR decreased from 85% in 2017 to 48% in 2020, p<0.001, while rates in HR did not change significantly from 2017 to 2020, range 97% to 79%, p=0.11. Nodal positivity rate was 14.2% overall: 7.2% in LR and 21.7% in HR, p=0.001. Of the LR electing BCS&SLN, 63% received XRT and 62% received HT compared to 42% and 46%, respectively in low-risk BCS, noSLN patients, p=0.004, p=0.03. 68% of HR with BCS&SLN received XRT and 74% received HT compared to 53% and 73%, respectively in high-risk BCS, noSLN patients, p=0.28, p=0.94. CONCLUSIONS: Guideline implementation resulted in a significant decreased use of SLN in women ≥70 years old with HR+ disease at our institution driven by BCS and clinically low-risk patients. SLN surgery is still often utilized in mastectomy patients and in clinically high-risk patients who have higher rates of SLN positivity. Low-risk patients electing BCS&SLN received adjuvant therapy more often than those without SLN surgery.



Use of SLN Surgery Over Time in Women ≥70 with HR+ cN0 Invasive Breast Cancer

P24

Is Sentinel Lymph Node Biopsy Reliable After Oncoplastic Breast Reduction? T.A. Martin,* S. Chaudry, L.H. Holton, C. Mylander, T.J. Sanders, L. Tafra, R.S. Jackson. *Breast Surgery, Anne Arundel Medical Center, Crownsville, MD.*

Background: Oncoplastic breast reduction/mastopexy is increasingly offered to select patients who desire breast conserving therapy. This method optimizes the oncologic benefits via the ability to remove a larger specimen, while offering the benefit of improved cosmetic result and relief of symptoms of macromastia. However, the tissue excision and rearrangement may disrupt the lymphatic drainage patterns and make subsequent identification of the sentinel lymph nodes (SLN) unreliable. There is little data on the success rate of sentinel lymph node biopsy (SLNB) after recent oncoplastic reduction, and there is no agreement on whether SLNB should be done at the time of the partial mastectomy and reduction for ductal carcinoma in situ (DCIS). Methods: This is a single institution, retrospective review of surgical re-intervention for SLNB after oncoplastic, Wise-pattern breast reduction/mastopexy from 2013-2020. The primary and secondary endpoints were the frequency of SLN identification and breast cancer recurrence. Results: Seven patients had a re-operation for SLNB for unexpected invasive cancer in the index or contralateral breast. The average patient age was 58±10 and the average BMI was 38±9. There was an average of 39±14 days between the oncoplastic reduction and the SLNB. The average weight of tissue removed from the breast was 529±271 grams. All patients were injected with Tc-99 and methylene blue prior to the operation in the upper outer periareolar area. At least one blue and/or radioactive SLN was identified in all patients and none of the nodes had nodal metastasis. There were no recurrences in this patient population, with a median follow up of 24 months. Conclusions: In our experience, SLNB after oncoplastic reduction/mastopexy with a bilateral Wise-pattern is feasible. At least one SLN was found in all patients, and there were no recurrences. We have adopted a standard practice of not removing SLN for DCIS at the time of oncoplastic reduction unless otherwise indicated based on a strong suspicion for invasive disease. To our knowledge, this is the largest reported series of SLNB after oncoplastic Wise-pattern reduction/mastopexy.

Is Sentinel Lymph Node Biopsy Reliable after Oncoplastic Breast Reduction?

	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5	Patient 6	Patient 7	Average ± Standard Deviation
Age	50s	60s	60s	40s	60s	40s	60s	58±10
Pre-reduction Bra Size		46DD	46DD	36B	42DD	38C	44DD	
Body Mass Index	27	48	48	30	36	42	33	38±9
Area of Calcifications on Imaging (cm)	1.5	2.0	Not seen (incidentally found in contralateral reduction specimen)	2.0	Not seen (Incidentally found in contralateral reduction specimen)	2.9	0.6	1.8±0.8
Tumor Description on Imaging	Multifocal calcifications	Multifocal calcifications	Not seen	Multifocal calcifications	Not seen	Mass	Mass	
Anatomic Location of Disease	UIQ	UOQ	UOQ reduction specimen	UOQ	Superior reduction specimen	Subareolar	UIQ	
Tumor Type on Final Pathology	DCIS, IDC	DCIS, IDC, ILC	DCIS, IDC	DCIS, IDC	DCIS, IDC	DCIS, IDC	DCIS, IDC	
Receptor Status (ER/PR/Her2)	-/-/-	73/34/-	100/96/-	-/-/+	99/96/-	100/92/-	100/10/-	
Ipsilateral Weight of Partial Mastectomy and Reduction (g)	717	720	665	75	817	365	345	529±271
Days from Reduction to SLNB	8	46	46	44	44	47	35	39±14
Number of Sentinel Nodes and Positivity	0/1	0/1	0/1	0/1	0/1	0/3	0/1	1.3±0.8
Recurrence	No	No	No	No	No	No	No	
Months of Follow Up	92	24	24	39	22	7	9	31±29

P25

Beyond BRCA: Oncologic Safety of Nipple-Sparing Mastectomy for Other Risk Gene Mutation Carriers A. Henriquez, M.E. Garstka,* B.R. Kelly, A. Webster, J. Khubchandani, S. Coopey, M. Gadd, K. Hughes, A. Nguyen, T. Oseni, M. Specht, B.L. Smith. *Massachusetts General Hospital, Boston, MA.*

Background: Nipple-sparing mastectomy (NSM) is increasingly offered for treatment and prevention of breast cancer. Widespread use of multigene panel testing for breast cancer patients and their relatives now identifies a wide variety of risk gene mutations. Current data supports NSM for patients with BRCA1 and BRCA2 mutations, but little is known about NSM for other risk gene mutations. Methods: Patients with risk gene mutations other than BRCA1 and BRCA2 undergoing NSM from 2/2009-12/2019 were identified in a prospective database of consecutive NSM. Patient, tumor, treatment and outcomes data were collected. Group 1 patients had mutations included in most breast cancer risk gene panels (ATM, BARD1, CDH1, CHEK2, P53, PALB2, PTEN) and Group 2 had mutations with low/no definite impact on breast cancer risk (APC, BRIP, MET, MSH2, MSH6, MTRHF, MUTYH, NBN, NF1, PIK3CA, RAD50, RAD51). Patients with only variants of unknown significance (VUS) were excluded. Results: Overall, 87 mutation carriers had 160 NSM. In Group 1, 62 patients had 45 NSM for known cancer and 66 planned prophylactic NSM, 4 of which contained unexpected cancer. Mean age was 45 years (22-65). These 49 cancers included 16 (33%) stage 0, 13 (26%) stage I, 17 (35%) stage II and 3 (6%) stage III tumors. At 31 months median follow-up, Group 1 recurrences included 2 (4%) distant and locoregional, 2 (4%) distant only, 2 (4%) locoregional only, but no nipple-areola complex (NAC) recurrences. Overall survival was 95%. In Group 2, 25 patients underwent 24 NSM for known cancer and 21 prophylactic NSM, with no unexpected cancers found in prophylactic NSM. Mean age was 52.4 years (27-73). There were 7 (29%) stage 0, 12 (50%) stage I, 4 (17%) stage II and 1 (4%) stage III tumors. At 26.5 months median follow-up, Group 2 recurrences included 3 (12.5%) distant only, 3 (12.5%) locoregional only, but no NAC recurrences. Overall survival was 96%. Conclusions: Early rates of distant, nipple and other

locoregional recurrence are low after NSM in carriers of risk genes other than BRCA1 and BRCA2. Incidental cancers were seen only in carriers of genes known to be associated with breast cancer risk.

Patient Factors	Group 1 (N=62) ATM, BARD1, CDH1, CHEK2, P53, PALB2, PTEN	Group 2 (N=25) APC, BRIP, MET, MSH2, MSH6, MTRHF, MUTYH, NBN, NF1, PIK3CA, RAD50, RAD51	All Risk Gene Carriers (N= 87)
Age [years, mean (range)]	45 years (22-65)	52.4 years (27-73)	47.1 (22-73)
Race: Caucasian	54 (87%)	23 (92%)	77 (89%)
Asian	1 (2%)	0	1 (1%)
Black	2 (3%)	1 (4%)	3 (3%)
Not Reported/Other	5 (8%)	1 (4%)	6 (7%)
Tumor Factors and Outcomes	**Group 1 Cancer Breasts (N=49)**	**Group 2 Cancer Breasts (N=24)**	**All Cancer Breasts (N = 73)**
Tumor Histology			
DCIS +/- microinvasion	18 (37%)	8 (33%)	26 (36%)
IDC	24 (49%)	10 (41%)	34 (46%)
ILC	7 (14%)	3 (13%)	10 (14%)
Invasive Other	0	3 (13%)	3 (4%)
Positive Nipple Margins	4 (8%)	0	4 (5%)
ER positive	39 (80%)	22 (92%)	61 (84%)
PR positive	37 (76%)	16 (67%)	53 (73%)
HER2 (invasive): Positive	9 (29%)	2 (8%)	11 (24%)
Negative	21 (68%)	14 (82%)	35 (74%)
Stage 0	16 (33%)	7 (29%)	23 (32%)
I	13 (26%)	12(50%)	25 (34%)
2	17 (35%)	4 (17%)	21 (29%)
3	3 (6%)	1 (4%)	4 (5%)
Cancer Patient Treatments	N = 45 Cancer Patients	N = 24 Cancer Patients	N = 69 Cancer Patients
Any chemotherapy	21 (47%)	7 (29%)	28 (41%)
Adjuvant endocrine therapy	26 (58%)	16 (67%)	42 (61%)
Any systemic therapy	33 (73%)	17 (71%)	50 (72%)
Post mastectomy radiation	9 (20%)	4 (17%)	13 (19%)
Total Recurrences	6 (12%)	6 (25%)	12 (17%)
Distant and locoregional	2 (4%)	0	2 (3%)
Distant only	2 (4%)	3 (12.5%)	5 (7%)
Locoregional only	2 (4%)	3 (12.5%)	5 (7%)

Demographics, tumor factors and outcomes after NSM in risk gene mutation carriers other than BRCA1 or BRCA2

P26

Outcomes of Contemporary Treatment of Occult Primary Breast Cancer D.M. Durgan,* T. Hoskin, J.E. Tonneson, C. Day, T.J. Hieken. *Breast Surgery, Mayo Clinic, Rochester, MN.*

Introduction: Guidelines suggest treatment of occult primary breast cancer (OBC) presenting with axillary metastatic disease are modified radical mastectomy (MRM) or axillary dissection (ALND) and adjuvant whole breast and nodal radiation (XRT). Yet data supporting these recommendations is retrospective, based on custom and consensus as no randomized clinical trial exists. Advances in both systemic therapies and imaging have changed clinical practice for clinically node-positive (cN+) patients with a known breast primary, suggesting opportunities to update management of OBC. Thus we evaluated current practice and outcomes to assess whether efforts to de-escalate treatment may be warranted. Methods: With IRB approval we identified cT0cN+ breast cancer patients 9/2008-8/2020 from our prospective registry operated on at our institution. Those with recurrent or stage IV disease were excluded. Descriptive statistical analyses were performed. Results: Among 1210 cN+ patients, 23 met our inclusion criteria (1.9%). Median patient age was 58; Stage was cN1 in 13 (57%), cN2 in 6 (26%), cN3 in 4 (17%) and most (65%) had >1 suspicious LN on imaging. The majority (19/23, 83%) had mammography, US, MRI and PET/CT for evaluation. Tumors were ER+ in 57%: 48% (11) HR+/HER2-, 13% (3) HR+/HER2+, 4% (1) HR-/HER2+, 35% (8) HR-/HER2-. 16 patients received NAC. 11/16 (69%) had a pCR (Table 1). 5 underwent MRM, 16 ALND and 2 SLNB. 8 received adjuvant chemotherapy (35%), 3 after NAC, and 11/14 HR+ (79%) adjuvant endocrine therapy, 21 received XRT. At 35 months median follow-up, there were no locoregional recurrences while 2 patients died of distant metastatic disease, both following XRT. Conclusions: We show excellent nodal pCR rates to NAC and locoregional control with omission of breast surgery in patients with axillary metastases from OBC evaluated with current multimodality breast imaging. The lack of locoregional recurrences observed suggest a prospective trial to evaluate the oncologic safety of further treatment de-escalation such as targeted axillary surgery and selective omission of adjuvant XRT, based on response to NAC, as in patients with known primary breast tumors, would be valuable.

pCR by Subtype Among Patients Receiving Neoadjuvant Chemotherapy

SubType	ypN0	Total	pCR
HER2+	3	3	100%
HR-/HER2-	5	8	63%
HR+/HER2-	3	5	60%
Total	11	16	69%

P27

Hospital-Based Same-Day Compared to Overnight Stay Mastectomy: A Combined ACS-NSQIP and Institutional Analysis U.S. Sibia,* J.R. Klune, L.H. Holton, R.S. Jackson, A.I. Riker. *Surgery, Anne Arundel Medical Center, Annapolis, MD.*

Introduction Increased use of Enhanced Recovery After Surgery (ERAS) for mastectomy, either unilateral or bilateral, have focused on earlier discharge. This has led to increased use of same-day mastectomy (SDM). However, whether SDM might lead to increased readmissions or reoperations is not well documented. This study utilizes both national and institutional data to compare outcomes and costs of these strategies. Methods The American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database was queried for all patients that underwent a mastectomy from 2016-2018 using Current Procedural Terminology (CPT) codes 19303 (simple) and 19304 (subcutaneous). Patients with >1-day length of stay (LOS) were excluded. Patients were categorized into LOS groups (SDM vs. 1-day). Our institutional cost accounting for mastectomy was used to quantify the total cost of care. Results A total of 6,700 cases (1,290 SDM vs. 5,410 1-day LOS) were identified. Patients in the SDM group were more often male (22.2% vs 2.0%, $p<0.01$) and active smokers (14.0% vs 10.4%, $p<0.01$), but less likely to have hypertension (33.3% vs 37.8%, $p<0.01$). Post-operative medical complications (pneumonia, urinary tract infection, pulmonary embolism, myocardial infarction, stroke) were comparable between groups. Patients in the SDM cohort had fewer superficial (1.2% vs. 2.0%, $p=0.04$) surgical site infections (SSI). Deep SSI, organ space SSI, wound disruption, and post-operative bleeding complications were comparable between groups. Patients in the 1-day cohort were more likely to return to the operating room (2.2% vs. 3.7%, $p<0.01$) or to be re-admitted (1.6% vs. 2.9%, $p<0.01$) within 30 days. Institutional accounting data revealed hospital costs for SDM were $3924 less compared to 1-day LOS cases. Conclusion This study demonstrates that SDM is a safe procedure, with no increase in the risk for serious post-operative complications. There is substantial cost savings per patient associated with SDM. Further studies are warranted to identify whether there are specific groups of patients that may not be optimal candidates for the SDM strategy.

P28

Radiation Therapy After Mastectomy in Patients with Nodal Metastasis: Outcomes and Compliance with Quality Metrics A. Marumoto,* J. Tseng, S.A. Angarita, A. Chung, S.C. Mohan, A.E. Giuliano, F. Amersi. *Cedars Sinai, Los Angeles, CA.*

Introduction: The Commission on Cancer recommends post-mastectomy radiation therapy (RT) within one year of diagnosis as a quality metric in breast cancer patients with ≥4 positive regional nodes (MASTRT). There is limited data evaluating the rates of compliance with MASTRT and the outcomes of those who receive RT. Methods: The National Cancer Database was queried from 2004-2014 to identify patients who met criteria for MASTRT. Clinicopathologic characteristics were evaluated. Patients were compared by age group (<50, 50-59, 60-69, 70-79, 80+). Logistic regression was used to determine factors associated with MASTRT compliance. Results: 51,749 patients were identified who met criteria for MASTRT (Table). Compliance rates increased in each age cohort over the ten year time period: ages <50: 76% to 89.8%, 50-59: 75.7% to 89.3%, 60-69: 71.5% to 89.7%, 70-79: 67.6% to 86.6%, 80+: 54.8% to 86.8%. Factors associated with lower odds of compliance include Black race (OR 0.90, 95%CI 0.82-0.98), age 70-79 (OR 0.87, 95%CI 0.77-0.97), Charlson-Deyo Score 2-3 (OR 0.78, 95%CI 0.67-0.91), and traveling >50 miles for treatment (OR 0.65, 95%CI 0.58-0.73). Factors associated with higher odds of compliance include private insurance (OR 1.28, 95%CI 1.10-1.49), higher education (OR 1.72, 95%CI 1.54-1.92), and care at an academic center or integrated network cancer program (OR 1.12, 95% CI 1.02-1.24; OR 1.33, 95%CI 1.18-1.51). Cox regression demonstrated that Asian race, private insurance, treatment at an academic program, receipt of

chemotherapy, and compliance with MASTRT were associated with a survival benefit. Subgroup analysis by age demonstrated a survival advantage with MASTRT compliance only for patients ages 70-79 (HR 0.87, 95%CI 0.76-0.995) and 80+ (HR 0.72, 95%CI 0.61-0.85). Conclusions: Compliance with MASTRT recommendations and outcomes vary by age. Patients ≥ 70 have improved survival when MASTRT recommendations are met. Age should not deter clinicians from complying with MASTRT.

Patient Characteristics

Age (years)		<50	50-59	60-69	70-79	80+
Total (%)		17,142 (33.2%)	14,246 (27.6%)	11,421 (22.1%)	6,420 (12.1%)	2,520 (4.9%)
Race	White	80.4%	82.6%	84.7%	86.4%	88.8%
	Black	13.1%	12.3%	11.3%	10.2%	9%
	Asian	4.9%	3.8%	3.1%	2.5%	1.8%
	Other	1.6%	1.3%	0.9%	0.9%	0.4%
ER	Pos	82.8%	82%	83.4%	83.1%	84.2%
	Neg	17.2%	18%	16.6%	16.9%	15.8%
HER2	Pos	22.3%	20.2%	16.4%	16.2%	16.1%
	Neg	77.7%	79.8%	83.6%	83.8%	83.9%
T stage	1	21.3%	20%	19.1%	18.1%	13.3%
	2	49.3%	49.9%	50.7%	52.2%	50.4%
	3	24.3%	24.1%	22.4%	20.4%	20.6%
	4	5.1%	6%	7.8%	9.3%	15.6%
N stage	2	70.9%	67.1%	65.7%	67.7%	67.7%
	3	29.1%	32.9%	34.3%	32.3%	32.3%
MASTRT	Yes	83.7%	83.6%	82.2%	77.9%	71.8%
	No	16.3%	16.4%	17.8%	22.1%	28.2%

P29

CD133 Expression in ER-positive/HER2-negative Breast Cancer is Prognostic for Survival J. Huang,* M. Oshi, K. Takabe. *Surgical Oncology, Roswell Park, Buffalo, NY.*

Background: Understanding the role of cancer stem cells (CSC) in breast cancer (BC) may provide an avenue for prognosis. CD133, a CSC surface marker, is associated with aggressive phenotypes in triple-negative and HER2-positive BC. However, its role may differ in ER-positive/HER2-negative (ER+/HER2-) BC that has a different biology. Here, we hypothesize that high-CD133 tumors proliferate less and is associated with improved survival in ER+/HER2- BC. Methods: Clinicopathologic variables and gene expression data were obtained from 1065 female BC patients of The Cancer Genome Atlas (TCGA) and 1904 patients of the METABRIC BC cohorts. Gene expression data from the GSE25066 cohort represented patients who received neoadjuvant chemotherapy (NAC). Gene set enrichment analysis was performed. Survival comparisons were determined with Kaplan-Meier curves. The xCell tool assessed for cell types in the tumor microenvironment. Results: ER+/HER2- tumors with high CD133 expression are enriched for stemness genes sets and correspond to higher levels of ALDH and DLL1. However, low-CD133 tumors enrich for proliferation gene sets, and correspondingly have higher Ki-67 index and proliferation (both $p < 0.001$.) Although there is no increase in mutation rate or neoantigens, high-CD133 tumors enrich for immune pathway gene sets. Supporting an antitumor microenvironment, high-CD133 tumors demonstrate higher infiltration of dendritic cells, lower infiltration of M2 macrophages, and higher TGF-beta response (all $p < 0.001$). Additionally, patients in TCGA with high-CD133 tumors have better progression free survival, disease free survival, and overall survival (OS) ($p = 0.01$, 0.01, and 0.05, respectively), compared to patients with low-CD133 tumors. Patients in the METABRIC cohort with high-CD133 tumors have better disease specific survival ($p=0.004$) and OS ($p = 0.004$ and $p < 0.001$). We also find that patients with high-CD133 tumors tend to have a complete pathologic response to NAC ($p = 0.03$). Conclusions: Altogether, these results suggest that high-CD133 ER+/HER2- tumors are more associated with immune response and decrease proliferation, which may be consistent with a better prognosis and response to NAC.

P30

Is Dermal Lymphatic Invasion Worse than Lymphovascular Invasion for Breast Cancer Patients? S. Melnikau,[1]* T. Ozmen,[1] C. Layton,[3] C. Gomez-Fernandez,[2] E. Avisar.[1] *1. University of Miami, Miller School of Medicine, Deparment of Surgery, Division of Surgical Oncology, Miami, FL; 2. University of Miami, Miller School of Medicine, Department of Pathology, Miami, FL; 3. Florida Atlantic University, Charles E. Schmidt College of Medicine, Department of Surgery, Boca Raton, FL.*

Objective: To assess influence of dermal lymphatic invasion (DLI) on oncologic outcomes of breast cancer with existing LVI in the breast tissue. Background: Lymphovascular invasion (LVI) is a negative prognostic factor of breast cancer associated with more aggressive clinical behavior. Dermal lymphatic invasion (DLI) could be associated with clinical inflammatory breast cancer or an incidental finding. Although DLI and LVI have a similar nature, DLI seems to carry a worse prognosis. The significance of DLI in addition to LVI was not studied before. Methods: A retrospective analysis of all the patients with reported LVI in breast tissue between October 2014 and August 2020 was performed. Presence of DLI was recorded separately. Surgical and pathologic outcomes as well as survival and recurrence data were recorded. The effect of DLI on those parameters was then analyzed. Results: A total of 163 patients with LVI were included in the analysis. 20 patients (12.3%) had additional DLI. Median follow-up after surgery was 26 (1-69) months. When compared to LVI alone, patients with DLI had higher rates of clinical node positivity (80% vs 50%, OR 4 [1.2-12.6], $p=0.012$) and positive skin margins on frozen section (33% vs 0%, $p=0.047$). In addition, DLI was associated with significantly higher rates of mortality (25% vs 10%, $p=0.047$), distant recurrence (50% vs 14%, $p<0.001$) and locoregional recurrence (65% vs 12%, $p<0.001$). Negative skin margins on frozen sections were highly predictive (93.8%) of margins status on final pathology (Table 1). Conclusions: For breast cancer with LVI, DLI is a significant worse prognostic factor associated with significant higher rates of locoregional and distant recurrence as well as a marked decreased survival. Negative skin margins by frozen section accurately predict the final margin status.

Table 1. The effect of dermal lymphovascular invasion (LVI) on oncologic outcomes

		Vital		P
		Dead	Alive	
Dermal LVI*	No	14 (10)	129 (90)	0.047
	Yes	5 (25)	15 (75)	
		Distant Recurrence		P
		No	Yes	
Dermal LVI*	No	117 (86)	19 (14)	< 0.001
	Yes	10 (50)	10 (50)	
		Locoregional recurrence		P
		No	Yes	
Dermal LVI*	No	120 (88)	16 (12)	<0.001
	Yes	7 (35)	13 (65)	
		Re-excision		P
		No	Yes	
Dermal LVI*	No	139 (97)	4 (3)	0.1
	Yes	18 (90)	2 (10)	
		Clinical Node Positivity		P
		Negative	Positive	
Dermal LVI*	No	70 (50)	70 (50)	0.012
	Yes	4 (20)	16 (80)	OR 4 [1.2-12.6]
		Frozen section (Margins)		P
		Negative	Positive	
Dermal LVI*	No	10 (100)	0	0.047
	Yes	6 (67)	3 (33)	
		Permanent Pathology (Margins)		P
		Negative	Positive	
Dermal LVI*	No	136 (95)	7 (5)	0.078
	Yes	17 (85)	3 (15)	

*LVI - lymphovascular invasion

P31

Malignant Phyllodes Tumor and Primary Breast Sarcoma: Distinct Rare Tumors of the Breast L.A. Gutnik,* Y. Ren, S. Thomas, J.K. Plichta, R. Greenup, O.M. Fayanju, S. Hwang, L.H. Rosenberger. *Duke University, Durham, NC.*

INTRODUCTION Malignant phyllodes (MP) and primary breast sarcomas (PBS) are rare neoplasms with overlapping histopathologic features. We aimed to compare the overall survival (OS) between MP and PBS, and the impact of surgery and adjuvant therapies on OS for these tumors. METHODS Using the National Cancer Database (2004-2016), we identified patients with surgical pathology of MP and PBS. Patients who did not receive surgery, had unknown surgical margins, or Stage IV disease were excluded. Kaplan Meier curves and Cox proportional hazards models were used to estimate unadjusted and adjusted OS for each neoplasm. RESULTS 5394 patients were identified: 3209 (59.5%) MP and 2185 (40.5%) PBS. The median age for MP was 52 vs 65 for PBS (p<0.001). Despite a larger median tumor size in MP (4.6 cm vs 4.0 cm PBS, p<0.001), lumpectomy rate was higher for MP (52.9% vs 27.0% PBS, p<0.001). Positive margins were similar (MP 6.4%, PBS 7.6%, p=0.23). Compared to MP, PBS patients received more radiation (30% vs 26%, p<0.001), chemotherapy (33% vs 9%, p<0.001), and endocrine therapy (3.6% vs 1.9%, p<0.001). Unadjusted 5-year OS was lower for PBS (57% vs 85% MP, p<0.001) (Figure 1). PBS had persistently worse survival (HR 1.98, 95%CI 1.69 - 2.31) after adjusting for age, tumor size, margins, surgery type, adjuvant therapy, and other factors. Receipt of adjuvant therapies had no statistically significant association with OS for either neoplasm; however, lumpectomy was associated with improved OS (vs mastectomy) for both PBS (HR 0.59, 95%CI 0.50-0.75) and MP (HR 0.65, 95%CI 0.53-0.81). Positive margins had no association with OS for MP (HR 1.09, 95% CI 0.75 - 1.60), but was associated with worse survival for PBS (HR 2.35 95%CI 1.82 - 3.02). CONCLUSIONS We found significant survival differences between MP and PBS, with PBS having worse OS. Our findings support surgery as the mainstay of treatment and suggest that lumpectomy may be a reasonable option for select patients without compromising outcomes.

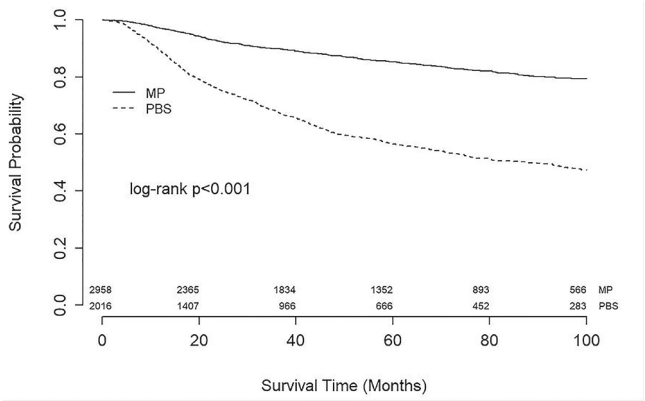


Figure 1: Unadjusted Overall Survival for Patients with Malignant Phyllodes (MP) and Primary Breast Sarcoma (PBS)

P32

Tubular Carcinoma of the Breast: Patterns of Incidence, Axillary Lymph Node Metastasis and Survival A. Saridakis,* E. Berger, E. Reisenbichler, T. Park, J. Le Blanc, G. Zanieski, N. Horowitz, A. Chagpar, M. Golshan, D. Lannin. *Surgery, Surgical Oncology, Yale University, New Haven, CT.*

INTRODUCTION Invasive tubular carcinoma (ITC) is an uncommon but very favorable type of breast cancer. We sought to characterize temporal trends in demographics, biology, and survival of this disease to evaluate the possible impact on surgical treatment. METHODS The Surveillance, Epidemiology, and End Results (SEER) database was used to evaluate the incidence and annual percent change (APC) of ITC (ICD-O-3 code 8211/3). Cases diagnosed from 2004-2017 were used to characterize clinicopathologic features and lymph node (LN) positivity rate. Breast cancer specific survival (BCSS) was determined by the life-table method. RESULTS Using SEER9, the age adjusted incidence of ITC increased steadily from 0.2 cases per 100,000 population in 1975, to 1.4 cases/100,000 in 1999 (APC 6.9, 95%CI 5.8 to 8.0) and thereafter decreased steadily to 0.3 cases/100,000 in 2017 (APC -9.8, 95%CI -11.2 to -8.3). Using SEER18, 6033 ITC cases were identified from 2004-2017. These made up 0.8% of all breast cancers in white women, but only 0.3% of breast cancers in black or Asian women (p<0.001). The most common age group was 40 to 70 where they made up 0.8% of all breast cancers, compared to 0.2% for under 40 and 0.6% for over 70 (p<0.001). ITCs were small, grade 1, ER/PR positive, almost exclusively luminal A molecular type, and only 6.1% had positive axillary nodes, Table 1. Of tumors 1 cm or smaller that were grade 1 and ER/PR positive, only 90/2580 (3.5%) had positive nodes. Of these, 38/90 (42%) had only micrometastases and 72/90 (80%) had only a single positive LN. In the group of 90 LN positive patients, there was only one breast cancer death, for a 10-year BCSS of 98%; BCSS was 98% for both LN positive and LN negativeT1 tumors respectively. CONCLUSIONS The increased incidence of ITC from 1975 to 1999 is possibly due to the increasing use of mammography during that period, while the decrease after 1999 may be due to refining the diagnostic criteria for ITC. Among grade one, ER/PR positive tumors, T1b or smaller, only 3.5% were LN positive yet survival was not affected by the LN positivity. Therefore, it may be reasonable to omit sentinel node biopsy in these patients.

Characteristics of Tubular Breast Cancers

	Tubular	Non-tubular	P value
Tumor size (cm)			P < 0.001
0.1-1.0	4231/5891 (71.8%)	206,914/795,595 (26%)	
1.1-2.0	1403/5891 (23.8%)	275,265/795,595 (34.6%)	
2.1-3.0	163/5891 (2.8%)	152,191/795,595 (19.1%)	
3.1-4.0	31/5891 (0.5%)	65,192/795,595 (8.2%)	
4.1-5.0	25/5891 (0.4%)	34,651/797,595 (4.4%)	
> 5.0	38/5891 (0.6%)	61,382/797,595 (7.7%)	
Grade			P < 0.001
1	5193/5592 (92.9%)	171,353/779,887 (22.0%)	
2	349/5592 (6.2%)	344,538/779,887 (44.2%)	
3	50/5592 (0.9%)	263,996/779,887 (33.9%)	
ER status			P < 0.001
Pos	5556/5621 (98.8%)	650,476/798,403 (81.5%)	
Neg	65/5621 (1.2%)	147,927/798,403 (18.5%)	
PR status			P < 0.001
Pos	4759/5507 (86.4%)	556,674/792,010 (70.3%)	
Neg	748/5507 (13.6%)	235,336/792,010 (29.7%)	
Molecular type (2010-2017)			P < 0.001
HR+, Her 2-	2411/2456 (98.2%)	345,383/470,112 (73.5%)	
HR-, Her 2+	1/2456 (0.0%)	21,396/470,112 (4.6%)	
Triple positive	40/2456 (1.6%)	50,757/470,112 (10.8%)	
Triple negative	4/2456 (0.2%)	52,576/470,112 (11.2%)	
Lymph node status			P < 0.001
Positive	316/5219 (6.1%)	235,703/717,650 (32.8%)	
Negative	4903/5219 (93,9%)	481,947/717,650 (62.2%)	

P33

MYC Targets Score is Associated with Cancer Aggressiveness and with Poor Survival in ER-Positive Primary and Metastatic Breast Cancer A.K. Schulze,[1]* M. Oshi,[2] I. Endo,[3] K. Takabe.[2] *1. Department of Surgery, University at Buffalo, Buffalo, NY; 2. Roswell Park Comprehensive Cancer Center, Buffalo, NY; 3. Yokohama City University Graduate School of Medicine, Yokohama, Japan.*

Introduction: MYC is one of the most studied oncogenes that is known to promote cell proliferation. We utilized Gene Set Variation Analysis of Molecular Signatures Database Hallmark gene set "MYC targets v1" as a score to quantify the overall expression of MYC target genes. We hypothesized that our MYC targets score correlates with tumor aggressiveness and survival outcomes in breast cancer. Methods: This is a retrospective study and we examined a total of 3109 breast cancer patients from TCGA, METABRIC, and GSE124647 cohorts. In each cohort, the patients were divided into high and low score groups using the upper third value as the cutoff and studied the correlation with cell proliferation, clinical and pathologic features, survival differences, immune cell infiltration and survival in metastatic breast cancer. Results: As expected, higher scores were related to increased cell proliferation as well as higher stage, pathological grade, and worse subtype. We found higher MYC scores were associated with worse survival, but only in ER-positive/HER2-negative tumors, as there was no survival difference in TNBC or HER2-positive tumors. Specifically looking at ER-positive tumors, we found there was a higher level of mutations associated with high MYC scores. We then examined the tumor immune microenvironment and found

there was significant infiltration of both favorable and unfavorable immune cells in higher MYC score tumors as well as correlation of higher T helper cells. There was a significant correlation between high MYC scores and worse progression-free survival in metastatic breast cancer. Conclusion: Our findings show the MYC targets score is associated with tumor aggressiveness and poor prognosis in ER-positive primary tumors, as well as in metastatic breast cancer. This supports further investigation into the MYC score and its association with treatment response in order to further utilize this score in patient treatment.

P34

Effect of Neoadjuvant Chemotherapy on Complications After DIEP Flap Reconstruction B.T. Saito,* C.P. Johnson, L.M. Sizer, C.D. Carruthers, E.P. Lamb, T.G. Frazier. *Breast Surgery, Bryn Mawr Hospital, Wayne, PA.*

Introduction: Free flap reconstruction after mastectomy using deep inferior epigastric perforators (DIEP) offers excellent cosmetic outcomes. Historically, the rate of complications has been 30-46%. The purpose of this study was to examine the effect of neoadjuvant chemotherapy (NACT) on complications after DIEP reconstruction. Methods: DIEP patients from January 2016 to March 2020 were retrospectively reviewed. Patients who received NACT were compared with patients who did not receive NACT. Clinical factors including age, body mass index (BMI), smoking status, history of radiation, and medical comorbidities were also reviewed. Rates of minor and significant complications, and rates of blood transfusion were analyzed. Results: A total of 342 flaps were reviewed from 200 patients. 46 patients (23%) received NACT. There was no difference in minor or significant complications between the two groups. NACT patients were more likely to require blood transfusions (39.1% vs 13.6%, P < .001). The mean preoperative hemoglobin was 11.8 in the NACT group compared with 13.0 in those who did not receive NACT (P < .001). Of the patients who required blood transfusion, 41% had an additional complication. Other clinical factors associated with increased complications included BMI >30, history of smoking, diabetes mellitus, and hypertension. Conclusion: Neoadjuvant chemotherapy did not statistically affect complication rates, but it did increase the incidence of blood transfusions following DIEP flap reconstruction. When counseling breast cancer patients who require NACT and are candidates for DIEP flap reconstruction, NACT should be addressed as a risk factor. Optimization of preoperative hemoglobin should be considered to minimize postoperative transfusions and additional complications.

Effect of Neoadjuvant Chemotherapy on Complication Rate and Severity

	No Neoadjuvant Chemotherapy (n=154)	Neoadjuvant Chemotherapy (n=46)	Odds Ratio	CI (95%)	P value
Minor Complications: Wound/fat necrosis Infection Seroma/hematoma Hernia	42 (27.9%) 34 (22.7%) 4 (2.6%) 4 (2.6%) 0	9 (19.6%) 4 (8.7%) 1 (2.2%) 3 (6.5%) 1 (2.2%)	0.49	[0.19-1.16]	.124
Significant Complications: Reoperation Flap loss	12 (7.8%) 9 (5.8%) 3 (1.9%)	2 (4.3%) 0 2 (4.3%)	0.20	[0.02-0.89]	.060
Transfusion	21 (13.6%)	18 (39.1%)	5.10	[2.28-11.66]	< .001
Other complications (PE, pneumonia, arrhythmia)	3 (1.9%)	0	0	[NA]	.987

P35

Can Symmetrization Procedures Affect the Decision for Contralateral Prophylactic Mastectomy in Women with Breast cancer? A Survey of Women Who Elected for Symmetrization Procedures at a Single Institution G. Osgood,* C.J. Jean-Louis, R. Henry-Tillman, D. Ochoa, T. Osborn. *Department of Breast Surgical Oncology, University of Arkansas for Medical Sciences, Little Rock, AR.*

Introduction Despite the annual incidence of a contralateral breast cancer in low-risk patients being <1%, the proportion of women undergoing contralateral prophylactic mastectomy (CPM) has been increasing in recent years. Breast symmetrization procedures offer women an alternative to CPM who wish to maintain symmetry in the non-affected breast. The aim of this study is to investigate the patient's satisfaction of their symmetrization procedures and whether the option of symmetrization procedures affects a woman's choice against CPM. Methods A retrospective chart review was performed at a single institution from August 8, 2013 to June 14, 2018. We identified patients with a unilateral breast cancer who underwent partial mastectomy and a contralateral symmetrization procedure. We then performed a telephone survey on these patients. We analyzed the results of this numeric telephone survey to determine whether or not a symmetrization procedure on the contralateral breast could affect the decision for a CPM. Results There were 53 patients identified with a unilateral breast cancer who underwent partial mastectomy in addition to a symmetrization procedure on the contralateral breast. The majority of patients who underwent contralateral symmetrization procedures are currently satisfied with their body image as well as with their decision for the symmetrization procedure. A minority of patients were considering CPM at the time of their index operation, but the majority of these patients have no regrets about their choice for contralateral symmetrization procedure. Conclusions This study demonstrates that the majority of patients with a unilateral breast cancer treated with a partial mastectomy and contralateral symmetrization procedure are currently satisfied with their body image as well as their choice of operation. The majority of these patients do not wish they would have elected for CPM, and would recommend contralateral symmetrization procedures to other women. These findings offer a potential alternative to the growing trend of CPM.

P36

Multiple Ipsilateral Foci of Breast Cancer in Women ≤ 40 Years of Age is Not Associated with Gene Mutation Status S.A. Angarita,[1]* J. Tseng,[1] R.E. Morgan,[1] L.M. DeStefano,[2] A. Marumoto,[1] A. Chung,[1] A.E. Giuliano,[1] F. Amersi.[1] *1. Surgery, Cedars-Sinai Medical Center, Los Angeles, CA; 2. University of Washington, Seattle, WA.*

INTRODUCTION: Younger age, tumor multifocality/multicentricity, and pathogenic genetic mutations have all been associated with more aggressive forms of breast cancer. There is limited data on the association of multiple ipsilateral foci of disease (MIFD), as well as rates of pathogenic mutations in women ≤ 40 years of age. METHODS: Women ≤ 40 years of age diagnosed with operable breast cancer between 1/2015-10/2018 were identified from a prospectively maintained database. Clinicopathologic characteristics were compared between patients with and without MIFD. MIFD was defined as the presence of 2 foci of the same tumor separated by 2cm in the same breast on pre-operative breast imaging. Factors associated with MIFD were analyzed. RESULTS: 120 patients met inclusion criteria. Mean age was 34 years (range 21-39). 46 (38%) patients had MIFD, 9 (21%) of whom had a pathogenic mutation compared to 27 (26%) with unifocal disease (p=0.5) (Table 1). Patients with MIFD were more likely to have ER+ (85% vs 67%, p=0.024) and PR+ disease (74% vs 57%, p=0.053), and less likely to have triple negative breast cancer (TNBC) (4 (8.7%) vs 24 (22%), p=0.049) than patients with unifocal disease. Patients with and without MIFD had similar rates of re-excision (70% vs 69%, p=0.946) and recurrence (6.5% vs 8.4%, p=0.69) (Table). Though the two groups had similar rates of neoadjuvant chemotherapy (NAC) (41% vs 49%, p=0.362), those with MIFD were less likely to have a complete pathologic response (8.7% vs 34%, p=0.039) and were more likely to receive adjuvant chemotherapy (64% vs 39%, p=0.005) compared to those with unifocal disease. CONCLUSIONS: Patients ≤ 40 years of age who have MIFD do not have higher rates of pathogenic mutations. Notably, they tend to have more favorable biomarker profiles. Despite having a higher incidence of 2 foci of disease in the same breast, these patients do not have increased rates of re-excision or recurrence.

Table. Patient and Tumor Characteristics Stratified by Disease Focality

	All Patients n=120	MIFD n=46 n (%)	Unifocal n=74 n (%)	p-value
Mean Age (range)	34 (21-39)	35 (21-39)	34 (23-39)	0.488
Mutation	36	9 (21)	27 (26)	0.5
Mutation Type	-	-	-	0.243
BRCA1	18	2 (4.7)	16 (16)	
BRCA2	9	4 (9.3)	5 (4.9)	
Other	8	3 (7.0)	5 (4.9)	
VUS	35	14 (33)	21 (20)	
Histology	-	-	-	0.302
IDC	145	42 (91)	103 (95)	
ILC	0	0 (0)	0 (0)	
Mixed	4	2 (4.3)	2 (1.8)	
IDC/ILC	-	-	-	
Metaplastic	2	1 (2.2)	1 (0.9)	
Mucinous	3	0 (0)	3 (2.8)	
ER positive	112	39 (85)	73 (67)	**0.024**
PR positive	96	34 (74)	62 (57)	0.053
HER2-neu positive	43	15 (33)	28 (26)	0.371
TNBC	28	4 (8.7)	24 (22)	**0.049**
NAC	70	18 (41)	52 (49)	0.362
Stage (pathologic)	-	-	-	0.06
0	37	6 (13)	31 (29)	
1	55	16 (35)	39 (36)	
2	49	17 (37)	32 (30)	
3	13	7 (15)	6 (5.6)	
Grade	-	-	-	0.2
1	12	7 (17)	5 (6.4)	
2	45	15 (36)	30 (39)	
3	63	20 (48)	43 (55)	

P37

Comparison of Outcomes Between BRCA Mutation Carriers Undergoing Breast Conserving Surgery Versus Mastectomy

S. Shubeck,[1]* E. Berger,[2] M. Robson,[1] A. Heerdt,[1] M. Pilewskie.[1]
1. Breast Service, Memorial Sloan Kettering Cancer Center, New York City, NY; 2. Yale University, New Haven, CT.

Introduction: BRCA mutation carriers presenting with an index breast cancer often choose mastectomy, both for therapeutic and prophylactic intent. There are mixed data on outcomes among mutation carriers undergoing breast conserving surgery (BCS) compared to mastectomy. We sought to compare oncologic outcomes among BRCA mutation carriers undergoing BCS vs mastectomy. Methods: Women with a BRCA 1/2 mutation and index breast cancer diagnosed from 2006-2014 were retrospectively identified from institutional databases. Patient, disease, and treatment characteristics were identified. Subsequent locoregional, contralateral breast cancer (CBC), and breast cancer specific survival (BCSS) events were compared between surgical groups. Results: 405 BRCA mutation carriers with an index breast cancer were identified, including 28 women with bilateral breast cancer. Surgical treatment included BCS for 101 and mastectomy for 331 cancers. Patients choosing mastectomy were younger, more often premenopausal, more frequently underwent axillary surgery, and were less likely to receive radiation therapy ($p<0.01$). 316 mastectomy patients opted for contralateral prophylactic mastectomy. With mean follow up of 89 months, there were 65 recurrence events (Table). Rates of locoregional and distant recurrence did not differ between groups. There were 5 (4.7%) CBCs among women undergoing unilateral breast surgery compared to 0 in the bilateral mastectomy patients, ($p<0.001$). 6 (6%) BCS women and 27 (9%) mastectomy patients died from breast cancer ($p=0.4$). Kaplan Meier estimates for 5- and 10- year BCSS did not differ between BCS and mastectomy patients (BCS 95.1% and 93.7%; mastectomy 94.7% and 88%, respectively, $p=0.3$). On multivariable analysis, higher N stage was associated with BCSS while type of surgery was not (HR 1.43, $p=0.4$). Conclusions: With over 7 years of follow-up, we report no difference in locoregional recurrence or BCSS among BRCA mutation carriers who underwent either BCS or mastectomy, although there is a higher incidence of CBC in those undergoing unilateral breast surgery. These data support BCS as an option for BRCA mutation carriers with ongoing high-risk screening.

Recurrence Outcomes by Surgery Type

	Overall	Breast Conservation	Masectomy	P Value
Any Recurrence (n)	65	20 (19%)	45 (14%)	0.3
Time to Any Recurrence (months)	34.3	27.2	35.6	0.6
Locoregional Recurrence (n)	24	7 (6.9%)	17 (5.1%)	0.7
Time to LR Recurrence (months)	33.2	14.5	41.0	0.2
Contralateral breast cancer (n) *	5	5 (4.7%)	0 (0%)	<0.001
Time to CBC (months)	71.2	71.6	N/A	
Distant Recurrence (n)	42	8 (7.5%)	34 (10%)	0.5
Time to Distant Recurrence (months)	34.0	26.6	34.8	0.5
Breast Cancer Deaths (n)	33	6 (5.7%)	27 (9%)	0.5
Time to Death (months)	50.2	47.4	50.3	0.8
Follow up interval (months)	90.5	98.8	87.8	0.11

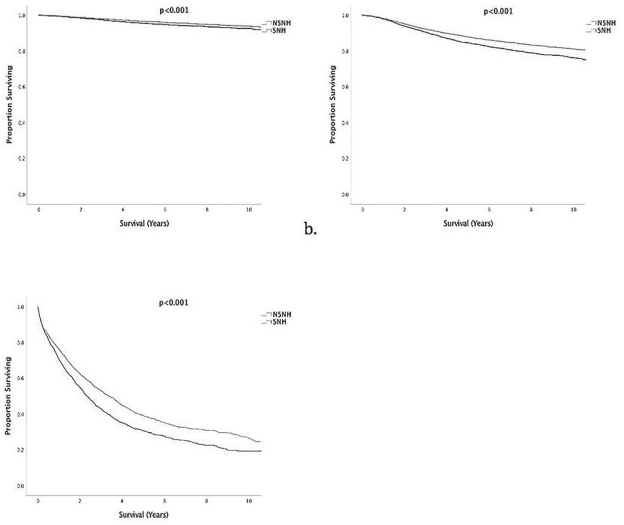
* Comparison of patients with unilateral vs bilateral breast surgery

P38

Disparities of Breast Cancer Treatment and Survival Between Safety Net Hospital and Non-Safety Net Hospitals

H. Emrani,* C. Lowder, C. Calvo-Strube, M. Leitch, E. Clifford, R. Wooldridge, J. Huth, A. Yopp, D.E. Farr. *General Surgery, Division of Surgical Oncology, UT Southwestern, Dallas, TX.*

Introduction: Safety net hospitals (SNH) disproportionately provide care to racial/ethnic minority and socioeconomic disadvantaged populations, yet it remains unclear if breast cancer patients evaluated at SNH have worse oncological outcomes compared to patients at non-safety net hospitals (NSNH). The objective of this study was to characterize the differences in presentation, treatment, and survival of breast cancer patients diagnosed at SNHs and NSNH. Methods: Patients diagnosed with breast cancer were identified in the Texas Cancer Registry from 2004 to 2015. Hospital and patient characteristics were compared between SNH and NSNH. Covariate-adjusted treatment use and DSS were compared between cohorts. SNH was defined as the top quartile of statewide Medicare Disproportionate Share Index. Results: Despite having patients with comparable histologic tumor types, receptor status, and age at diagnosis, SNH treated a larger proportion of black (14.3% v. 10.1%) Hispanic white (38.8% v. 10.7%), uninsured (13% v. 1.7%) and lowest socioeconomic status quintile (45.2% v. 20.4%). While NSNH treated a larger proportion of patients with local disease (65.1% v. 58.2%), SNH treated a larger amount of regional (33.6% v. 28.7%) and metastatic disease (5.8% v. 4%). Breast cancer patients treated at SNH had increased time to initial treatment (34 v. 29.6 days, $p<0.001$) and treatment receipt use after adjustment for significant clinicopathological variables was significantly higher for those treated at SNH (OR 1.179, 95%CI, 1.13-1.23, $p<0.001$) when compared with NSNH. In a subset analysis of patients with metastatic disease, SNH was associated with decreased survival (HR 1.141 CI 1.09-1.20, $p<0.001$) when adjusted for age, stage, receipt of treatment, and race/ethnicity (Figure 1). Conclusion: Racial/ethnic minorities and those of lower socioeconomic status with breast cancer were more likely to be treated at SNH systems. Despite higher treatment receipt, SNH status was associated with longer time to treatment decreased DSS. Further studies are needed to characterize the system-level factors associated with disparities in breast cancer prognosis.



Supplementary Figure 1.
Disease specific survival for a. **localized breast cancer stratified by SNH status.** The median DSS was not reached (NR). The 1-, 3- and 5-year DSS was 99.5%, 98.0%, and 96.5% for NSNH and 99.2 %, 97.4%, and 95.4% for SNH, b. **regional breast cancer stratified by SNH status.** The median DSS was not reached (NR). The 1-, 3- and 5-year DSS was 98.2%, 92.2%, and 87.8% for NSNH and 97.8 %, 90.4%, and 84.5% for SNH, c. **metastatic breast cancer stratified by SNH status** The median DSS was 3.38 (0.13) years for NSNH and 2.32 (0.10) years for SNH. The 1-, 3- and 5-year DSS was 76.3%, 52.9%, and 38.9% for NSNH and 70.8 %, 42.8%, and 30.4% for SNH.

P39

Newly Diagnosed Breast Cancer Patients: Which Combination of Imaging is Better 2D or 3D Mammography with Breast MRI? Fatty Breast or Dense Breast: Does it Matter? C.J. Jean-Louis,* P. Jennings, N. Kaukis, G. Osgood, R. Henry-Tillman, D. Ochoa, S. Harter, G. Bryant. *Breast Surgical Oncology, University of Arkansas Medical Sciences, Little Rock, AR.*

Introduction Many institutions have transitioned from 2D digital mammography to 2D mammography with digital breast tomosynthesis, a 3D technology. The aim of this study is to evaluate the differences in 2D and 3D mammography when combined with Breast MRI in newly diagnosed breast cancer patients and the role of breast density with this combination of imaging. Methods Retrospective chart review was performed from July 2016 to August 2020. We assessed patients with BIRADS 4 or 6 who subsequently underwent breast MRI and additional biopsies. We recorded what initial imaging modality was used for diagnosis, 2D or 3D mammography, and breast density. Breast density was categorized on the standard A, B, C, D scale (fatty to dense). There were 113 (39.8%) fatty breasts (categories A and B) and 75 (60.1%) dense breasts (categories C and D). Results 188 patients were reviewed. 2D mammography (p=0.5080) did not perform as strongly as 3D mammography (p= 0.002) in cancer detection with a lower bound detection probability of 55.5518%. A strong determining factor in identifying all cancer pre MRI was fatty tissue with 3D mammography (p-value = 0.0106), with weak evidence for 3D mammography and dense breast tissue (p = 0.1090). There is moderate evidence for 3D decreasing additional biopsies after breast MRI compared to 2D (p = 0.0627). The most important factor in determining the probability of additional biopsies after MRI was breast density rather than 2D vs 3D mammography. Fatty breast tissue had a lower probability of having an additional biopsy recommended after MRI (p=0.0119) and a 95% confidence lower bound of 29.4425%. Conclusions 3D mammography in fatty breasts outperforms 2D mammography alone in detecting primary breast cancer and additional lesions. If the initial mammogram study is 3D in a fatty breast, MRI is unlikely to identify additional cancer compared to 2D. 3D mammography outperforms 2D mammography in cancer detection in dense breast but does not decrease the likelihood of additional lesions identified on MRI.

P40

Management of Ipsilateral Breast Tumor Recurrence After Prior Breast Conservation Therapy H. Vora,[1]* M. McGrath,[1] J.R. Bellon,[2] E.A. Mittendorf,[1] T. King.[1] *1. Department of Surgical Oncology, Dana-Farber Cancer Institute/Brigham and Women's Hospital, Boston, MA; 2. Department of Radiation Oncology, Dana-Farber Cancer Institute/Brigham and Women's Hospital, Boston, MA.*

Introduction: In light of recent clinical trial data establishing the safety and efficacy of repeat breast conservation therapy (BCT) in select patients (pts) with ipsilateral breast tumor recurrence (IBTR), our multidisciplinary team adopted standardized criteria for consideration of repeat BCT. Here we report clinical characteristics and surgical management among pts treated for IBTR prior to the adoption of these criteria and define the proportion of pts who would have qualified for repeat BCT based on our current algorithm. Methods: A prospectively maintained database was reviewed to identify pts presenting for surgical management of IBTR after BCT for stage 0-III breast cancer. Clinical characteristics and surgical management of IBTR were recorded and compared to current eligibility criteria for repeat BCT, which include: age > 55yrs, unifocal DCIS or cT1N0, estrogen receptor positive (ER+) IBTR > 5yrs after prior BCT. Results: From 2016 to 2020, 378 pts underwent surgery for IBTR either after BCT for DCIS (n=131) or invasive disease (n=247) (Table). 327 (85.6%) received radiation (RT) at initial BCT. The median age at IBTR was 65.8 yrs (36-97yrs); median time interval from initial BCT to IBTR was 10.7 yrs (0.3-43.4yrs). Overall, 302 (79.9%) pts recurred with invasive disease; 239 (79.1%) were ER+. IBTR was managed with repeat lumpectomy in 72 (19.0%), lumpectomy + RT in 30 (7.9%), mastectomy (TM) in 260 (68.8%), and TM + RT in 16 (4.3%). Only 10 pts with previous RT received re-irradiation for IBTR. At a median followup of 15.6 mos (0.4-57.1 mos) there were 3 (2.9%) local-regional recurrences (LRR) in the repeat BCT (+/-RT) group and 3 (1.1%) LRR in the TM +/- RT group. Applying our current criteria for repeat BCT identified 170 (45.0%) pts, 107 (62.9%) of whom had TM, who would have qualified for repeat BCT. There were 2 (1.1%) LRR in this group. Conclusions: Our experience demonstrates that over 70% of pts with IBTR undergo TM +/- RT; crude rates of LRR are low and similar to that among pts treated with repeat BCT. The application of standardized criteria for repeat BCT provides an opportunity to better define these outcomes in clinical practice.

Table 1: Clinical and Management Characteristics of IBTR

	All pts IBTR n=378	IBTR after BCT for DCIS n=131	IBTR after BCT for Invasive Cancer n=247
Median Age at IBTR (years)	65 (36-97)	65 (43-93)	67 (36-97)
Median Interval BCT to IBTR (years)	10.7 (0.3-43.4)	12.0 (0.5-37.5)	11.1 (0.3-43.4)
Invasive IBTR	302 (79.9)	94 (71.8)	208 (84.2)
-ER+/Her2-	213 (70.6)	77 (81.9)	136 (65.4)
-ER+/Her2+	24 (7.9)	5 (5.3)	19 (9.1)
-ER-/Her2+	12 (4.0)	3 (3.2)	8 (3.4)
-ER-/Her2-	51 (16.9)	7 (7.4)	44 (21.2)
DCIS IBTR	76 (20.1)	37 (28.2)	39 (15.8)
-ER+	64 (84.2)	33 (89.2)	31 (12.6)
Median Invasive IBTR Clinical Tumor Size (cm)	2.2 (0.1-9.5)	1.7 (0.1-8.5)	2.2 (0.15-9.5)
Median Invasive IBTR Pathologic Tumor Size (cm)	1.6 (0.1-12.5)	1.5 (0.1-12.5)	1.6 (0.1-10.0)
Initial BCT management			
-Lumpectomy Alone	51 (13.5)	13 (9.9)	38 (15.4)
-Lumpectomy with RT	327 (86.5)	118 (90.1)	209 (84.6)
Management for IBTR			
-Lumpectomy Alone	72 (19.0)	24 (18.3)	48 (19.4)
-Lumpectomy with RT	30 (7.9)	11 (8.4)	19 (7.7)
-Mastectomy	260 (68.8)	94 (71.8)	166 (67.2)
-Mastectomy with RT	16 (4.3)	2 (1.5)	14 (5.7)
Chemotherapy for IBRT	75 (19.8)	18 (13.4)	57 (23.1)
Anti-Her2 therapy for Her2+ Invasive IBTR (n=36)	28 (77.8)	7 (87.5)	21 (75)
Endocrine Therapy for ER+ IBTR (n=239)	207 (86.6)	73 (86.9)	134 (86.5)
Median Follow Up after IBTR (months)	15.6 (0.4-57.1)	16.5 (0.4-51.3)	14.7 (0.4-57.1)
Local-regional Recurrence after IBTR	6 (1.6)	1 (0.8)	5 (2.0)
Distant Recurrence after IBTR	7 (1.9)	2 (1.5)	5 (2.0)
Any death after IBTR	11(2.9)	1 (0.8)	10 (4.0)

P41

Single Center Oncoplastic Experience and Patient Satisfaction Reported via Modified BREAST-Q X. Wang,* A.E. Erickson, A. Mathews, B. Coburn, E. Bucholz, C. Godellas, D. Vandevender, F. Vaince. *General Surgery, Loyola University Medical Center, Maywood, IL.*

Introduction: Oncoplastic breast surgery (OPS) is gaining in popularity compared to breast conserving surgery (BCS) due to wider resections and better satisfaction with cosmetic outcomes. This study analyzes the level II (tissue rearrangement with nipple reposition/plastic assistance) OPS experience versus BCS. Outcomes include wound complications (infections, dehiscence, hematomas/seromas) within 3 months of surgery, and rates of re-excision (margins, fat necrosis, mammoplasty revision). Patients were surveyed retrospectively using a modified BREAST-Q questionnaire to assess their satisfaction. Methods: This IRB approved, single academic center retrospective study examined 165 patients between 2015-2020. Even distribution amongst level II-OPS and BCS. A modified BREAST-Q questionnaire was adopted based on BREAST-Q Version 2.0. Each question was graded on a scale of 1 to 3, and tallied. Statistical analyses were done with T-test, Chi-squared, and multivariable regression (MVR). Results: Compared to BCS, the OPS cohort was younger (57 vs. 62, p<0.01), less likely to smoke (6% vs. 17%, p=0.05), and more likely to be ER+ (87% vs. 70%, p=0.03) and PR+ (82% vs. 57%, p<0.01). Patients with carcinoma in-situ (19% vs. 7%, p=0.04) and invasive lobular carcinoma (14% vs. 4%, p=0.03) were more likely to undergo OPS, while those with invasive ductal carcinoma (67% vs. 87%, p<0.01) were more likely to have BCS. There was no statistical difference between cohorts for wound complications. OPS had a higher rate of re-excisions (20% vs. 7%, p=0.03), but the significance disappeared with MVR. Results of the modified BREAST-Q showed that OPS patients were more satisfied with their sexual well-being (p<0.01) and outcomes of breast surgery (p<0.01) than BCS patients. No differences were found in psychosocial or physical well-being and satisfaction with breasts, or breast surgeons. Discussion: Our study showed that OPS is an oncologically safe technique that should be discussed with appropriate patients. OPS patients were overall more satisfied with their operation via BREAST-Q, and thus operative planning should involve patient preferences in optimizing long term cosmetic outcomes.

Table 2: Modified BREAST-Q questionnaire results

	OPS (37)	BCS (31)	p-value
Psychosocial well-being	5.63	5.55	0.7
Sexual well-being	5.53	4.58	<0.01
Satisfaction with breasts	4.03	3.84	0.54
Physical well-being	2.83	2.71	0.57
Satisfaction with breasts surgery	13.1	15.2	<0.01
Satisfaction with breast surgeon	2	1.97	0.32

Modified BREAST-Q questionnaire highlight significant differences in sexual well-being and satisfaction with breast surgery between OPS and BCS patients.

P42

Oncotype Testing is Not Consistently Performed Across Age and Nodal Status M. Roberson,[1] K.A. Iles,[2]* S. Downs-Canner,[2] P.D. Strassle.[2] *1. Gillings School of Global Public Health, University of North Carolina at Chapel Hill, Chapel Hill, NC; 2. University of North Carolina at Chapel Hiill, Chapel Hill, NC.*

Introduction: The Oncotype DX recurrence score (ODX) is a validated, prognostic, and predictive tool to guide the use adjuvant chemotherapy in early, node negative hormone receptor positive (HR+) and Her2 negative (Her2-) breast cancer. While a trial is ongoing to assess its use in node positive women (N1), we hypothesize that the use and value of this test varies across age groups and nodal status. Methods: All women diagnosed with HR+/Her2- early stage breast cancers (T1-2, N0-N1) and underwent mastectomy or lumpectomy between 2010-2017 in the National Cancer Database were included. Log-binomial regression was used to assess differences in the prevalence of ODX use across patient and cancer characteristics. Interaction terms were used to assess whether testing differed across nodal status and age. Results: 535,878 women were included. 257,297 (48%) received an ODX test and of these 42,047 (16%) were node positive. Women who received an ODX test were younger, had fewer comorbidities, and lower pathologic T and N stage (Table). However, the impact of pathologic nodal status was not consistent across age. Among women <40 and 40-69, node-positive women were less likely to undergo ODX testing (<40: prevalence ratio [PR] 0.47, 95% CI 0.45, 0.49; 40-69: PR 0.79, 95% CI 0.79, 0.80); however, nodal positivity was associated with increased use in women ≥70 (PR 1.34, 95% CI 1.32, 1.37). Among node negative women who received ODX testing, there was an increasing prevalence of receiving chemotherapy with increasing age for those with intermediate or high scores. The same association was also observed among node positive women but with smaller effect sizes. Conclusions: Older, node-positive women were more likely to have ODX testing, compared to younger, node-negative women. ODX testing is less prevalent in older women; however, when testing is used, clinicians are more likely to test node positive women in this cohort. Clinicians may be employing the use of oncotype testing in older, node positive women to support treatment decisions against the receipt of chemotherapy. This may also reflect a difference in the perceived utility of Oncotype testing across age and nodal status.

	Not Tested (n=277,660)	Oncotype Tested (n=258,218)
Age Group		
<40	7,624 (45)	9,506 (55)
40-69	156,174 (43)	203,564 (57)
70+	113, 862 (72)	45,148 (28)
Charlson Score		
0	223,594 (51)	218,185 (49)
1	41,089 (56)	32,160 (44)
2	9,237 (61)	5,897 (39)
3+	3,740 (65)	1,976 (35)
Histologic type		
Ductal	202,372 (51)	191,636 (49)
Lobular	58,740 (50)	58,439 (50)
Other	16,548 (67)	8,143 (33)
Pathologic N stage		
0	217,997 (50)	215,250 (50)
I	54,350 (56)	42,047 (44)
Not staged	5,313 (85)	921 (15)
Pathologic T stage		
I	217,369 (53)	194,500 (47)
II	60,006 (49)	63,651 (51)

P43

In Search of the Lost Clip: Outcome of Women After Needle Guided Lumpectomy of a Marking Clip R.R. Tvito- Green,[1]* R. Weiser,[1] O. Golan,[1] T. Menes.[2] *1. surgery, Tel Aviv medical center, Givatayim, Israel; 2. Sheba medical center, Tel Hashomer- Ramat Gan, Israel.*

Background: Needle localization of a marking clip is required to guide accurate removal of many breast tumors. When the marking clip is not visualized on specimen mammography, concerns regarding the completeness of cancer removal and long-term outcome arise. Using a large cohort of women undergoing breast conservation we examined the magnitude of the problem, and the outcome of women with a missing clip. Methods: Case-control study including all women undergoing mammographic wire-guided localization between 2013 and 2018, with a specimen radiograph showing a missing clip. For every case at least 4 women with successful removal of the clip(s) were included in the control group which included 196 patients. Data included demographics, cancer and treatment characteristics and outcome. The groups were compared regarding margin status, repeat surgery and recurrence rates. Results: The research group included 43 women (5% of the cohort; 95% CI 3.9; 7.2) with a missing clip. Positive margins were similar between study and control groups (7;17% vs. 29;15% respectively, P=0.96). Eleven women (33%) had a residual clip visualized on post-surgery mammography; in 4 a percutaneous biopsy of the clip was successful, all with no residual tumor. There was no difference in re-excision rates, local or distant recurrence. Conclusions: In the majority of women with a missing clip it is not visualized on post-surgery mammography. Those with a residual clip can be managed with percutaneous biopsy as long as the lesion was removed with clear margins, with comparable outcome to women in whom the clip is visualized on specimen radiograph.

P44

Does More Extensive Nodal Dissection Impact Complications of Implant-based Reconstruction? An Analysis of the NSQIP Database

J. Bogach,[1]* E. Cordeiro,[2] E. Reel,[3] T.D. Cil.[3] *1. University of Toronto, Toronto, ON, Canada; 2. The Ottawa Hospital, Ottawa, ON, Canada; 3. University Health Network, Toronto, ON, Canada.*

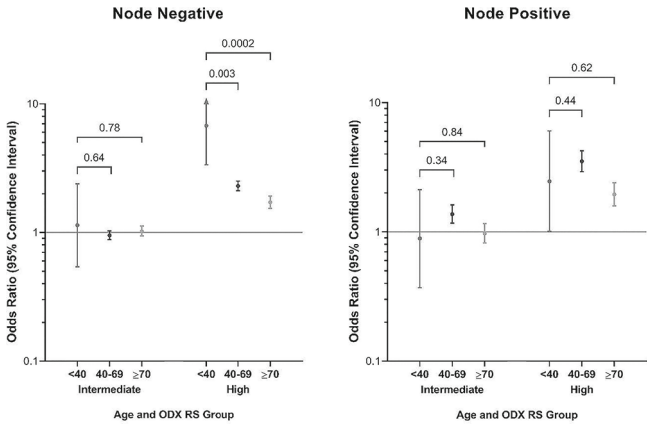
Introduction Some series have shown increased complications with extended nodal surgery and immediate breast reconstruction with implants (IBR). We aim to explore complications associated with axillary dissection compared to sentinel node biopsy at a population level. Methods American College of Surgeons National Surgical Quality Improvement Program participant user files from 2008-2018 were searched to create a cohort of female patients undergoing unilateral mastectomy with IBR and axillary surgery for non-metastatic breast cancer. Patients were classified as having sentinel node biopsy (SLNB), axillary dissection (ALND), or sentinel node biopsy and axillary dissection (SLNB+ALND). Baseline demographics and pertinent risk factors for complications were collected. Baseline demographics were compared, and multivariable logistic regression was to assess for independent predictors of the primary outcome of 30-day morbidity. Results Between 2008-2018, 18,232 patients in the database met the inclusion criteria; 12,632 had SLNB, 3,727 had upfront ALND and 1873 had SLNB+ALND. Mean age of patients in the cohort was 52.2 (SD 11.1). Rates of pre-operative chemotherapy were significantly higher in ALND patients (11.0% vs 3.2% and 2.1% in SLNB and SLNB+ALND groups respectively, p<0.0001). Tissue expander IBR was most common in all groups, and direct to implant was used more frequently in SLNB patients (16.4% vs 15.2% and 12.7% in ALND and SLNB+ALND, respectively). There was no difference in 30-day morbidity between groups (SLNB: 4.3%, ALND: 4.9%, SLNB+ALND: 4.2%, p=0.207). Multivariable regression showed that type of axillary surgery was not an independent predictor of 30-day complications [OR 0.78 (95%CI 0.52-1.15) for ALND, and OR 0.87 (95% CI 0.52-1.45) for ALND+SLNB vs SLNB alone]. Significant independent predictors for complications were BMI [OR 1.06 (95%CI 1.04-1.08)] and operative time [OR 1.003 (95% CI 1.001-1.005)]. Conclusions Axillary lymph node dissection does not increase 30-day morbidity in patients undergoing IBR when compared to sentinel node biopsy. This supports concurrent axillary dissection for IBR patients when indicated.

P45

Declining Utility of Oncotype Dx Recurrence Score with Advancing Age

K.A. Iles,[1]* M. Roberson,[2] P.M. Spanheimer,[1] K.K. Gallagher,[1] D.W. Ollila,[1] H. Muss,[3] P.D. Strassle,[1] S. Downs-Canner.[1] *1. Department of Surgery, University of North Carolina at Chapel Hill, Chapel Hill, NC; 2. Gillings School of Global Public Health, University of North Carolina at Chapel Hill, Chapel Hill, NC; 3. Department of Medicine, University of North Carolina at Chapel Hill, Chapel Hill, NC.*

Introduction: The Oncotype DX recurrence score (ODX) is a validated prognostic and predictive tool to guide the use adjuvant chemotherapy in hormone receptor positive (HR+) and Her2 negative (Her2-), node negative breast cancer. While a prospective trial is underway to assess ODX use in node positive (N1) disease, it is already being used in this cohort. The biology of breast cancer in older women may be distinct and thus the predictive value of ODX may vary with age and nodal status. Methods: All women diagnosed with HR+/Her2- early breast cancer (T1-2, N0-1) from 2010-2017 in the National Cancer Database who received an ODX test were included. ODX were categorized into low (<10), intermediate (11-25) and high (≥26). We assessed the interaction between ODX and age on all-cause mortality using Cox regression in node negative and node positive women. Results: 254,425 women met inclusion criteria. Median oncotype score was similar across age groups and nodal positivity status (median 15-18). In node negative women, high ODX RS was strongly associated with increased mortality in younger women (<40: HR 6.77, 95%CI 3.36, 13.67), but the association significantly weakened as age increased (40-69: HR 2.30, 95%CI 2.11, 2.51; ≥70: HR 1.72, 95%CI 1.54, 1.92), (Figure). In node positive women, ODX was still associated with mortality, but was consistent across age groups (<40: HR 2.46, 95%CI 1.01, 6.04; 40-69: HR 3.52, 95%CI 2.29, 4.24; ≥70: HR 1.95, 95%CI 1.59, 2.40) and was weaker than among young, node negative women, (Figure). Conclusions: ODX was most strongly associated with mortality among younger, node negative women, although high oncotype scores were associated with increased mortality across all ages and nodal status. Our findings suggest oncotype scoring in older women may have less clinical utility. Oncotype testing should be used judiciously in this population, taking into consideration life expectancy and patient values. The weaker association between high ODX and mortality in node positive patients may reflect bias in selection criteria for testing.



Cox Proportional Hazard Model assessing association between age group and oncotype score interaction on all-cause mortality. Odds ratios are comparing intermediate and high oncotype scores, respectively, to low oncotype score.

P46

Increased Apoptosis is Associated with Robust Immune Cell Infiltration, Cytolytic Activity and Better Survival in Breast Cancer

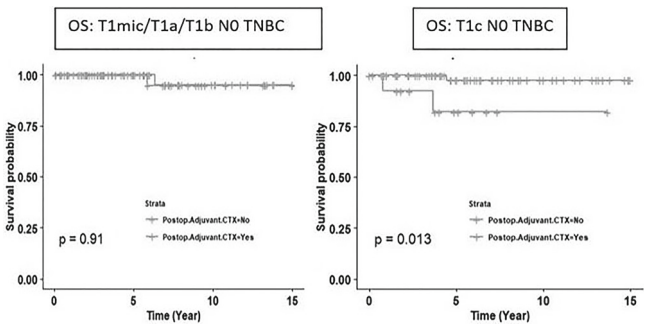
V. Murthy,* M. Oshi, K. Takabe. *Surgical Oncology, Roswellpark Comprehensive Cancer Center, Jersey city, NJ.*

Introduction: Tumor immune microenvironment play a critical role in cancer biology, treatment response and survival regardless of immunotherapy. Breast cancer (BC) is known to have less tumor infiltrating lymphocytes compared to other cancers. Apoptosis is an autonomous cell death that may release immunogenic molecules that attract immune cells. To this end, we hypothesized that increased apoptosis in BC patients is associated with high infiltration of immune cells, high cytolytic activity, with better survival. Methods: METABRIC cohort (n=1904) and TCGA (n=1065) as validation cohort were used. Gene Set Variation Analysis of Molecular Signatures Database Hallmark gene set was used as apoptosis score and median to divide into high vs low groups. Results: High apoptosis group was significantly associated with better DFS and OS, although it did not corelate with tumor subtype, pathological grade or stage. High apoptosis was associated with low MKI67 expression that indicates less cell proliferation and high infiltration of fibroblasts, endothelial cells and adipocytes, as well as high Lymphocyte infiltration and IFN-γ scores. High apoptosis BC significantly enriched inflammation- and immune response-related gene sets like Inflammatory response, Allograft rejection, IFN-γ response and Complement, consistently in both cohorts. It was also associated with high rate of silent and non- silent mutation as well as SNV neoantigens. In agreement, immune cells such as CD8, CD4 memory, dendritic cells, M1 and M2 macrophages were uniformly infiltrated in high apoptosis tumors consistently in both cohorts. Overall, cytolytic activity were significantly elevated in high apoptosis group in both cohorts. There was no difference in apoptosis by response to neoadjuvant chemotherapy. All of 9 immune checkpoint molecules studied were uniformly elevated in high apoptosis BC in both cohorts. Conclusion: Our results imply that breast cancer with high apoptosis is associated with inflammatory and immune response-related gene sets, high mutation and neoantigen, and immune cell infiltration with global cytolytic activity, which possibly explains better DFS and OS.

P47

Benefit of Adjuvant Chemotherapy in T1 N0 Triple Negative Breast Cancer Stratified by Tumor Size G.A. Fasano,[1]* S. Bayard,[1] Y. Chen,[2] M. Davis,[1] L. Varella,[1] T. Cigler,[1] R. Simmons,[1] A. Swistel,[1] J. Marti,[1] J. Ng,[1] A. Brandmeier,[1] S. Formenti,[1] L. Newman.[1] *1. Breast Surgery, Weill Cornell Medicine, New York, NY; 2. Henry Ford Health System, Detroit, MI.*

INTRODUCTION: National Comprehensive Cancer Network guidelines recommend delivery of adjuvant chemotherapy (CTX) in node-negative triple negative breast cancer (TNBC) if the tumor is larger than 1 cm, and consideration of adjuvant CTX for T1b tumors but not for T1a disease. Data are sparse regarding the benefits of adjuvant (postoperative) CTX in T1b N0 TNBC. METHODS: We evaluated survival outcomes in an IRB-approved prospectively-maintained dataset of TNBC cases treated in a single academic institution from 1998-2018. Primary tumor size, histology and nodal status were based upon definitive surgical pathology. Median follow-up was 4.9 years (mean 5.6 years). RESULTS: Of 444 TNBC cases, 247 had T1 tumors (55.6%) and 332 were node-negative (74.8%). Most cases had invasive ductal histology (89.9%) and only 7 had metaplastic disease (1.6%; p<0.05). Of 187 patients with T1N0 disease, 17% had T1a, 35% had T1b, and 59% had T1c tumors. Median age was 61 years (range 29-92). Factors associated with delivery of CTX included age ≤50 years (75% v. 49%; p=0.013); high-grade disease (59% v. 38%; p=0.02) and T category but not lymphovascular invasion (69.6% v. 53.1%; p=0.22). Among the N0 cases, adjuvant CTX was delivered to 32.3% of T1a, 52.3% of T1b and 73.6% of T1c cases (p<0.0001). Adjuvant CTX improved overall survival (OS) in patients with T1cN0 disease (5-year OS probability 97.6% v. 82.1%; p=0.013) but not in patients with T1aN0 disease or in patients with T1bN0 disease (Figure 1, OS curves shown for T1a and T1b grouped together), where the outcomes were extremely favorable. CONCLUSIONS: Our data support current guidelines indicating benefit from adjuvant chemotherapy in node-negative TNBC associated with T1c but not in T1a tumors. With the limitations inherent to a retrospective analysis, our data demonstrate excellent survival outcomes in T1bN0 TNBC regardless of whether adjuvant CTX is delivered.



P48

Upstaging of Fibroepithelial Lesions: A Single Institution Experience S.C. Mohan,* J. Tseng, A. Marumoto, S.A. Angarita, F. Dadmanesh, F. Amersi, A.E. Giuliano, A. Chung. *Cedars Sinai Medical Center, Los Angeles, CA.*

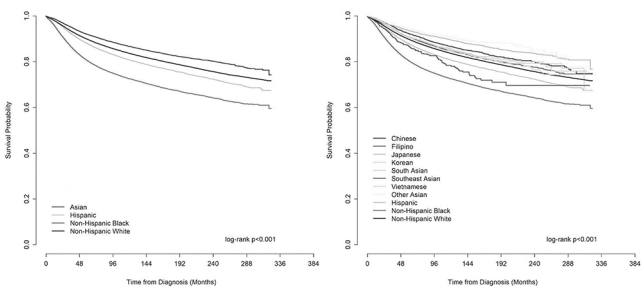
INTRODUCTION: Fibroepithelial lesions of the breast (FEL) are heterogeneous lesions that range from fibroadenomas (FA) to phyllodes tumors (PT). FEL with cellular stroma can pose a diagnostic challenge on core needle biopsy (CNB), as it is difficult to distinguish cellular FA from PT. Excision of such lesions is advised for definitive classification. The purpose of this study was to determine features of FEL on CNB that may be predictive of PT and the upstage rate to PT after surgical excision. METHODS: A total of 307 patients diagnosed with FEL on CNB between 2009-2019 were identified from a prospectively maintained institutional database. Patient presentation, imaging, CNB pathology, and final surgical pathology were evaluated. RESULTS: Mean age at diagnosis was 43.8 years. Pathology on CNB included 98 with FEL favoring FA, 19 FEL favoring PT, 4 FEL vs pseudoangiomatous stromal hyperplasia, and 186 FEL not otherwise specified. Following CNB, 96 (31.3%) were managed with observation, 159 (51.8%) had an excisional biopsy, 48 (15.6%) underwent segmental mastectomy, and 4 (1.3%) had a mastectomy. Among those who had CNB alone, no tumor growth or subsequent excision was observed with median follow up of 31.6 months (IQR 8.6-67.7 months). Upgrade rate from FEL on CNB to PT upon surgical excision was 25.8%. Patients with PT after excision were older than those with FA on final pathology (43.8 vs 37.5 years, p<0.01) and had larger tumor size on imaging at diagnosis (3.9 cm vs 1.8 cm, p<0.01). There were no other significant differences in imaging characteristics between PT and FA. PT on final pathology was more commonly seen when the CNB pathology identified stromal overgrowth, necrosis, and diagnosis of FEL favoring PT. On multivariable analysis, a final diagnosis of PT was associated with older age (HR 1.06, 95% CI 1.02-1.09), larger tumor size (HR 2.28, 95% CI 1.41-3.66), and ≥1 mitoses/10 HPF on CNB (HR 6.36, 95% CI 1.12-36.12). CONCLUSIONS: In this single institution 10-year experience of FEL, age, size of tumor, and mitotic activity on CNB were predictive of PT after excision. FEL on CNB was upstaged to PT in 25.8% of resected cases. FEL on CNB warrants excision to rule out PT.

P49

Disease Characteristics & Mortality Among Asian Women with Breast Cancer A.Y. Yu,* S. Thomas, G. DiLalla, R. Greenup, S. Hwang, T. Hyslop, C.S. Menendez, J.K. Plichta, L.H. Rosenberger, L.A. Tolnitch, O.M. Fayanju. *Surgery, Duke University, Durham, NC.*

INTRODUCTION Asian women are often aggregated in breast cancer research, belying a diversity that may be differentially associated with outcomes. We examine differences in breast cancer characteristics and mortality among 8 groups of Asian women. METHODS Asian, non-Hispanic Black (NHB), Hispanic, and non-Hispanic White (NHW) women≥18y diagnosed with breast cancer 1975-2016 were identified in the SEER18 database. Asian patients were further divided into Chinese, Japanese, Korean, Filipino, Vietnamese, South Asian (Asian Indian & Pakistani), Southeast (SE) Asian (Cambodian, Laotian, Hmong, & Thai) and Other Asian groups. Kaplan-Meier and Cox proportional hazards models were used to estimate unadjusted and adjusted overall (OS) and cancer-specific survival (CSS), respectively. RESULTS 910,415 women were included (Asian=63,405, NHB=92,226, Hispanic=84,451, NHW=670,333). Filipino women (n=17,190) constituted the largest Asian group while SE Asian women made up the smallest (n=1147). South and SE Asian women had the highest rates of de novo Stage IV disease while Japanese women had the lowest (p<0.001). Asian women had higher rates of HER2+ disease vs NHW women (19% vs 14%), with Filipino women (27.1%) having the highest rates among women<50 and Vietnamese women (21.5%) having the highest rates among women≥50 (both p<0.001). Asian women had the best 10y unadjusted OS and CSS of all races (both p<0.001). SE Asian women had the worst 10y unadjusted OS (70%, 95% CI 66.1-73.5%) and CSS (78%, 95% CI 74.1-81.3%) of any Asian group. Japanese women – who also the highest proportion of patients>50 – had the 2nd worst 10y unadjusted OS (75.4%, 95% CI 74.5-76.3%) but the highest 10y unadjusted CSS (89.4%, 95% CI 88.7-90.1%) of any distinct Asian group (all p<0.001; Figure). After adjustment, SE Asian women had the worst OS of any Asian group (HR 0.83, 95% CI 0.72-0.96, p<0.001) but still had better OS than NHW women (ref). CONCLUSIONS Breast cancer characteristics and outcomes vary significantly among Asian women, for whom data is rarely disaggregated by country of origin. Future research should consider such disaggregation to identify Asian subgroups at risk for worse outcomes than aggregated data may suggest.

Figure 1. Unadjusted Cancer-Specific Survival



P50

Opioid Prescribing Practices in Breast Oncologic Surgery

É Di Lena,* N. Barone, B. Hopkins, S. Dumitra, J.F. Fiore Junior, S. Meterissian. *Surgery, McGill University, Montreal, QC, Canada.*

Opioid analgesics are a mainstay treatment for post-operative pain but carry significant potential for adverse effects and misuse. 2/3 of breast cancer surgery patients receive opioids and 2-4% will continue to use them after 3 months. The November 2020 American Society of Breast Surgeons consensus statement advised for the use of routine co-analgesia and the reduction of opioid prescriptions in breast oncologic surgery. To inform future institutional guidelines, the objective of this study was to determine baseline opioid prescribing patterns in a single high-volume specialist-referral breast cancer center. We hypothesized that opioid prescribing practices varied between procedures and operating surgeons. We performed a retrospective analysis of all women undergoing breast cancer surgery (any-stage) between September and December 2019. Opioid prescriptions at discharge were converted to milligram equivalents of morphine (MEM). Patients from a surgeon who only performed 2 surgeries were excluded, as was a patient who received over 2000MEM. The primary outcome of interest was MEM at discharge. Multiple linear regression was used to identify independent risk factors for increased MEM. 152 patients met inclusion criteria, of which 67.1% underwent partial mastectomy. Median age was 63(IQR 51.5-71). All but one patient (99.3%) received an opioid prescription at discharge, with median MEM of 112.5(IQR 75-150). 80.8% were prescribed co-analgesia. The prescriber was a trainee in 41.7% of cases. 5 patients (3.5%) required an opioid renewal. On multivariate analysis, patients undergoing total mastectomy and/or axillary lymph node dissection were at increased risk of receiving more MEM (ß=23 p=0.037 and ß=32 p=0.029 respectively). However, the factor with greatest association with MEM was operating surgeon (ß=92 p<0.001). A resident prescriber was not associated with an increase in MEM prescribed. In a tertiary care center, the operating surgeon has the greatest influence on opioid prescribing practices. These findings support the need for a standardized approach to optimize prescribing and reduce opioid-related harms after oncologic breast surgery.

Figure 1. Miligram Equivalents of Morphine Prescribed by Breast Surgeons after Partial and Total Mastectomy

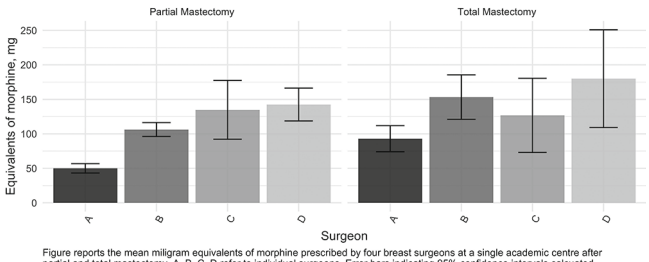


Figure reports the mean miligram equivalents of morphine prescribed by four breast surgeons at a single academic centre after partial and total mastectomy. A, B, C, D refer to individual surgeons. Error bars indicating 95% confidence intervals calcuated using the delta method

P51

The Breast Cancer Surveillance Consortium Model Accurately Predicts Invasive Breast Cancer Risk Among Women with LCIS

I. Eroglu,[1]* V. Sevilimedu,[1] T. King,[2] M. Pilewskie.[1] *1. Surgery, Memorial Sloan Kettering Cancer Center, New York, NY; 2. Dana-Farber/Brigham and Women's Cancer Center, Boston, MA.*

Background The Breast Cancer Surveillance Consortium (BCSC) model is used to predict invasive breast cancer risk among women based on age, race, family history, breast density, and history of benign breast diagnoses, including lobular carcinoma in situ (LCIS), although the validation studies for this model included few women with this lesion. Other risk-prediction models have been found to over-estimate risk among women with LCIS and therefore we sought to evaluate the accuracy of the BCSC model among women with LCIS. Methods Women with LCIS diagnosed between 1983 and 2017 in ongoing surveillance were identified from a prospectively maintained database. The BCSC score was calculated for each woman; those with a prior history of breast cancer, unknown breast density, and those under age 35 or over 74 were excluded. The Kaplan-Meier method was used to estimate invasive cancer-free probability. Receiver operating characteristic (ROC) analysis was used to analyze the discriminative capacity of the model. A ROC of 0.8 or higher is considered an indicator of good discriminative ability. Results A total of 1302 women with LCIS criteria were included. The median age at LCIS diagnosis was 50 years, the cohort is 90% white, 30% have a first-degree relative with breast cancer, and 79% have mammographic BIRADS C/D breast density. At a median follow-up of 7 years, 152 women (12%) developed invasive cancer (5 with bilateral disease). The median age at cancer diagnosis was 55 years and the median crude time from LCIS diagnosis to cancer was 4.6 years. The Kaplan Meier estimate of cumulative incidence of breast cancer at 5 years was 7.1% (95% confidence interval (CI) 5.6, 8.7) and 10 years was 13.3% (95% CI 10.9,15.6). The median 5- and 10-year BCSC scores were 4.9 and 10.4, respectively. The median 10-year BCSC score was significantly lower than the 10-year Tyrer-Cuzick score (10.4 vs 20.8, respectively, p<0.001). The ROC for 5-year and 10-year BCSC scores were 0.593 and 0.587 respectively. Calibration curves are shown in the Figure. Conclusions The BCSC model appears to accurately predict invasive breast cancer risk with fair discrimination in women with LCIS.

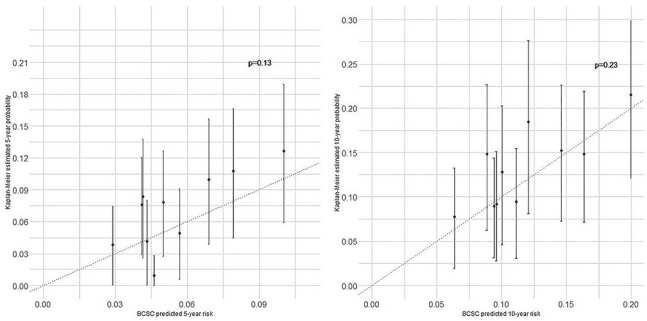


Figure 1: Calibration of the BCSC risk score for predicting 5-year and 10-year cancer risk

P52

Non-Operative Management of Fibroepithelial Lesions: Understanding When Phyllodes Tumors May Be Missed

D. Mousadoust,* L. Chen, B. Wen, C.k. Dingee, A. Bazzarelli, U. Kuusk, J. Pao, R. Warburton, E. McKevitt. *University of British Columbia, Vancouver, BC, Canada.*

Introduction: Fibroepithelial lesions (FEL) range from benign fibroadenoma (FA) to malignant phyllodes tumor (PT). It is sometimes difficult to distinguish FA from PT on core needle biopsy (CNB) due to overlapping histological features, however pathologists will often indicate when FA is thought to be likely or if there are features suspicious for PT on CNB (QPT). This study looks at outcomes of patients that had PT diagnosed following a CNB diagnosis of FA to see whether the conventional recommendation for excision at 3 cm is justified. Methods: Patients having surgery with FEL on CNB at our hospital from 2009-2018 were identified from a prospective database and charts were reviewed to determine recurrence for those patients diagnosed with PT. Univariable and multivariable logistic regression analysis was conducted to identify the risk factors of upstage to PT and trend analysis was performed to assess tumor size cut offs. Results: Of 627 patients with FEL, 405 had CNB of FA. A total of 110 cases of PT were identified upon surgical excision, 28 patients had CNB of FA, and the remainder had QPT. Follow-up was available for 86 with a mean of 56 months; 6 patients had recurrence of PT, all of whom had QPT on CNB. All patients diagnosed with PT following CNB of FA had enlarging lesions with a mean size of 38.3 mm. There were 3 cases of borderline and 24 benign PT. The finding of PT was associated with increasing age and size on multivariate logistic regression. The risk of finding PT at different size thresholds is outlined in Table 1, but if pathology size is considered there was only one PT <30mm. For patients with FA ≥30 mm, three had borderline PT and there was no recurrence at a mean of 48 months, for <30mm all had benign PT and no recurrence at a mean of 33 months. Conclusion: Traditionally, CNB diagnosed FA larger than 3 cm have been surgically excised to avoid missing PT. Our data does not support routine excision of FAs at 3 cm and we recommend that excision of FA be 4 cm based on size alone or 3 cm and enlarging. Patients with CNB diagnosis of QPT should continue to have excision due to high risk of PT and association with recurrence.

Table 1. Risk of upstage to PT among FA tumors by three thresholds of largest clinical or imaging tumor size, stratified by whether they were enlarging.

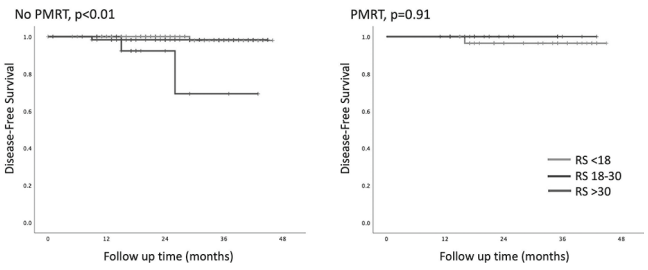
		Max Size (mm)	Max size (mm)	Max size (mm)	Max size (mm)	Max Size (mm)	Max size (mm)
		<25	≥25	<30	≥30	<40	≥40
Enlarging	No	0/132	0/84	0/153	0/63	0/190	0/26
		(0%)	(0%)	(0%)	(0%)	(0%)	(0%)
Enlarging	Yes	1/46	26/118	4/67	23/97	11/112	16/52
		(2.2%)	(22.0%)	(6.0%)	(23.7%)	(9.8%)	(30.8%)

P53

Association of the 21-Gene OncotypeDX RS™ with Postmastectomy Radiation Decisions in Early Stage Hormone-Receptor Positive Breast Cancer O. Kantor,[1]* J. Means,[1] R.A. Freedman,[2] J.R. Bellon,[2] E.A. Mittendorf,[1] T. King.[1] *1. Surgery, Brigham and Women's Hospital, Boston, MA; 2. Dana Farber Cancer Institute, Boston, MA.*

BACKGROUND: Higher OncotypeDX RS has been associated with an increased risk of locoregional recurrence (LRR) after mastectomy, suggesting that RS may help identify women with hormone-receptor positive, HER2-negative (HR+HER2-) breast cancer who will benefit from postmastectomy radiation therapy (PMRT). METHODS: Analysis of a prospective database identified 260 patients with 264 HR+HER2- cT1-2N0 breast cancers treated with upfront mastectomy and subject to RS testing from 2015-2018. Here we examine trends in PMRT use, LRR-free survival (LRRFS) and disease-free survival (DFS) by RS. RESULTS: Among 264 tumors, 132 (50%) were stage I, 123 (47%) stage II, and 9 (3%) stage III. RS was <18 in 165 (63%), 18-30 in 77 (29%), and >30 in 22 (8%). Chemotherapy (CT), hormonal therapy and PMRT were administered in 58 (22%), 248 (95%) and 59 (22%) cases respectively. On adjusted multivariable analyses, receipt of PMRT was significantly associated with increasing pathologic T (OR 3.2 for pT2, OR 61.3 for pT3) and N category (OR 36.9 for pN1mi, OR 1605.0 for pN1), multifocal disease (OR 4.4) and LVI (OR 13.6). Higher RS or CT use were not associated with receipt of PMRT (p>0.53). Among 70 (27%) patients with pN1 disease, 71% had PMRT and RS distribution was similar to the overall cohort (63% RS <18, 29% RS 18-30, 9% RS >30); PMRT receipt was similarly not associated with higher RS in this subset (p>0.44). At a median follow up of 25 months, there have been 5 (2%) recurrences, including 1 LRR. On Kaplan-Meier analysis, RS >30 was associated with decreased DFS in patients without PMRT (p=0.01), although not in patients with PMRT (p=0.91) [Figure]; this finding persisted when adjusted for CT use. There were no significant differences in LRRFS by RS. CONCLUSIONS: In this prospective analysis, PMRT decisions did not appear to be impacted by RS status although RS >30 was associated with decreased DFS in patients who did not receive PMRT. LRR events were rare and could not be analyzed by RS result. While longer follow up and additional prospective studies are needed, these results suggest that RS should be considered in decisions for PMRT.

Figure. Kaplan-Meier Curves of DFS, Stratified by receipt of PMRT (n=260).



P54

Effect of Endocrine "Bridging" on Ki67 Index for ER-Positive Invasive Breast Cancer Patients Impacted by Surgical Delays Due to the COVID-19 Pandemic J. Schwartz,* P. McAuliffe, J. Lee, L. Kirkpatrick, R. Johnson, A. Soran, J. Steiman, R. Bhargava, E. Diego. *UPMC Magee Women's Hospital, Pittsburgh, PA.*

INTRODUCTION: Neoadjuvant Endocrine Therapy (NET) is effective for tumor downsizing in patients (pts) with estrogen receptor positive (ER+) breast cancer (BC). Change in Ki67 indicates response to NET. During the COVID-19 pandemic, elective operations were delayed to preserve resources. Many pts with ER+ BC were "bridged" with NET, for undefined intervals, until performing surgery was deemed appropriate. We evaluated the effect of bridging NET on Ki67 during this time. METHODS: Pt, tumor characteristics and clinical course were prospectively recorded for all pts with T1-3,N0-1 ER+ BC seen from March-May 2020 at a single academic institution who received pre-operative NET only. Ki67 was determined on pre-NET core biopsies and post-NET surgical specimens. Ki67 was categorized as follows: low (≤10%), moderate (11-25%), high (26-50%) and very high (>50%). RESULTS: 50 pts were identified. Mean age was 63 years; 14% were premenopausal. Histology was ductal in 90% and lobular in 10%. Duration of NET was 5+/-3.2 wks (mean+/-SD). 70% had breast conservation and 30% had mastectomy. 86% had sentinel node biopsy, 4% had axillary node dissection and 10% did not have axilla surgery. At baseline, Ki67 distribution was as follows: 18% low, 52% moderate, 22% high and 8% very high. After NET bridge, Ki67 decreased or remained unchanged in 74%, but increased in 26% of tumors. The changes in Ki67 and tumor distribution pre- and post-NET are displayed in Table 1. CONCLUSIONS: During the COVID-19 pandemic, many pts had decreased Ki67 with NET bridge. Marginally increased Ki67 may be explained by tumor heterogeneity, but a subset increased by >10%, suggesting increased tumor proliferation during the delay. These data support using NET as a bridge to surgery in select pts during a pandemic when resources are limited. Optimal pt selection is key, as it is unknown whether an increase in Ki67 during this period may impact BC outcomes. Further follow-up of this pt subset will provide valuable information for triaging ER+ BC pts during resource-poor periods.

Changes in Ki67 and Tumor Distribution pre- and post- NET

Pre-NET Ki67	n (%)
Low (10%)	9 (18)
Moderate (11-25%)	26 (52)
High (26-50%)	11 (22)
Very high (>50%)	4 (8)
Total	50 (100)
Post-NET Ki-67	n (%)
Low (≤10%)	26 (52)
Moderate (11-25%)	17 (34)
High (26-50%)	7 (14)
Very high (>50%)	0 (0)
Total	50 (100)
Post-NET change in Ki-67	n (%)
Decreased >10%	22 (44)
Decreased 1-10%	12 (24)
No change	3 (6)
Increased 1-10%	8 (16)
Increased >10%	5 (10)
Total	50 (100)

P55

Lack of Disparity in the Surgical Treatment of a Diverse Population of Breast Cancer Patients Undergoing Neoadjuvant Chemotherapy C.Y. Lowder,* H. Emrani, C. Calvo-Strube, A. Garza, C. Abdou, D.E. Farr, J. Huth, E. Clifford, M. Leitch, R. Wooldridge. *Department of Surgical Oncology, University of Texas Southwestern Medical Center, Dallas, TX.*

INTRODUCTION: There are known disparities in healthcare and having a breast cancer diagnosis is no exception. In this study, we examine common disparity factors in patients undergoing neoadjuvant chemotherapy (NAC), to determine if any factor affects the final surgery these patients go on to have. METHODS: Using a retrospectively constructed database, 529 patients with breast cancer who underwent NAC were identified between 1998 and 2017. These patients were treated in either a county hospital or university private hospital; all managed by medical school faculty surgeons. Disparity covariates including surgeon gender, hospital setting, age at diagnosis, race, primary

language, comorbidities, and insurance status were analyzed against type of breast surgery and reconstruction decision as endpoints. Also analyzed was whether or not the patient was offered breast conserving therapy (BCT), and their ultimate decision. RESULTS: 335 patients underwent total mastectomy (TM) and 194 underwent partial mastectomy (PM). Better imaging and clinical response to NAC preoperatively was associated with PM on univariate analysis ($p<0.001$, $p<0.005$), and having a genetic mutation identified preoperatively correlated to TM more often than PM ($p<0.005$). Surgeon recommendation of BCT was associated with more PM than TM on both uni- and multivariate analyses ($p<0.001$). No significance was found in final surgery type when analyzing race, primary language, age at diagnosis, county versus private hospital, or surgeon gender. Immediate reconstruction was more likely to be performed in the private hospital setting, at a younger age, and in patients with private insurance ($p<0.05$). CONCLUSION: The surgeon's recommendation for breast conserving surgery was a significant predictor of the final type of breast surgery, and not influenced by any disparity factor. Patients offered partial mastectomy tended to accept, across all groups. The decision for immediate reconstruction was influenced by disparity factors, but interestingly, no difference was found in type of final breast surgery between any disparity factor, translating to equal treatment across all groups.

Significant factors affecting final surgery

Covariate		Univariate			Multivariate		
	N	PM (%)*	TM (%)*	P value	OR	95% CI	P value
Total pts	529	36.7	63.3	-	-	-	-
Imaging response to NAC:	.	.	.				
None / progression	67	17.9	82.1				
Complete response	91	58.2	41.8	<0.001	-	-	-
Calcifications only	32	37.5	62.5				
Less than 50% reduction	93	44.1	55.9				
More than 50% reduction	122	43.4	56.6				
Clinical response to NAC:	.	.	.				
None	68	29.4	70.6	0.003	-	-	-
Complete	180	50.0	50.0				
Improvement	186	36.0	64.0				
Genetic mutation:	.	.	.				
No	162	37.7	62.3	0.004	-	-	-
Yes	58	17.2	82.8				
Recommended for BCT:	.	.	.		.	.	
No	202	5.4	94.6	<0.001	-	-	<0.001
Yes	263	64.6	35.4		0.024	(0.012,0.046)	
	N	No Recon (%)*	Immed. Recon. (%)*	P value	OR	95% CI	P value
Age at diagnosis	485	50+/-10**	45+/-10**	<0.001	0.943	(0.920,0.966)	<0.001
Insurance type:	.	.	.		.	.	
None	94	87.2	12.8		-	-	
Medicare/Medicaid	110	78.2	21.8	<0.001	2.235	(0.090,5.102)	0.001
Parkland Health plus	58	91.4	8.6		0.850	(0.269,2.683)	
Private	206	56.8	43.2		3.452	(1.647,7.231)	
Hospital:	.	.	.		.	.	
County hospital	211	88.6	11.4	<0.001	-	-	<0.001
University private hospital	274	60.9	39.1		2.889	(1.578,5.291)	

*Percentage of total N in each treatment category are reported in table. **Age reported as age range, not percentage.

P56

Are Surgeons Still Doing Sentinel Node Biopsies In Older Women?

A. Chagpar,[9]* T. Tsangaris,[1] c. garcia-cantu,[3] M. Howard-McNatt,[2] A. Chiba,[2] a. berger,[1] E.A. Levine,[2] J. Gass,[4] K.K. Gallagher,[5] S. Lum,[6] R. Martinez,[3] A.I. Willis,[1] S. Pandya,[4] E.A. Brown,[7] A. Fenton,[8] A. Mendiola,[8] M. Murray,[8] V. Haddad,[3] N. Solomon,[6] M. Senthil,[6] D. Edmonson,[4] M. Lazar,[1] J. Namm,[6] F. Li,[9] M. Morris,[9] N. McGowan,[10] Y. Avitan,[5] B. Yoder,[11] L. Walters,[7] T. McPartland,[9] E. Dupont.[10] *1. Thomas Jefferson University, Philadelphia, PA; 2. Wake Forest University, Winston-Salem, NC; 3. Doctors Hospital at Renaissance, Edinburg, TX; 4. Women and Infants Hospital, Providence, RI; 5. University of North Carolina, Chapel Hill, NC; 6. Loma Linda University, Loma Linda, CA; 7. Beaumont Hospital, Troy, MI; 8. Cleveland Clinic Akron General, Akron, OH; 9. Yale University, New Haven, CT; 10. Watson Clinic, Lakeland, FL; 11. MicroPath Laboratories, Lakeland, FL.*

INTRODUCTION: SSO published guidelines suggesting that surgeons should not routinely perform sentinel lymph node (SLN) biopsies for patients (pts) ≥ 70 years of age (yo) with hormone receptor positive, her2 negative (HR+her2-) early stage invasive breast cancer (IBC). METHODS: We evaluated HR+her2- early stage IBC patients (pts) who were accrued to a multicenter trial between 2016-2018. Lymph node (LN) evaluation was left to the discretion of the treating surgeon. We sought to determine whether those ≥ 70 yo were treated differently in terms of LN staging than their younger counterparts, the results of the SLN biopsy, and its impact on adjuvant chemotherapy (ctx). RESULTS: 229 pts with IBC < 2 cm participated in this study; 76 (33.2%) were ≥ 70 yo. ER, PR and her2 status was known in 201 (87.8%). The proportion of pts who were HR+her2- was similar in the older vs. younger cohort (89.9% vs. 86.4%, respectively, p=0.653). Of those who were HR+her2-, the older cohort was no different from the younger in terrms of pt race, ethnicity, size and grade of the IBC, palpability, EIC and LVI. SLN biopsy was equally likely to be performed in the older and younger cohorts (91.9% vs. 97.4%, respectively, p=0.132), and final LN positivity was also similar for both groups (12.6% vs. 14.0%, respectively, p=0.812). Pts in the older group were less likely to receive ctx (5.9% vs. 19.4%, p=0.029), as were LN negative patients (9.9% vs. 47.6% for LN positive patients, p<0.001). On multivariate analysis, both of these factors were found to be independent predictors of receipt of ctx. While younger pts were five times as likely to receive ctx than their older counterparts (OR=5.295; 95% CI: 1.297-21.612, p=0.020) independent of LN status, those who were LN positive were ten times as likely to receive ctx than their LN negative counterparts (OR=10.772; 95% CI: 3.423-33.900, p<0.001) independent of age. Indeed, among pts ≥ 70 yo, LN positive patients were more likely to receive ctx than those who were LN negative (25.0% vs. 2.6%, p=0.071). CONCLUSION: Despite the "Choosing Wisely" guideline, over 90% of pts ≥ 70 yo with HR+her2- IBC underwent a SLN biopsy. SLN status influenced the receipt of adjuvant ctx in these pts.

P57

Patients Awaiting Mastectomy Report Increased Depression, Anxiety, and Decreased Quality of Life Compared to Patients Awaiting Lumpectomy for Treatment of Breast Cancer

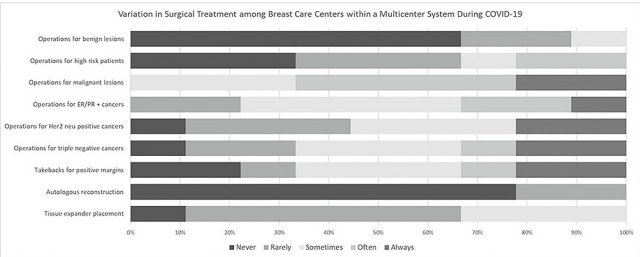
E. McKevitt,[1]* G. Liu,[1] R. Warburton,[1] C.k. Dingee,[1] J. Pao,[1] A. Bazzarelli,[1] T. Crump,[2] J. Sutherland.[1] *1. University of British Columbia, Vancouver, BC, Canada; 2. University of Calgary, Calgary, AB, Canada.*

Introduction: There is a trend to increasing mastectomy (TM) for treatment of breast cancer despite studies demonstrating equivalent survival and better postoperative outcomes with lumpectomy (PM). There is a need to better understand the constellation of physical and mental health conditions patients face in the preoperative period. The objective of this research is to measure aspects of patient's preoperative mental health and identify differences in between patients scheduled for TM and PM. Methods: This study was based on a prospectively recruited cohort of consecutive patients scheduled for breast cancer surgery at our institution between April 2016 and July 2020. Preoperatively, participants completed a survey which included the Patient Health Questionnaire (PHQ-9) for depression, the General Anxiety Disorder-7 (GAD-7) for anxiety, the pain intensity (P), interference with enjoyment of life (E), and interference with general activity (G), known as the PEG, for pain and the EQ-5D(5L) for health status. Participants also reported their chronic health conditions. Scores were calculated for each instrument and compared for TM and PM. Results: The overall response rate among all eligible patients was 31% with 667 participants. The average age was 59 years. The most common comorbidities were hypertension (27%), arthritis (24%) and depression (13%.) Among participants, 477 were scheduled for PM (71.5%) and 190 were scheduled for TM (28.5%.) TM patients reported more severe symptoms of anxio-depressive disorders: with higher levels of depression (5.3 versus 4.2; $p < 0.01$) and anxiety (5.7 vs 3.9; $p < 0.01$.) There were no differences in pain. Participants scheduled for PM reported high health status compared to participants scheduled for TM (75.0 vs 70.7; $p < 0.01$.) Conclusion: Patients scheduled for TM reported more severe symptoms of depression and anxiety than those scheduled for PM. This information will be useful when counselling patients about surgical options. Preoperative referral to mental health providers may offer an opportunity to enhance perioperative care.

P58

A Multicenter Review of Variation in Breast Cancer Surgery During COVID-19 S.K. Serres,* M.G. Valero, S. Pandya, B. Fan, A. Mele, T.A. James. *Surgery, Beth Israel Deaconess Medical Center, Boston, MA.*

INTRODUCTION: National organizations provided guidelines for the appropriate treatment of breast cancer corresponding to different phases of the Covid-19 pandemic. The present study aimed to assess the variation in diagnostic and treatment protocols within one health care system. METHODS: We surveyed the directors of breast care centers within a single, multi-hospital system. Participants completed a survey ascertaining information related to surgery, clinic visits, and imaging procedures performed at their respective institutions during the timeframe from 3/1/2020 to 5/15/2020 (initial COVID-19 surge in Massachusetts). RESULTS: In total, 9 of 11 surveyed leaders participated, representing 9 separate breast centers. Eight of the nine respondents (88.9%) indicated that there were uniform standards at their respective institutions for which cases should undergo an operation. 77.8% (n=7) indicated that their center continued diagnostic mammography during the study timeframe. No centers conducted screening mammography. All institutions continued seeing new patients, with the percentage of in-person visits ranging from 10-100% (mean59.0%, SD34.4). 77.8% continued to see postoperative patients, with a range of 5-82% in-person (mean32.3%, SD22.9). Compared to baseline, total operative volume ranged from 10-65% (mean29.9%, SD18.2), and clinic volume ranged from 10-65% (mean31.0%, SD18.3). Seven institutions initiated neoadjuvant therapy in patients who would have previously had surgery. Variation was noted in specific surgical procedures performed during the timeframe (Figure 1). When asked about the impact of Covid-19, 6 respondents (66.7%) indicated a somewhat negative impact, 2 respondents (22.2%) reported a significantly negative impact, and one respondent (11.1%) noted no impact. CONCLUSIONS: Within one multi-hospital health system, considerable variation was observed in the surgical treatment provided by breast centers experiencing the height of the pandemic at the same time. This variation may echo practice variation on a national level and indicates the need for greater alignment, evidence-based practice, or facility-specific considerations to drive care protocols during the pandemic.



P59

Axillary Response to Neoadjuvant Therapy in Node-Positive, Estrogen Receptor Positive, HER2 Negative Breast Cancer Patients O. Friedman-Eldar,* T. Ozmen, F. Valle Reyes, N. Goel, Y. Tjendra, M. Moller, S.B. Kesmodel, D. Franceschi, E. Avisar. *University of Miami, Jackson Memorial Hospital, Miami, FL.*

Introduction: The role of neoadjuvant therapy (NAT) for patients with node-positive, estrogen receptor-positive (ER+), HER2 negative breast cancer is unclear. One of the potential benefits is axillary downstaging in an effort to avoid axillary dissection. The objective of this study is to evaluate axillary response to NAT, either chemotherapy (NCT) or endocrine therapy (NET), and identify potential predictors of response. Methods: Prospectively collected database was queried for node positive ER+ HER2- breast cancer patients treated with NAT and surgery from January 2011 to September 2020. Axillary response was categorized into pathologic complete response (pCR) vs. no pCR, and was correlated to demographic and clinicopathologic parameters in a logistic regression model. Results: 180 patients were identified and included in the study. The overall axillary pCR rate was 12.8% (23/180). NCT and NET achieved a response rate of 14.4% (20/139) and 7.3% (3/41), respectively (p=0.23). Among the 23 patients with ypN0, 13 (56.5%) underwent sentinel node biopsy without completion axillary dissection. A significantly higher axillary pCR rate was identified in patients with clinical stage II at diagnosis, 12/60 (20%), compared to stage III, 11/120 (9.2%) (p=0.04). No correlation was found between axillary pCR and age at diagnosis, race, grade, progesterone receptor status or histology. Conclusions: For patients with node-Positive ER+ HER2- breast cancer, a lower burden of disease at time of diagnosis (stage II) is associated with a significantly higher axillary pCR, enabling to spare those patients an axillary dissection. Further studies are necessary to define the role of genomic profiling in the prediction of axillary response.

P60

Accuracy of Preoperative Imaging Estimates: Optimizing the Planning for Breast Conserving Surgery H. Kapur,* L. Chen, A. Bazzarelli, R. Warburton, J. Pao, C.k. Dingee, E. McKevitt. *University of British Columbia, Vancouver, BC, Canada.*

Introduction: There is current concern for overtreatment of breast cancer and Surgical Quality indicators (QIs) including the breast conserving surgery (BCS) rate have been published by European and American Breast Cancer Societies. As an increasing number of breast cancers are nonpalpable, recommendations are often based on preoperative imaging sizes (PIS). This study compared PIS to postoperative pathology sizes (PPS) with a view to identifying opportunities to de-escalate surgery. Methods: Patients having breast cancer surgery from 2013-2017 were identified using our institution's database and mammography (MMO), ultrasound (US), MRI size, and largest PIS were compared to PPS using paired t-tests. Differences between PIS and PPS were calculated and visualized on a boxplot, stratified by modality and imaging size category. Results: We identified 3015 patients meeting study criteria with a mean age of 59.3 years. On preoperative biopsy, 74% had invasive ductal carcinoma (IDC), 2% invasive lobular carcinoma (ILC), 18% ductal carcinoma in situ (DCIS) and 6% had other histology. In total, 2838 (94.1%) patients received treatment for a first breast cancer, and 1797 (60%) underwent BCS. Mean PIS was 18.8mm on US (N=1941), 21.5mm on mammography (N=1838), 28.2mm on MRI (N=160), and 20.2mm on PPS. Grouping all imaging sizes regardless of modality, 61.7% were ≤20mm, 28.0% were between >20 and 40mm, and 10.3% were >40mm. DCIS ≤20mm on PIS were underestimated except via MRI. At >20mm, PIS overestimated size, although US appeared reliable above 20mm (Figure 1). Conclusion: Ultrasound and mammography tended to underestimate tumor size below 2cm, but above 2cm ultrasound tended to be more accurate, while mammography overestimated tumor size. Patients can be reassured that imaging size can be used dependably by surgeons to plan BCS at sizes recommended by QIs for DCIS and invasive disease.

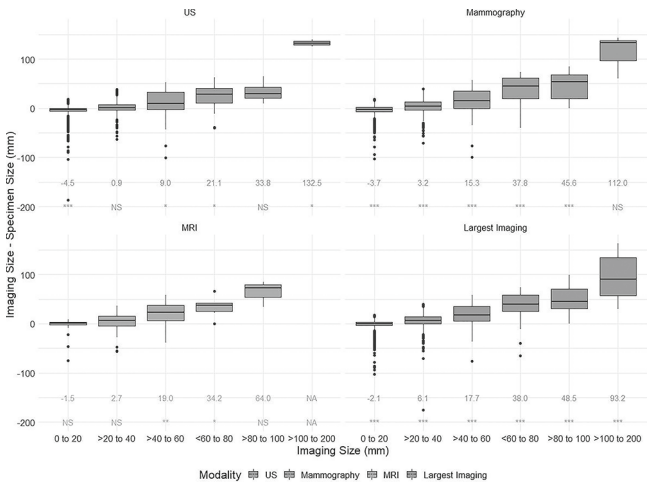


Figure 1. Difference between imaging and final pathology size by imaging size. Negative mean differences represent underestimates of PPS by PIS, while positive values represent overestimates. Significance is labeled as non-significant (NS), < 0.05 (*), <0.01 (**), and <0.001 (***).

P61

Chyle Leak After Axillary Node Clearance in Breast Cancer Surgery: A Rare Complication and a Proposed Management Strategy from British and Italian Experience A. Ashoor,[1]* G. Lissidini,[2] U. Datta,[1] L. Bertoldi,[2] P. Veronesi,[2] M. Ley Hui Tan.[1] *1. Sandwell and West Birmingham NHS Trust, Birmingham, United Kingdom; 2. European Institute of Oncology, Division of Breast Surgery, Milan, Italy.*

Introduction: Chyle leak is a recognized complication in abdominal, thoracic and neck surgery; in breast cancer surgery, axillary chyle leak is a rare complication with a reported incidence of less than 0.5%. There is lack of consensus and treatment guidelines on chyle leak management after axillary node clearance, but early post-operative leak requires rigorous scrutiny where efforts are made to avoid delays in commencing adjuvant treatment. Here we present our experience in the management approaches to chyle leak after axillary node clearance following breast cancer surgery. Methods: We conducted a retrospective multicentric observational study of chyle leak after axillary surgery for breast cancer in the United Kingdom and Italy between January 2013 to May 2020. Data were collected from prospective databases and patients' records. Primary outcome was type of management; conservative or surgical. Secondary outcomes were out or in patient management, and delay to adjuvant therapy. Results: Over 77 months, 4 patients developed chyle leak following axillary node clearances out of 655 done in the United Kingdom and 4969 in Italy. All had left sided clearances: 3 had level III node clearance with expander reconstruction; and 1 had level II node clearance with therapeutic mammoplasty. All leaks appeared in the early postoperative phase within 5 days. Leak duration between 11 and 30 days with a maximum daily output of 600cc. All cases were treated conservatively with nutrition team support. Managment included but not exclusively to each patient were; low fat diet, total parental nutrition and medium chain triglycerides supplements. Two patients were treated in outpatient settings; 2 needed in patient hospital stay. None had delays in adjuvant treatment. Conclusion: Chyle leak is rare and challenging complication in breast cancer surgery after axillary dissection. A risk seems to be associated with with left sided surgery. Conservative management with nutritional support has been shown to be successful with no delays to adjuvant treatment, and does not interfere with breast immediate reconstruction.

Case no.	Age	Side	Type of Breast surgery	Level of axillary node clearance (nodal yield)	Post surgery staging	Chyle leak diagnosis at post-operative day	Type of treatment	Duration of leak (days)	Maximum daily output reached (cc)
1	40	Left	Therapeutic mammoplasty (after completion of neoadjuvant chemotherapy)	II (17/18)	Residual IDC ypT1N3M0 ER postive HER2 negative	5	Conservative (low fat diet and oral protein supplement)	12	376
2	42	Left	Nipple sparing mastectomy and expander reconstruction	III (3/31)	Multifocal IDC pT2N1M0 ER postive HER2 negative	3	Conservative (low fat diet and medium chain triglycerides supplements)	11	150
3	44	Left	Nipple sparing mastectomy and expander reconstruction	III (3/24)	IDC pT2N1M0 ER postive HER2 negative	1	Conservative (total parental nutrition and low fat diet and medium chain triglycerides supplements)	30	600
4	52	Left	Nipple sparing mastectomy and expander reconstruction	III (1/55)	Multifocal IDC pT1N1MO ER postive HER2 positive	2	Conservative (low fat diet)	13	140

P62

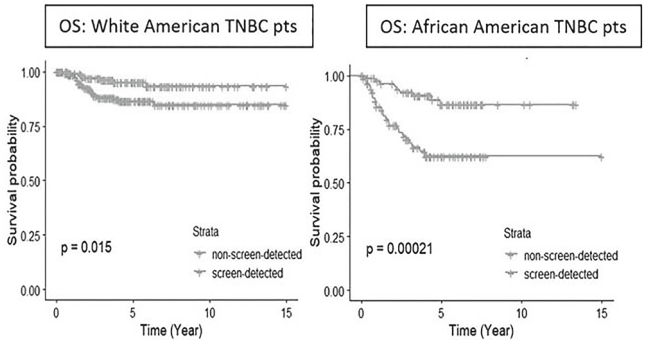
Determining Biomarkers that Predict Lymph Node-Positive Invasive Breast Cancer in Older Women F.A. Angarita,* M. Oshi, K. Takabe. *Breast surgery, Roswell Park Comprehensive Cancer Center, Buffalo, NY.*

Introduction: The Society of Surgical Oncology's Choosing Wisely campaign recommends against the routine use of sentinel lymph node biopsy in older women (≥70y) with clinically node-negative (N0), hormone receptor-positive and HER2-negative invasive breast cancer. Using an age cut-off to make this decision can be misleading as fitness levels are individual. Therefore, it would be beneficial if lymph node positive (N+) tumors could be predicted using biomarkers within the primary tumor. This study aims to determine biomarkers that predict lymph node metastasis among older women (≥70y) with invasive breast cancer. Methods: A total of 6,170 breast cancer patients were reviewed across 3 large cohorts with transcriptome: The Cancer Genome Atlas Breast Cancer (TCGA-BRCA), Molecular Taxonomy of Breast Cancer International Consortium (METABRIC), and GSE96058. Immune and connective tissue infiltration was compared between N+ and N0 women. Results: A total of 1,708 patients were analyzed: TCGA (n=211), METABRIC (n=510), and GSE96058 (n=987). N+ tumors were significantly associated with shorter disease free (DFS), disease specific (DSS), and overall (OS) survival. Compared to N0 tumors, N+ tumors were significantly infiltrated by $CD4^+$ cells, dendritic cells, T helper type 2 cells, and B-cells. N+ tumors showed significantly enhanced cytolytic activity compared to N0 tumors. These data were not reproducible in the TCGA cohort due to smaller sample size. Infiltration of fibroblasts, adipocytes, endothelial cells, and pericytes in the primary tumor did not differ between N+ and N0 women. The oxidative phosphorylation gene set was significantly enriched in N+ tumors in the METABRIC cohort (normalized enrichment score = 1.66, false discovery rate = 0.06) but not the TCGA or GSE96058 cohorts. There was no enrichment of cell proliferation-related gene sets amongst N+ women, which we have previously demonstrated to associate with breast cancer progression and metastasis. Conclusions: To date, no N+ biomarker was identified across several transcriptome cohorts. Additional studies are underway to elucidate biomarkers that predict N+ amongst older women with invasive breast cancer.

P63

Screening Mammography Mitigates Breast Cancer Disparities via Early Detection of Triple Negative Breast Cancer S. Bayard,[1]* G. Fasano,[1] Y. Chen,[2] M. Davis,[1] M. Drotman,[1] J. Bensenhaver,[2] A. Swistel,[1] R. Simmons,[1] J. Marti,[1] L. Newman.[1] *1. Breast Surgery, Weill Cornell Medicine, New York, NY; 2. Henry Ford Health System, Detroit, MI.*

INTRODUCTION: Screening mammography improves breast cancer survival through early detection, but Triple Negative Breast Cancer (TNBC) is more difficult to detect on mammography compared to non-TNBC and has lower survival compared to non-TNBC even when detected early. TNBC is twice as common among African American (AA) compared to White American (WA) women, thereby contributing to the 40% higher breast cancer mortality observed in AA women. The role of screening mammography in addressing breast cancer disparities is therefore uncertain. METHODS: Outcomes were evaluated for TNBC pts treated in prospectively-maintained databases of academic cancer programs in two metropolitan cities of the Northeast and Midwest, 1998-2018. Median follow-up was 4.6yrs in the Northeast and 3.8yrs in the Midwest. RESULTS: Of 756 TNBC pts, 301 (39.8%) were mammographically screen-detected; 46% of 189 AA and 38.5% of 460 WA pts had screen-detected TNBC (p=0.16). Median age for Midwest pts was 61yrs v. 56yrs for the Northeast (p<0.001). Of 257 TNBC pts age ≤50 yrs, 25.3% had screen-detected disease compared to 47.3% of 499 TNBC pts >50yrs (p<0.0001). 220/301 (73.1%) screen-detected TNBC pts had T1 lesions compared to 118/359 (32.9%) non-screen-detected pts (p<0.0001). Screen-detected TNBC was also more likely to be node-negative (51.9% v. 40.4%; p<0.0001). AA pts had lower 5-yr OS compared to WA (74% v. 90.9%; p<0.0001), but age did not significantly impact survival. 5-yr OS was better for screen-detected TNBC compared to non-screen-detected TNBC (92.8% v. 81.5%; p<0.0001) in the entire cohort, and the magnitude of this effect was most significant among AA pts (Fig 1); 5-yr OS for screen-detected v. non-screen-detected AA TNBC 86.6% v. 62.5%; p=0.0002; and for WA TNBC 95.1% v. 86.5%; p=0.015. These screening-related survival benefits were consistent among AA and WA pts when stratified by city. CONCLUSION: Ongoing research regarding race-related breast cancer outcome differences is warranted, but our data from two different cities demonstrate the value of screening mammography in mitigating breast cancer disparities in WA compared to AA women through early detection of TNBC.



P64

Surgical Management of the Axilla Following Neoadjuvant Endocrine Therapy B.M. Murphy,* T. Hoskin, A.C. Degnim, J. Boughey, T.J. Hieken. *Mayo Clinic, Rochester, MN.*

Background: Based on randomized clinical trial data, there has been a marked recent de-escalation of axillary surgery in selected breast cancer patients with low volume axillary disease treated with a surgery first approach. However, these studies did not enroll patients treated with neoadjuvant endocrine therapy (NET) - an approach increasingly used to test response in hormone receptor-positive breast cancer and determine the need for chemotherapy. As little evidence exists to guide axillary surgery for patients treated with NET, we aimed to evaluate the extent of axillary surgery among NET patients in a high-volume contemporary practice. Methods: With IRB approval, we identified patients with invasive breast cancer treated with NET 10/2008 to 11/2019 from our prospective breast surgery registry. Patients presenting with stage IV disease or recurrence were excluded. Statistical analyses were performed using chi-square, Fisher's exact and Wilcoxon rank-sum tests. Results: We identified 195 invasive breast cancers in 187 patients (median age 66 years) treated with NET for a median 177 days. 82 had breast-conserving surgery (BCS) and 113 mastectomy. 84 cases (43%) were clinically node-positive with 8 (9.5%) pN0 following NET; overall 14 (17%) were managed with sentinel lymph node biopsy alone (SLNB), 27 (32%) SLNB+axillary dissection (ALND) and 43 (51%) ALND. Of 111 clinically node-negative patients 11 (10%) had no axillary operation while 72/100 (72%) who did have axillary surgery were pN0; axillary operation was SLNB in 83 (75%), SLNB+ALND in 14 (13%) and ALND in 3 (2%). Axillary operation stratified by breast operation in relation to patient and tumor variables is summarized in the table. Among patients with 1 or 2 positive nodes, SLNB alone was performed more frequently in BCS than mastectomy patients (65% vs 34%, p=0.02). With 35 mos median follow-up, no regional nodal recurrences were observed. Conclusions: We observed de-escalation of axillary surgery among patients with one or two positive nodes following NET, particularly among BCS patients, and no nodal recurrences. These data suggest NET patients might be managed similarly to patients treated with a surgery first approach.

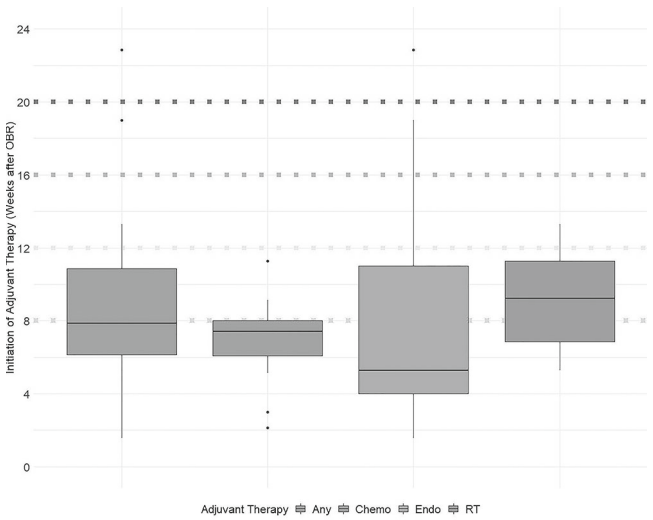
Axillary and Breast Operations After NET

	cN0 (N=111)	cN+ (N=84)	Total (N=195)	p value
Suitable for BCS at presentation				0.79
No	51 (45.9%)	37 (44.0%)	88 (45.1%)	
Yes	60 (54.1%)	47 (56.0%)	107 (54.9%)	
Breast Operation				0.50
BCS	49 (44.1%)	33 (39.3%)	82 (42.1%)	
Mastectomy	62 (55.9%)	51 (60.7%)	113 (57.9%)	
Axillary Operation				<0.001
None	11 (9.9%)	0 (0.0%)	11 (5.6%)	
SLNB only	83 (74.8%)	14 (16.7%)	97 (49.7%)	
SLNB + ALND	14 (12.6%)	27 (32.1%)	41 (21.0%)	
ALND	3 (2.7%)	43 (51.2%)	46 (23.6%)	
Pathologic nodal status				<0.001
pNX	11 (9.9%)	0 (0.0%)	11 (5.6%)	
pN0	72 (64.9%)	8 (9.5%)	80 (41.0%)	
pN+	28 (25.2%)	76 (90.5%)	104 (53.3%)	
Number of LN+ (among pN+ patients)				<0.001
Median (range)	2 (1-39)	4 (1-35)	3 (1-39)	

P65

Time to First Adjuvant Treatment After Oncoplastic Breast Reduction S. Mysuria,[1]* M. Zhang,[1] E. McKevitt,[2] R. Warburton,[2] A. Bazzarelli,[2] J. Pao,[2] L. Chen,[2] U. Kuusk,[2] N. Van Laeken,[2] E. Bovill,[2] K. Isaac,[2] C.k. Dingee.[2] *1. University of British Columbia, Vancouver, BC, Canada; 2. University of British Columbia Department of Surgery, Vancouver, BC, Canada.*

Introduction: Oncoplastic Breast Reduction (OBR) allows breast conservation surgery (BCS) to be combined with breast reduction for select patients. The objective of this study was to measure time to first adjuvant treatment (AT) in OBR patients, and whether their initiation dates conformed to conventional post-BCS treatment windows for radiation, chemotherapy and endocrine management. Methods: Institutional and university ethics boards approved this retrospective review, which included all patients receiving OBR from April 2009 to April 2020. Consecutive patients were identified from OR slates. Data was extracted from a prospectively maintained database and surgeons EMR's. Relative start date (RST) of AT was calculated as time elapsed between the OBR date and earliest start date or the first day post-resolution of delays due to medical reasons or patient preference. Results: This study included 5504 new breast cancer cases, 1629 received mastectomy associated breast reconstruction, and 81 had OBR. OBR patients had unilateral (N=79) or bilateral (N=1) breast cancer, malignant phyllodes tumor (N=1), had bilateral (N=73) or unilateral (N=8) OBR, and had OBR as a first surgery (N=69) or during margin re-excision post-BCS (N=12). Incidental breast cancer was noted in the contralateral reduction in 4 patients, in situ (N=3) or invasive (N=1). Additional surgery post-OBS was required by 7 patients for margin revision (N=6) or sentinel node biopsy (N=1), while 7 had completion mastectomy. No patients required reoperation for debridement, or hematoma evacuation. In total, 72 (88.9%) patients received AT, of which 36 started with radiation, 19 with chemotherapy, and 17 with endocrine. RST averaged 9.4 weeks for radiation, 7.0 weeks for chemotherapy, 8.0 weeks for endocrine, and 8.4 weeks for any AT. Among patients receiving AT, 70 (97.2%) initiated AT by week 16, and 100% of patients that received chemotherapy first initiated AT by week 12. Conclusion: Average time to first adjuvant treatment conformed to local recommendations for chemotherapy 8 upper limit 12 weeks and for radiation 10 upper limit 20 weeks.



Weeks	Any	Chemo	Endo	RT
20	71/72 (98.6%)	19/19 (100.0%)	16/17 (94.1%)	36/36 (100.0%)
16	70/72 (97.2%)	19/19 (100.0%)	15/17 (88.2%)	36/36 (100.0%)
12	61/72 (84.7%)	19/19 (100.0%)	14/17 (82.4%)	28/36 (77.8%)
8	37/72 (51.4%)	13/19 (68.4%)	10/17 (58.8%)	14/36 (38.9%)

Figure 1. Initiation of adjuvant therapy post-OBR. RST of first AT initiated stratified by modality. Horizontal dashed lines are plotted at 8, 12, 16, and 20 weeks to represent windows of initiating adjuvant therapy recommended by local cancer agency or written in protocols. Table (bottom) shows patients that initiated a treatment within the window.

P66

Recurrence of Extensive Ductal Carcinoma in Situ Treated with Breast Conserving Surgery Compared to Mastectomy J. Que,[1]* D. Kim,[1] L. Chen,[1] R.Q. Liu,[2] M. Zhang,[1] C.k. Dingee,[1] R. Warburton,[1] E. McKevitt,[1] U. Kuusk,[1] J. Pao,[1] A. Bazzarelli.[1] *1. Faculty of Medicine, University of British Columbia, Vancouver, BC, Canada; 2. Western University, London, BC, Canada.*

INTRODUCTION: Ductal carcinoma in situ (DCIS) is one of the most commonly identified breast lesions on screening mammography. While other studies have demonstrated the safety of breast conserving surgery (BCS) for large volume DCIS identified on pathology, there is a paucity of evidence showing the non-inferiority of BCS compared to mastectomy (M) for high volume DCIS defined based on pre-operative imaging. METHODS: This retrospective cohort study included patients with extensive areas of DCIS who underwent BCS or mastectomy at a single institution between January 1st, 2012 and December 31st, 2018. Included patients had high volume DCIS without invasive disease identified on core needle biopsy. High volume disease was defined as imaging (mammography, ultrasound, MRI) or physical exam size greater than 2cm. Recurrence and survival analyses were right-censored at 5 years, and differences in Kaplan-Meier curves were evaluated using Log-Rank tests. RESULTS: Of the 286 patients included, 106 (37.2%) patients underwent BCS and 179 (62.8%) underwent mastectomy as their initial treatment. Patients who underwent mastectomy had larger lesions (M=4.60cm vs. BCS=3.29cm on mammography, p<0.001). Although a higher volume of breast tissue was removed for mastectomy compared to lumpectomy (M=1232.4cm^3 vs. BCS=81.7cm^3, p<0.001), the average diameter of DCIS measured on pathology was comparable (M=3.91cm vs. BCS=4.23cm, p=0.744). The average size of DCIS was 4.11cm on mammography, 2.51cm on ultrasound, 4.10cm on MRI, and 4.02cm on pathology. Time to recurrence was significantly shorter after lumpectomy (p=0.032) while overall survival (p=0.110) was comparable (Figure 1), although cases of recurrence [M=1 (0.6%), BCS=4 (3.8%)] and mortality [M=1 (0.6%), BCS=3 (2.8%)] were rare. CONCLUSIONS: Although a shorter time to recurrence after BCS was observed, no significant differences were found in overall survival between patients treated with BCS and mastectomy. These findings suggest that lumpectomy is a reasonable alternative to mastectomy for treatment of large volume DCIS found on imaging.

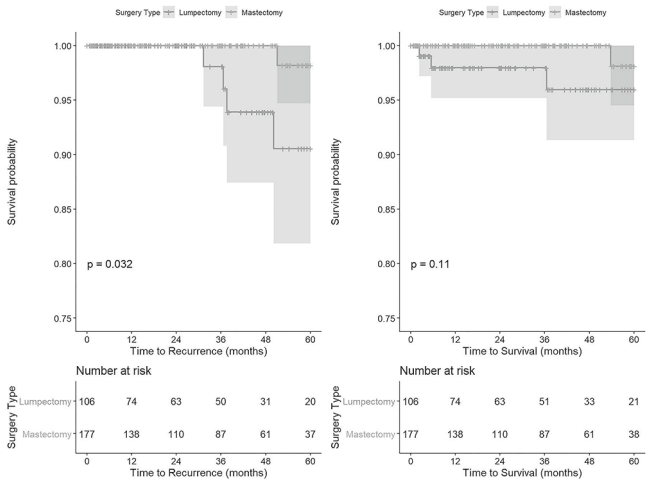


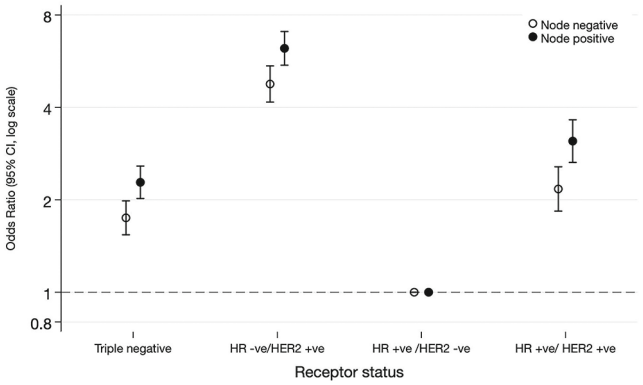
Figure 1. Kaplan Meier Curves for Recurrence and Survival by Surgery Type

P67

Nodal Disease in Breast Cancer Predicts in Breast Pathologic Complete Response X. Baldwin,* S. Downs-Canner, U.N. Maduekwe. *General Surgery, University of North Carolina, Chapel Hill, NC.*

Introduction: An abscopal response is an enhanced systemic immune response to malignancy due to immune activation of a local disease site, classically by radiation. Tumor draining lymph nodes are critical for the induction of this response. We hypothesized that patients with more regional (nodal) disease will have a higher rate of pathologic complete response (pCR) after treatment with neoadjuvant therapy. Methods: We used the National Cancer Database to perform a retrospective analysis of adult women treated for T1-T4/N0-N3 breast cancer who received neoadjuvant therapy (chemotherapy and/or anti-Her2 therapy) and underwent surgery between 2012 and 2017. Tumors were categorized as triple negative (TN), hormone receptor positive Her-2 negative (HR+Her-2-), HR+Her2+, and HR-Her2+. Logistic regression was used to assess the impact of clinical nodal disease on in-breast pCR (dT0 or Tis), adjusting for age, race, T-stage, poor differentiation, and tumor histology. Results: A total of 43,619 patients were included. The majority of patients were clinically N0 (48.7%) or N1(39.4%) compared to N2 (6.7%) or N3 (5.2%). The overall rate of in-breast pCR was 35%. Using multivariable logistic regression, we found that age 18-39 (p=0.005), ductal histology (p<0.001), and poor differentiation (p<0.001) were associated with an increased likelihood of in-breast pCR while age ≥ 60 (p<0.001) and increasing clinical tumor stage (p<0.001) were associated with a decreased likelihood of in-breast pCR. We also found that the effect of positive nodal disease was modified by receptor subtype. In a stratified analysis, the presence of a pretreatment positive node increased the likelihood of in-breast pCR in TN (OR 1.74 N0, 2.2 node positive), HR+Her2+ (OR 2.17 N0, 3.11 node positive), HR-Her2+ (OR 4.76 N0, 6.23 node positive) patients with HR+Her2- patients as the reference (Figure 1). Conclusion: Women with TN and Her2+ breast cancer with clinically positive nodes prior to neoadjuvant therapy were more likely to have in-breast pCR. These data support the ongoing development of immunotherapies, including studies designed to potentiate native immunity by inciting an abscopal response.

Figure 1: Odds of In-Breast Pathologic Complete Response Stratified by Pre-Treatment Nodal Status



* Adjusted for age, race, differentiation, histology and clinical T stage

P68

The Use of Neoadjuvant Therapy Increases the Rate of Breast Conservation in Men with Locally Advanced Breast Cancer A.D. Williams,* R.M. Ciocca, J.L. Sabol, N.Z. Carp. *Department of Surgery, Lankenau Medical Center, Wynnewood, PA.*

ntroduction: Male breast cancer (MBC) is often diagnosed at a later stage and with a more unfavorable tumor-to-breast ratio compared to women, prompting higher rates of mastectomy despite demonstrated safety of breast conservation (BCT) in men. We sought to assess the practice patterns of neoadjuvant therapy (NT) in MBC patients and the impact on BCT. Methods: Men with nonmetastatic, invasive breast cancer were identified in the National Cancer Database (2006-2017). Patients were categorized as having small (cT1/2) or locally advanced (cT3/4) tumors and by whether they received NT (which included endocrine or chemotherapy). Univariate and multivariate analyses were performed to assess patterns of NT use, rates of BCT, and overall survival (OS). Results: A total of 19,259 men were identified, 6,840 (35.5%) of which were cT3/4. 845 (4.4%) received NT, the majority of whom (677, 80.1%) received chemotherapy. 624 (81.1%) had at least a partial response (Table). NT was more common in patients who were Black, low socioeconomic status, and had large, high-grade tumors with nodal metastases and triple negative or Her2+ subtypes (all p<0.05). The unadjusted rate of lumpectomy was 21.3% in those who did not receive NT and 18.5% in those who did (p<0.001). Age, medical comorbidities, larger tumor size, higher grade, and hormone-receptor positivity were all independently associated with lumpectomy. The adjusted odds of lumpectomy for cT3/4 tumors were lower than cT1/2 in those who did not receive NT (OR 0.4, 95% CI 0.35-0.45, p<0.001); there was no difference

in those who underwent NT (OR 0.74, 95% CI 0.40-1.29, p=0.28). Median OS was 121.1 months with no difference in adjusted mortality odds for those undergoing NT (HR 1.23, 95% CI 0.93-1.64, p=0.15), but higher odds for those with T3/4 lesions and those undergoing mastectomy (both p<0.001). Conclusions: Men with invasive breast cancer have an expected low rate of BCT, but NT appears to reduce the use of mastectomy in patients with locally advanced cancers. More work is needed to understand the impacts of BCT on locoregional recurrence and disease-free and overall survival for MBC.

Clinical and pathological tumor stage with and without neoadjuvant systemic therapy

No neoadjuvant therapy				
	cT1	*cT2*	*cT3*	*cT4*
pT0	47 (2.7)	19 (0.4)	41 (0.9)	9 (1.5)
pT1	1531 (88.1)	4360 (82.0)	701 (15.1)	53 (8.6)
pT2	119 (6.8)	874 (16.4)	85 (1.8)	104 (16.9)
pT3	11 (0.6)	17 (0.3)	3675 (79.4)	189 (30.7)
pT4	30 (1.7)	48 (0.9)	129 (2.8)	261 (42.4)
Neoadjuvant therapy				
	cT1	*cT2*	*cT3*	*cT4*
ypT0	5 (11.6)	12 (12.6)	34 (11.3)	19 (10.3)
ypT1	19 (44.2)	60 (63.2)	112 (37.2)	23 (12.4)
ypT2	8 (18.6)	18 (18.9)	139 (46.2)	60 (32.4)
ypT3	4 (9.3)	3 (3.2)	6 (2.0)	42 (22.7)
ypT4	7 (16.3)	2 (2.1)	10 (3.3)	41 (22.2)

Values are given as [No. (%)].

P69

Changes in Incidence of Triple Negative Breast Cancer Among African-American Women in Delaware M.T. Richards,* J. Sims Mourtada, D. Dickson-Witmer. *Breast Surgical Oncology, Christiana Care Health System, Newark, DE.*

OBJECTIVE: Breast cancer rates overall in the United States have remained relatively stable for the past 15 years, and mortality rates have steadily declined. Delaware, on the other hand, currently ranks 6th overall in incidence of breast cancer, and 20th overall in mortality, despite being ranked third nationally in mammogram screening. This is thought to be attributed to a higher rate of triple negative breast cancer (TNBC), specifically in the African American population, than is seen nationally. This study seeks to determine if incidence of TNBC is increasing in younger African American patients, to better direct community outreach. METHODS: A retrospective chart review was used to identify first breast cancers in patients treated in Delaware from 2010 through 2019, with 8775 total patients identified. Demographic and receptor status were collected for each patient, and patients without invasive disease or with incomplete information about receptor status were excluded. Age-adjusted incidence was calculated, and subgroup analysis was performed based on receptor status and race using heat maps and t-test to test for an increase in incidence in the later 5 years over the first 5 years. RESULTS: There was no significant increase in overall invasive cancer or TNBC in combined group or subgroup analyses. Heat map analysis of the data points show an overall decrease in TNBC in all groups, and an upward trend identified in the 25-29-year-old and 75-79-year-old subgroups of African American women. These two groups reached significance in the t-test comparing the years 2010-2014 with 2015-2019, p = 0.0039 and 0.0474 respectively. CONCLUSIONS: Not only did the data fail to meet the threshold of significance, the heat map display shows an overall downward trend in the rate of TNBC over the study period, contrary to expectations. However, on subgroup analysis, two groups of younger and older African American women showed increasing rates of TNBC, indicating a need for additional outreach specific to these groups.

TNBC as percent of all cancer in African American women

Age Range	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
<5	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
5 to 9	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
10 to 14	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
15 to 19	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
20 to 24	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
25 to 29	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%	100.0%	100.0%	100.0%	0.0%
30 to 34	0.0%	0.0%	0.0%	50.0%	0.0%	33.3%	0.0%	0.0%	0.0%	100.0%
35 to 39	66.7%	0.0%	33.3%	0.0%	0.0%	50.0%	100.0%	0.0%	25.0%	33.3%
40 to 44	36.4%	33.3%	20.0%	0.0%	20.0%	27.3%	40.0%	37.5%	25.0%	33.3%
45 to 49	50.0%	83.3%	30.0%	27.3%	18.2%	41.2%	0.0%	33.3%	20.0%	20.0%
50 to 54	45.5%	14.3%	30.8%	22.7%	45.5%	33.3%	21.1%	26.7%	15.4%	28.6%
55 to 59	14.3%	21.4%	25.0%	20.0%	33.3%	26.1%	25.0%	21.1%	35.0%	9.5%
60 to 64	10.0%	21.4%	41.7%	22.2%	11.1%	31.3%	36.8%	25.0%	9.5%	30.0%
65 to 69	14.3%	37.5%	8.0%	23.5%	13.3%	7.7%	38.5%	0.0%	8.3%	5.0%
70 to 74	6.7%	33.3%	25.0%	11.1%	22.2%	31.3%	37.5%	10.0%	7.1%	25.0%
75 to 79	20.0%	0.0%	0.0%	14.3%	20.0%	20.0%	25.0%	28.6%	40.0%	14.3%
80 to 84	50.0%	16.7%	0.0%	0.0%	0.0%	0.0%	33.3%	0.0%	0.0%	0.0%
>85	0.0%	33.3%	0.0%	0.0%	50.0%	100.0%	33.3%	50.0%	0.0%	20.0%
TOTAL	27.6%	26.5%	25.6%	18.5%	22.3%	24.6%	27.1%	25.5%	17.1%	17.9%

P70

The Characteristics of Breast Cancer Receptor Profile in a Jamaican Cohort R.D. Shaw,* P. Roberts, L. Powell, D. Cornwall, R. Thompson. *Surgery, University of the West Indies, Kingston and St. Andrew, Jamaica.*

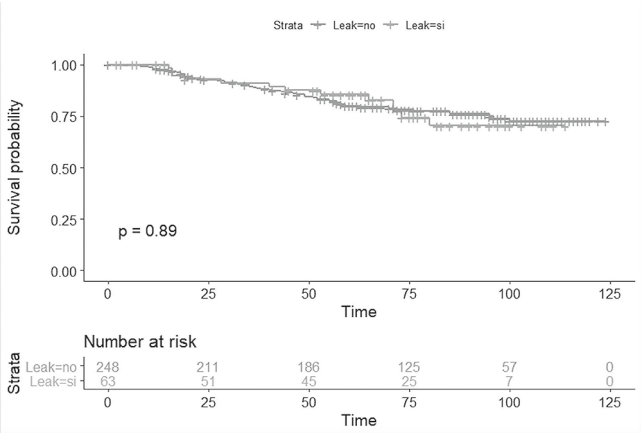
Introduction There is a paucity of data looking at breast cancer affecting Caribbean women. This study examines the proportion of each breast cancer subtype, in a predominantly Afro-centric population in Jamaica, and their clinicopathologic characteristics. Method This is a retrospective study. A prospective pathological database was reviewed to identify patients who had receptor studies done for breast cancer within a 5 year period, January 1, 2012 to December 31, 2016. Univariate analysis, bivariate analysis, and linear regression models were used to evaluate the relationships between each tumor characteristic. Results 1312 patients were included. The mean age was 71.5. Most patients were > 50 years old, accounting for 62% of the study population. 45.9% of tumours were <2cm, with 69.8% of these being pT1b lesions. 36.4% of patients in this study had tumours between 2-5 cm and 17.7% of tumours were >5cm. 52.3% were histologic grade 2. 52.8% of tumors were estrogen receptor (ER) positive, 47.7% were progesterone (PR) positive and 24% were human epidermal growth factor receptor 2 (Her2) positive. The most common cancer subtype was luminal A at 49%. Triple negative breast cancer (TNBC) accounted for 27%. The remaining samples were equally Luminal B and Her2 enriched at 12% each. The average age of TNBC was 47 years old while non-TNBC had an average age of 62.5 years old. Larger tumors had increased odds of being triple negative (OR = 1.08; p = 0.003). Tumors with positive lymph nodes had reduced odds of being Luminal A (OR = 0.77; p = 0.036) and increased odds of being triple negative (OR = 1.41; p = 0.011). Tumors with BRS grade 3 were 8 times as likely of being Her2-enriched (OR = 9.70; p < 0.001) and a > 5-fold increased odds of being triple negative (OR = 6.47; p < 0.001). Logistic regression revealed that as the size of a tumor increased so did the odds of having positive lymph nodes (OR= 1.33, p<0.001). Conclusion: Luminal A breast cancer was the most encountered subtypes with the best pathologic features. Triple negative breast cancer was present in almost a third of all patients (27%). Triple negative disease had the worse profile for women with breast cancer.

P71

Impact of Anastomotic Leak After Low Anterior Resection for Mid-Low Rectal Cancer on Long-term Oncological Outcomes Q. Bao,[1]* G. Spolverato,[1] A. Restivo,[2] S. Deidda,[2] G. Capelli,[1] P. Del Rio,[3] F. Bianco,[3] D. Cuicchi,[4] E. Jovine,[4] C. Belluco,[5] A. Amato,[6] F. La Torre,[7] C. Asteria,[8] A. Infantino,[9] T. Contardo,[10] S. Pucciarelli.[1] *1. University of Padova, Padova, Italy; 2. University of Cagliari, Cagliari, Italy; 3. Istituto Nazionale Tumori – IRCCS Fondazione G. Pascale, Napoli, Italy; 4. Sant'Orsola-Malpighi Hospital, Bologna, Bologna, Italy; 5. National Cancer Institute, Aviano, Aviano (PN), Italy; 6. Sanremo Hospital, San Remo (IM), Italy; 7. Policlinico Umberto I, Sapienza University, Roma, Italy; 8. Ospedale Carlo Poma, Mantova, Mantova, Italy; 9. Santa Maria dei Battuti Hospital, San Vito al Tagliamento, San Vito al Tagliamento (PN), Italy; 10. Camposampiero Hospital, Camposampiero (PD), Italy.*

BACKGROUND Anastomotic leak is a clinically relevant complication after low anterior resection for mid-low rectal cancer and is associated with significant morbidity and mortality. The impact of anastomotic leak on long-term oncological outcomes is still debated. METHODS The data collected in the prospective multicentre randomized controlled trial (NCT01110798), comparing colonic J pouch or straight colorectal anastomosis after low anterior resection, were updated. In order to evaluate the long-term outcome, patients, tumour and treatment characteristics, date of death or last follow-up, and date of local or distant recurrence were updated. The impact on OS and DFS were evaluated using the Cox regression analysis. The main endpoint of the study was to evaluate the impact of anastomotic leak on 3-, 5-, 10-year OS and DFS which were calculated applying the Kaplan-Meier method. RESULTS Of 457 patients enrolled, long term follow-up was available for 311 patients. Of them, 185 (59.5%) were male and 126 (40.5%) were female, 252 (81.0%) underwent preoperative chemoradiotherapy, and 138 (44.3%) patients underwent adjuvant therapy. Overall 63 (20.3%) patients were found to have an anastomotic leak. At a median follow-up of 76 months, 23 (7.4%) patients experienced local recurrence and 49 (15,8%) experienced distant recurrence. In multivariate

analysis preoperative CEA, distance from the anal verge, pT stage, pN stage, CRM positive, were found to be independently associated with a worse OS and DFS, while anastomotic leak was not an independent predictor of OS (HR 0.65, CI 95% 0.34-1.28) and DFS (HR 0.70, CI 95% 0.39-1.25). The estimated cumulative 3-, 5- and 10- year OS and DFS were 89.2, 85.3 and 70.2%, 80.7, 75.1 and 63.5% respectively in anastomotic leak group, 88.9, 79.8 and 72.3%, 83.7, 74.2 and 62.8% respectively in no anastomotic leak group. Anastomotic leak was not correlated with worse OS and DFS. CONCLUSION Anastomotic leak after low anterior resection for mid-low rectal cancer does not seems to affect the long-term oncological outcomes.



Kaplan-Meier Overall survival (OS) estimate.

P72

Neoplastic Appendiceal Incidentalomas: Predictors of Surgery and Disease Outcomes A. Kelly,[1]* S. O'Connor,[1] D. Kane,[1] C. Huang,[2] H. Mogal.[1] *1. Surgery, Medical College of Wisconsin, Milwaukee, WI; 2. University of Wisconsin-Milwaukee, Milwaukee, WI.*

Intro: Radiographically detected incidental appendiceal abnormalities, herein termed appendiceal incidentalomas (AIs), are an ill-defined entity with unknown prevalence of neoplasms. This study aims to determine factors prompting surgical intervention and outcomes of patients diagnosed with neoplastic AIs. Methods: Electronic health records for patients at a single institution undergoing abdominopelvic CT/MRI from 2000-2020 for non-appendix-related complaints with mention of appendix abnormality in the radiology report were reviewed. Suggested diagnosis at index imaging was recorded (Fig. 1). Outcomes were compared between operative and non-operative patients. Results: Of 484 identified AIs (9% of abnormal appendices), neoplasms were suggested radiographically in 16% (n=79) (Fig. 1). 59% (47/79) of neoplastic AIs were resected. 32 were pathologically confirmed as neoplasms yielding a diagnostic accuracy of 68%. In comparison to non-operative patients, operative AIs had higher mean diameter (22.7 ±13.0 mm vs 17.8 ±7.7 mm; p = 0.04), higher colonoscopy rate (51% vs 22%; p = 0.01), and lower age at diagnosis (55.8 ±15.6 years vs 67.2 ±16.0 years; p = 0.003). Of 47 neoplastic AIs that underwent surgery, none had regional adenopathy or peri-appendiceal fluid and 2% had fat stranding detected on imaging. 26% had minor (grade I/II) and 4% had major (grade III-V) Clavien-Dindo post-operative complications. With a median follow up of 28.3 months, 94% of patients were alive without disease, 6% died of other causes, and none had disease recurrence. Of 32 non-operative neoplastic AIs, none had regional adenopathy, peri-appendiceal fluid, or fat stranding. With a median follow up of 20.9 months, 59% are alive with a stable/persistent abnormal appendix, 13% had no appendix abnormality at last follow up, and 28% died of other causes. Conclusions: Larger appendiceal diameter and younger age predict operative intervention when neoplastic AIs are suggested at imaging. While surgery is associated with minimal risk of postoperative complications, observation of suspected neoplastic AIs may be a safe alternative in select patients undergoing radiographic longitudinal follow up.

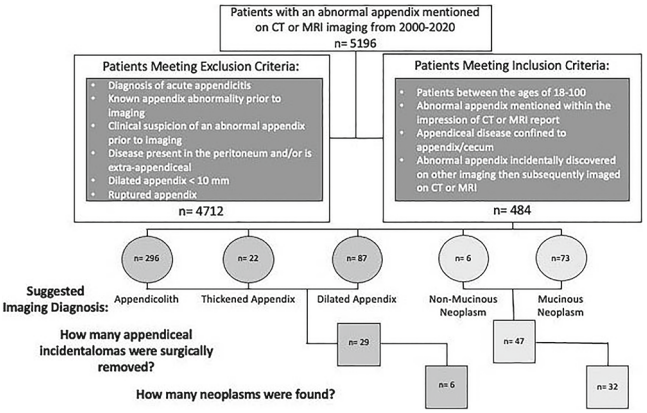


Figure 1.

P73

Rural Residence is Not Associated with Disparities in Colon Cancer Care Delivery R.A. Snyder,* W. Irish, A.A. Parikh. *Surgery, Brody School of Medicine at East Carolina University, Greenville, NC.*

INTRODUCTION: Incidence and mortality rates of colon cancer (CC) are higher in rural compared to urban populations. The purpose of this study was to determine if rural residence is associated with differences in stage-specific guideline-concordant-care (GCC) in patients with locoregional CC independent of patient insurance status. METHODS: Patients with stage I-III CC from 2006-2016 were identified within the National Cancer Database. Multivariable logistic regression (MVR) was performed to evaluate the association of rural residence and odds of receiving GCC. Effect modification was evaluated using a two-way interaction term for rurality by insurance status. RESULTS: Of 320,719 identified patients, 1.9% (N=6,191) were rural. Compared to urban, rural patients had lower income, lower educational status, were more often Medicare-insured, and less often privately-insured (p<0.001). Rural patients traveled farther for care (44.5 vs. 7.5 miles; p<0.001), although time to surgery was similar (8 vs. 9 days). Rates of resection (98.8% vs. 98.0%), margin positivity (5.4% vs. 4.8%), adequate lymphadenectomy (80.0% vs. 81.4%), adjuvant chemotherapy (stage III; 69.2% vs. 68.7%) and receipt of stage-specific GCC (66.5% vs. 68.3%) were similar between both cohorts. By MVR, the odds of receiving GCC did not differ among rural and urban patients [OR 0.99, 95%CI 0.94-1.05] (Table). Insurance status did not differentially impact receipt of GCC in rural vs. urban patients (interaction p=0.83). CONCLUSIONS: Rural and urban patients with locoregional CC are equally likely to receive GCC consistent with national guidelines, suggesting that differences in cancer care delivery do not explain rural-urban disparities.

Adjusted Odds Ratio of Receipt of Guideline Concordant Care

	Odds Ratio	95% Confidence Interval
Residence		
Rural (Ref: Urban)	0.99	0.94-1.05
Insurance		
Government/VA (Ref: Private)	0.83	0.77-0.91
Medicaid (Ref: Private)	0.79	0.76-0.82
Medicare (Ref: Private)	1.03	1.01-1.05
Uninsured (Private)	0.80	0.77-0.84
Age per year increase	0.97	0.97-0.98
Sex		
Female (Ref: Male)	1.10	1.08-1.12
Race		
Non-Hispanic Black (Ref: Non-Hispanic White)	0.88	0.86-0.90
Hispanic (Ref: Non-Hispanic White)	0.93	0.89-0.96
Other (Ref: Non-Hispanic White)	0.90	0.87-0.92
Charlson/Deyo Comorbidity Index		
1 (Ref: 0)	1.03	1.01-1.05
2 (Ref: 0)	0.94	0.91-0.96
≥ 3 (Ref: 0)	0.81	0.78-0.85
Median Household Income		
$38,000 to $47,999 (Ref: < $38,000)	1.08	1.05-1.10
$48,000 to $62,999 (Ref: < $38,000)	1.10	1.07-1.12
> $63,000 (Ref: < $38,000)	1.13	1.09-1.16
Percent Did Not Graduate from High School		
13% to 20.9% (Ref: ≥ 21%)	1.02	1.00-1.05
7% to 12.9% (Ref: ≥ 21%)	1.08	1.06-1.11
< 7% (Ref: ≥ 21%)	1.17	1.14-1.21

P74

What is the Risk for Peritoneal Recurrence in T4 Colon Cancers?

A. Uppal,[1]* B. Helmink,[2] T.E. Grotz,[3] K. Fournier,[1] S. Nguyen,[1] M.W. Taggart,[1] J.Y. Shen,[1] B. Bednarski,[1] Y. You,[1] G.J. Chang.[1] *1. University of Texas MD Anderson Cancer Center, Houston, TX; 2. Washington University at St. Louis, St. Louis, MO; 3. Mayo Clinic, Rochester, MN.*

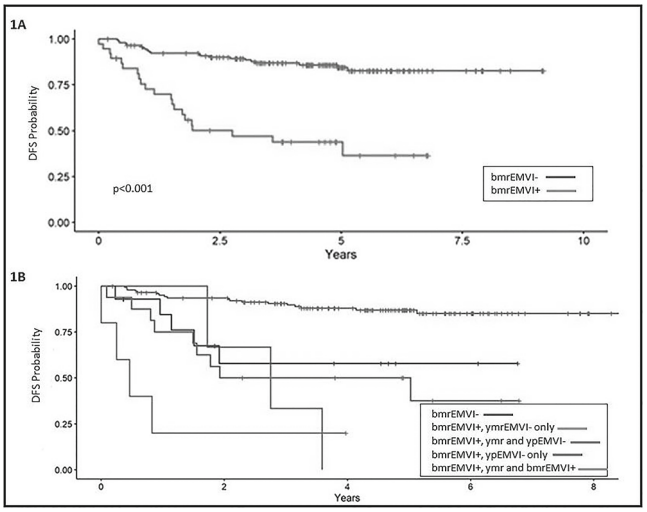
Introduction: Patients with T4 colon adenocarcinomas have an increased risk of carcinomatosis, but the risk factors and timeframe of metastases are not well described. We sought to evaluate the patterns and timing of, and factors associated with, metastatic recurrence in this population. Methods: Patients with pathologic T4 colon adenocarcinomas who had undergone curative resection at a single referral cancer center from 2004-17 were identified. Patient, tumor, treatment and recurrence data were collected. Categorical comparisons were performed with chi-squared tests. Survival analyses were performed using Cox proportional hazards analysis. Results: We identified 96 patients with median 83 [IQR: 63-114] months follow-up. Median age was 61. Pathologic T stages were T4a (64, 66%) or T4b (32, 33%). N stages were classified as N0 (29, 30%) or N1-2 (67, 70%). 13 patients (14%) presented with obstruction and 18 (19%) with perforation. Tumors were moderately (66, 69%) or poorly (30, 31%) differentiated. Lymphovascular invasion was noted in 64 (67%) and tumor deposits in 17 (19%). Signet ring and mucinous histology were noted in 6 (6.3%) and 13 (14%) cases. Perioperative chemotherapy was given to 7 (7%) patients and adjuvant to 78 (82%). Overall, 38 (40%) developed metastases at a median 20 months. Patients were classified according to recurrence sites: (A) none (58, 60%); (B) carcinomatosis only (6, 6%); (C) non-peritoneal only (18, 19%); and (D) carcinomatosis & other site (14, 15%). 5-year overall survival (OS) was 97% among those without recurrence and 50% with (p=0.0001). Median time to recurrence did not differ between groups B & C (33 mos & 29 mos, p=0.21), and both had longer time to recurrence than group D (13 mos, p=0.016). On multivariate analysis, grade (OR 3.5, p=0.02) and pN+ (OR 2.2, p=0.03) were associated with carcinomatosis. Conclusion: Carcinomatosis risk after resection of T4 colon cancers is associated with N stage and poorly differentiated histology. Isolated peritoneal recurrence has a similar DFI and OS to non-peritoneal metastasis, and should be considered as a distinct entity from recurrence at multiple sites.

P75

Impact of Extramural Venous Invasion in Locally Advanced Rectal Cancer Patients Undergoing Total Neoadjuvant Therapy

H. Thompson,* S. Park, d. bates, J. Golia Pernicka, M. Nourbakhsh, M. Fiasconaro, J. Yuval, I.H. Wei, E.P. Pappou, J. Smith, G.M. Nash, M.R. Weiser, P.B. Paty, J. Garcia-Aguilar, M. Widmar. *Memorial Sloan Kettering Cancer Center, New York, NY.*

Background: Extramural venous invasion (EMVI) is associated with poor prognosis in locally advanced rectal cancer (LARC). The impact of converting from EMVI positive (EMVI+) to negative (EMVI-) after total neoadjuvant therapy (TNT) has yet to be established. We examined the impact of EMVI status on survival, assessed by MRI and pathology, in LARC patients undergoing TNT. Methods: LARC patients undergoing TNT and total mesorectal excision from 2008-2017 with pre- and post-TNT MRI were included. Two radiologists assessed baseline (bmrEMVI+/-) and post-TNT (ymrEMVI+/-) status; interobserver agreement was measured by Cohen's kappa. Associations between EMVI status, disease-free survival (DFS) and overall survival (OS) were analyzed by log-rank and cox regression. Results: 185 patients were included, with mean age of 53 and most clinically stage III. Concordance between radiologists on bmr and ymr was moderate/substantial (κ= 0.46, 0.7). There were significant differences in DFS and OS between bmrEMVI+ and bmrEMVI- patients on univariate and multivariate analyses (DFS HR 6.0, 95%CI 3.2-11.4; OS HR 5.6, 95%CI 2.1-15.4) (fig. 1a). There were 38 bmrEMVI+ patients. Post-TNT, 30 (79%) converted to EMVI- by pathology (ypEMVI-) and 17 (45%) by MRI. Converting by MRI and pathology were not associated (p=0.7). Only 47% of patients who converted to ypEMVI- also became ymrEMVI-, whereas 82% of patients who converted by MRI also converted on pathology. Exploratory analyses were performed in bmrEMVI+ patients due to small numbers. Converting to EMVI- on pathology was associated with longer DFS on univariate and multivariate analyses compared to staying EMVI+ by pathology and MRI (fig. 1b). Patients who became EMVI- on pathology alone and those who became EMVI- on both MRI and pathology had similar survivals. Discussion: Baseline EMVI+ status is associated with poor prognosis even after conversion to EMVI-. More baseline EMVI+ patients converted to EMVI- by pathologic criteria than MRI, and pathologic conversion was associated with longer DFS. Our data suggest a high false positive rate for ymrEMVI status, limiting its utility for clinical prognostication.

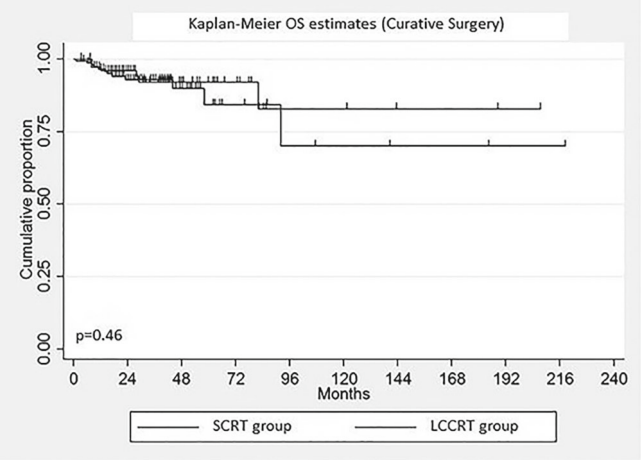


P76

Preoperative Short-Course Radiation Therapy versus Long-course Chemoradiation in 350 Rectal Cancer Patients: Audit of Experience from an Indian Tertiary Care Cancer Center

K. Dhall,[1]* S. Bhoriwal,[1] S. Deo,[1] S. Kumar,[1] P. Bhagat,[1] B. Mohanti,[2] S. Pathy,[2] A. Sharma.[3] *1. Department of Surgical Oncology, All India Institute of Medical Sciences, New Delhi, India; 2. Department of Radiation Oncology, All India Institute of Medical Sciences, New Delhi, India; 3. Department of Medical Oncology, All India Institute of Medical Sciences, New Delhi, India.*

Introduction: Multimodality therapy is the standard of care for locally advanced rectal cancer. Although various types of neoadjuvant treatments are used for tumor regression, sphincter preservation and to improve survival, the best form of neoadjuvant approach is debatable. We evaluated and compared the outcomes of preoperative short-course radiation therapy (SCRT) and long-course chemoradiation therapy (LCCRT) in the management of locally advanced rectal cancer. Methods: A retrospective analysis of prospectively maintained rectal cancer database was performed and histologically proven locally advanced (Stage II-III) rectal adenocarcinoma patients undergoing preoperative SCRT (25Gy/5 fractions) and LCCRT (45Gy/25 fractions with concurrent 5-fluorouracil/capecitabine based chemotherapy) were identified. Between January 1994 to December 2019, a total of 195 patients received preoperative SCRT and 155 patients received LCCRT. A comparative analysis of demographic data, clinical profile, treatment details, and outcomes was performed between two groups. Results: The mean age was 46.1 years in the SCRT arm and 42.2 years in the LCCRT arm and 132 (67.7%) and 94 (60.6%) patients were males in SCRT and LCCRT arms, respectively. The lower rectum was involved in 111 (56.9%) patients in SCRT arm and 109 (70.3%) patients in LCCRT arm. The curative surgery rates were 79.5% and 65.8% in the SCRT and LCCRT arms, respectively. Overall sphincter salvage rate was 18.6% in the SCRT arm and 20.9% in the LCCRT arm. The pathological complete response rate in SCRT and LCCRT arms were 3.6% and 8.4%, respectively. Relapse of disease was observed in 18.5% of SCRT and 16.8% of LCCRT curatively treated patients. Overall 5-year survival rates were 84.2% and 92.03% (p=0.46), respectively in SCRT and LCCRT arms. Conclusion: Our study showed a higher curative surgery rate and comparable sphincter salvage and relapse rates with SCRT. Overall survival was better among curatively treated patients with LCCRT. The major advantage of SCRT is shorter duration of therapy which is beneficial in low-resource settings.



Overall survival curves in curatively treated patients

P77

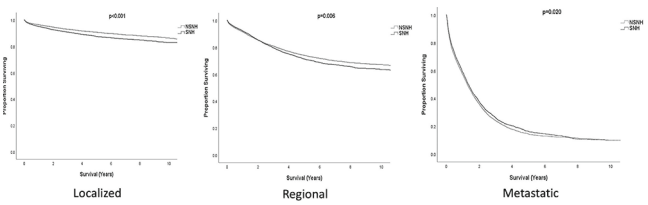
Demographic and Clinical Profile of Young Colorectal Cancer in India: A High Volume Cancer Center Experience K. Dhall,[1]* S. Deo,[1] P. Bhagat,[1] S. Bhoriwal,[1] S. Kumar,[1] S. Pathy,[2] A. Sharma,[3] S. Sengupta,[4] P. Das.[5] *1. Department of Surgical Oncology, All India Institute of Medical Sciences, New Delhi, India; 2. Department of Radiation Oncology, All India Institute of Medical Sciences, New Delhi, India; 3. Department of Medical Oncology, All India Institute of Medical Sciences, New Delhi, India; 4. National Institute of Immunology, New Delhi, India; 5. Department of Pathology, All India Institute of Medical Sciences, New Delhi, India.*

Introduction: Globally, colorectal cancer (CRC) ranks third in terms of incidence. The median age at diagnosis varies but during the last few decades, the incidence in younger individuals i.e. ≤40 years of age (YCRC) has dramatically increased. There is limited literature related to YCRC from low and middle-income countries. In this study, the incidence, demographic, and clinical profile of YCRC patients were analyzed. Methods: A retrospective analysis of prospectively maintained CRC database was performed and data of histologically proven young CRC patients (≤40 years of age) operated between January 1994 to December 2019 was extracted. The proportion of YCRC, demographic and clinical profile, treatment patterns, and oncological outcomes were analyzed. Results: A total of 970 CRC patients were operated out of which, 401 (41.3%) had colon cancer and 569 (58.7%) had rectal cancer. A total number of 337 (34.7%) patients qualified for inclusion as YCRC. The proportion of young rectal cancers (YRC) was higher (41.3%) in contrast to young colon cancers (YCC) (25.4%). The male-to-female ratio was 2.2 and 1.8 in YCC and YRC, respectively. The family history was positive in 22 (21.6%) YCC patients and 13 (5.5%) YRC patients. The commonest location of tumor in YCC and YRC was ascending colon (54.9%) and the lower rectum (64.3%), respectively. The majority of YCC patients presented with stage 2 disease (58.8%) and YRC patients with stage 3 disease (54.9%). Among YRC patients neoadjuvant treatment in the form of short-course radiation or long-course chemoradiation was used in 79 (33.6%) and 77 (32.8%) patients respectively. The curative resection rates for YCC and YRC were 73.5% and 59.6%, respectively. After curative resection, 15 (20%) and 46 (32.9%) patients with YCC and YRC developed relapses. Conclusion: These results indicated that YCRC constitutes a significant proportion of the CRC burden. Among YCRC, rectal cancer was more common than colon cancer. The majority presented with a locally advanced stage and had modest curative resection and disease control rates. YCRC seems to be a distinct entity warranting future basic and clinical research.

P78

Effect of Hospital Safety Net Designation on Treatment Use and Survival in Colorectal Cancer N.M. Nevarez,[1]* C.A. Hester,[2] M.R. Ju,[1] C.H. Olson,[1] J. Salgado Pogacnik,[1] M.R. Porembka,[1] P. Polanco,[1] J. Mansour,[1] H. Zeh,[1] A. Yopp.[1] *1. University of Texas Southwestern Medical Center, Dallas, TX; 2. University of Texas MD Anderson Cancer Center, Houston, TX.*

INTRODUCTION: Colorectal cancer (CRC) disproportionally affects racial/ethnic minority and socioeconomic disadvantaged populations. Identifying patient-, provider-, and system-level factors contributing to racial/ethnic and socioeconomic disparities in CRC is critical in the development of interventions aimed at reduction in disparities improving overall survival. The objective of this study was to characterize the differences in presentation, treatment, and survival of CRC patients diagnosed at safety net hospitals (SNHs) and non-SNHs. METHODS: Patients diagnosed with CRC were identified in the Texas Cancer Registry from 2004 to 2015. Patient demographics, hospital characteristics, covariate-adjusted treatment use and disease-specific survival (DSS) were compared among SNHs and non-SNHs. SNH was defined as the top quartile of statewide Medicare Disproportionate Share Index. RESULTS: Despite comprising only 15% of hospitals, SNHs cared for 29% of 65,751 CRC patients and disproportionately delivered care to younger aged (65 vs. 68 years, median), Hispanic white (39% vs. 12%), black (17% vs. 11%), low socioeconomic status (50% vs. 25%), and more advanced staged (20% vs. 16%, metastatic) patients compared to non-SNHs (all p<0.001). Compared with non-SNHs, treatment receipt use after adjustment for significant clinicopathological variables was significantly lower at SNHs (OR 0.89, 95%CI, 0.85-0.94, p<0.003). When treatment was received, patients at SNHs had a significantly longer median time to treatment (20.4 vs 15.7 days, p<0.001). Compared with non-SNHs, DSS was significantly worse in SNHs (HR 1.1, 95% CI 1.02-1.1, p<0.001) when adjusted for age, stage, receipt of treatment, and race/ethnicity. CONCLUSIONS: CRC patients at SNHs are more likely to be racial/ethnic minorities and from socioeconomic disadvantaged populations. These patients have longer median time to treatment and are less likely to receive treatment which likely contributes to worse survival. System-level differences in care delivery may partly explain racial/ethnic and socioeconomic disparities in CRC prognosis.



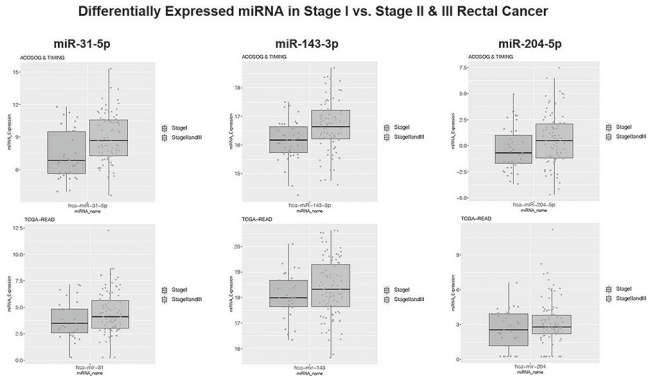
Survival in CRC patients at SNHs vs non-SNHs based on extent of disease.

P79

Integrative Analysis to Study the Role of MicroRNAs in the Progression of Rectal Cancer J. Kim,* X. Qu, C. Chen, J. Smith, F. Sanchez-Vega, J. Garcia-Aguilar. *Memorial Sloan Kettering Cancer Center, New York, NY.*

Introduction: MicroRNAs (miRNAs) are aberrantly expressed in colorectal cancer and play important roles in carcinogenesis by regulating post-transcriptional levels of their target mRNA. In this study, we performed an integrative analysis of miRNA and mRNA expression in stage I versus stage II-III rectal tumors to investigate the role of miRNAs in cancer progression. Methods: RNA from 127 formalin-fixed-paraffin-embedded pre-treatment rectal adenocarcinoma biopsy samples (n= 41 stage I, n= 86 stage II-III) was extracted and miRNA sequenced using the Illumina HiSeq 2000 Platform. mRNA was profiled using Affymetrix U133 Plus 2.0 arrays. Differentially expressed miRNA [|log2FC| > log2(1.5), FDR <0.05] in stage I vs stage II-III tumors were mapped to predicted target mRNA using miRTarBase. Integrative analyses were then performed to identify pairs of inversely correlated miRNA-mRNA (Spearman correlation rho <0, FDR <0.1) that can be linked to regulatory mechanisms. Results were validated in an independent cohort of 127 rectal cancer patients (n=29 stage I, n=98 stage II-III) from The Cancer Genome Atlas (TCGA). Results: A total of 174 miRNA were differentially expressed in stage I vs stage II-III tumors. After filtering for those with significant correlation with known mRNA targets, we arrived

at 5 miRNA that were upregulated in stage I tumors with 6 target genes and 39 miRNA that were downregulated in stage I tumors with 119 target genes. Using the independent cohort from TCGA, we identified 3 miRNA-mRNA pairs that exhibited consistent significant associations in both cohorts: MiR-31 - SATB2, miR-143 - KLF5, miR-204 – EZR. In the literature, miR-31-SATB2 and miR-143-KLF5 has been reported to play a role in tumor progression in colorectal cancer. miR-204 – EZR has not been reported before and is a good candidate for follow-up studies. Conclusions: Integrative analysis of miRNA and mRNA in stage I versus stage II-III tumors suggests that miRNAs can play a role in the progression of rectal cancer. Therefore, they should be further studied in order to harness their potential as novel biomarkers or therapeutic targets.



P80

The Accuracy of Clinical Restaging to Detect Responders After Neoadjuvant Chemoradiotherapy for Locally Advanced Rectal Cancer S. Deidda,[1]* R. Bao Quoc,[2] G. Capelli,[2] L. Zorcolo,[1] G. Spolverato,[2] A. Restivo.[1] *1. University of Cagliari, Selargius, Italy; 2. University of Padova, Padova, Italy.*

Introduction Selection of patients who respond to neoadjuvant chemoradiotherapy (CRT) for locally advanced rectal cancer (LARC), and who may benefit from an organ preservation strategy, would require an accurate clinical assessment of tumor response. This study aimed to review our experience with the clinical restaging of rectal cancer after CRT to assess its accuracy in detecting major and complete pathological response to treatment. Methods Patients who underwent CRT and surgery (local excision or rectal resection) for LARC from January 2012 to June 2020 were included. Clinical response was defined as no palpable mass, no mucosal abnormality at endoscopy (complete response, cCR), or a superficial ulcer <2cm (major response, mCR), and no metastatic nodes at MRI. Sensitivity, specificity, positive-predictive value (PPV), negative-predictive value (NPV) of these criteria in detecting complete (ypT0) or major (ypT0-1) pathological response was explored for cCR and mCR, respectively. Results Three-hundred and thirty-nine patients were included (Table1); 77 (22.7%) were downstaged to ypT0 and 108 (31.8%) to ypT0-1 tumor. Sensitivity was upsetting both for cCR (33.7%) in detecting ypT0 and mCR (52.7%) in detecting ypT0-1. Precision was also low. PPV was, in fact, 63% for ypT0 and 58.2% for ypT0-1. Cohen's K coefficient showed a fair agreement between clinical and pathological response. Accuracy for cCR and mCR was 80.5% and 72.8%, respectively. Conclusion Results of this study showed that criteria to define cCR or mCR were overall poorly accurate. Failure to achieve good sensitivity and precision in fact is a major limiting factor in the clinical setting. On one hand, many patients who may benefit from a conservative approach would not be identified. Also, using cCR as an indicator for non-operative management may lead to a dangerous chance of undertreat those patients that still carry microscopical residual disease. If rectal conservation after CRT is to be pursued, clinical assessment has to improve. A more accurate restaging would also maximize the number of patients who might benefit from this approach by reducing the rate of false negative.

Table1. Performance of restaging at predicting ypT0-1

		ypT0								
		Yes	No		Sensitivity%	Specificity%	PPV%	NPV%	Accuracy	Cohen
cCR	Yes	26	15	41	33.7 (23.6 - 45.5)	94.3 (90.5 - 96.6)	63.4 (46.9 - 77.4)	82.9 (78.0 - 86.9)	80.5 (75.9 - 84.6)	0.34
	No	51	247	298						
		77	262	339						
		ypT0-1								
		Yes	No		Sensitivity%	Specificity%	PPV%	NPV%	Accuracy	Cohen
mCR	Yes	57	41	98	52.7 (42.9 - 62.5)	82.2 (76.7 - 86.9)	58.2 (49.9 - 65.9)	78.8 (75.2 - 82.1)	72.9 (67.8 - 77.5)	0.36
	No	51	190	241						
		108	231	339						

cCR=complete clinical response; mCR=major clinical response; PPV=positive predictive value; NPV=negative predictive value

P81

Survival in Patients with Neuroendocrine Tumors of the Colon, Rectum and Small Intestine H.R. Keller,* H. Senapathi, A. Morada, D. Bertsch, B. Cagir. *Surgery, Guthrie Robert Packer Hospital, Sayre, PA.*

Introduction: Neuroendocrine tumors (NETs) of the colon, rectum and small intestine (SI), although rare, are increasing in incidence and prevalence. The reported 5-year overall survival (OS) varies depending on the site of origin and extent of disease. However, the relationship between tumor site and histopathological subtype on OS remains unclear. We aimed to directly compare the 5-year OS between different tumor types among colonic, rectal, and SI. Methods: The Surveillance, Epidemiology, and End Results (SEER) 18 registry from 2004 to 2015 was accessed to identify patients diagnosed with colonic, rectal, and SI primary NETs. The primary outcome was 5-year OS. The Cox proportional-hazards model was used to compare survival between each tumor type and primary site. Results: 31,187 patients were diagnosed with NETs of the colon (6,258, 20%), rectum (12,434, 39.9%), and SI (12,495, 40%). Mixed neuroendocrine-non-neuroendocrine neoplasms (MiNENs) were primarily from the colon (478, 88.7%), and associated with worse 5-year OS (52.8%) compared with poorly differentiated neuroendocrine carcinomas or NECs (63.6%, HR 0.75, 95% CI 0.66-0.85, p<0.001) and well differentiated NETs (85.4%, HR 0.28, 95% CI 0.25-0.32, p<0.001). The majority of NECs were from the SI (2763 or 46.1%) and associated with a better 5-year OS (72.2%) compared with colon (48.8%, HR 2.18, 95% CI 1.99-2.40, p<0.001) or rectum (65.1%, HR 1.24, 95% CI 1.11-1.39, p<0.001). Among those with NECs who underwent surgical resection, SI primary tumors were associated with better 5-year OS (75.8%) compared to colon (53%), and rectum (40.6%, p<0.001). Conclusions: Overall, poorly differentiated NECs of the SI have better 5-year OS while colon was associated with worse survival. Surgical resection may improve 5-year OS for NECs arising from the small intestine and colon, except in the rectum where survival was reduced. More frequent surveillance and early consideration for multimodal chemo-radiation therapy should be considered for rectal NECs.

Multivariable Hazard Ratio Survival Analysis

Survival Parameter		n (%)	HR (univariable)	HR (multivariable)
Primary site	Small intestine	12038 (100)		
	Colon	5901 (100)	1.74 (1.62-1.88, p<0.001)	1.05 (0.97-1.14, p=0.247)
	Rectum	12168 (100)	0.33 (0.30-0.36, p<0.001)	0.49 (0.44-0.55, p<0.001)
Tumor type (WHO classification)	Well-differentiated NETs	23941 (100)		
	MiNENs	517 (100)	8.20 (7.11-9.45, p<0.001)	2.20 (1.87-2.59, p<0.001)
	Poorly differentiated NECs	5648 (100)	5.03 (4.69-5.40, p<0.001)	2.80 (2.56-3.05, p<0.001)
Grade (prior classification)	Well differentiated, Grade I	11449 (100)		
	Moderately differentiated, Grade II	2395 (100)	2.10 (1.84-2.40, p<0.001)	1.89 (1.66-2.17, p<0.001)
	Poorly differentiated, Grade III	1086 (100)	17.25 (15.52-19.18, p<0.001)	8.67 (7.70-9.75, p<0.001)
	Undifferentiated, anaplastic, Grade IV	370 (100)	23.50 (20.36-27.12, p<0.001)	11.66 (10.02-13.58, p<0.001)
	Unknown	14807 (100)	1.26 (1.15-1.38, p<0.001)	1.93 (1.75-2.13, p<0.001)
Extent of resection	Local	11680 (100)		
	Invasive	12906 (100)	9.23 (8.06-10.57, p<0.001)	3.74 (3.22-4.35, p<0.001)
	None	4970 (100)	12.73 (11.04-14.67, p<0.001)	8.00 (6.91-9.27, p<0.001)
	Not otherwise specified	270 (100)	8.77 (6.30-12.23, p<0.001)	4.21 (3.00-5.90, p<0.001)
	Unknown	281 (100)	3.30 (2.02-5.40, p<0.001)	2.77 (1.69-4.53, p<0.001)

P82

Genetic Testing in Colon Cancer: How are We Doing?

R.H. Joung,[1]* B.C. Brajcich,[1] M.A. Abbass,[2] K.Y. Bilimoria,[1] R.P. Merkow.[1] *1. Surgical Outcomes and Quality Improvement Center, Northwestern University, Chicago, IL; 2. Northwestern University Feinberg School of Medicine, Department of Surgery, Chicago, IL.*

INTRODUCTION: Microsatellite instability (MSI), caused by DNA mismatch repair (MMR) deficiency, is observed in up to 15% of colorectal cancers, and it has important implications in treatment and prognosis. Despite NCCN-guideline recommendations to broaden testing in 2014 (all patients age <70 and/or stage II), the impact of these recommendations on MSI/MMR testing in the US is unclear. Our objectives were to (1) evaluate MSI/MMR testing trends over time, (2) identify factors associated with appropriate MSI/MMR testing, and (3) assess hospital-level variation in MSI/MMR testing. METHODS: Patients diagnosed with invasive colon adenocarcinoma between 2010 and 2017 who were less than 70 years old or had stage II disease were identified in the National Cancer Database. The primary outcome was receipt of MSI/MMR testing. Trends were evaluated by comparing pre-guideline (2010-2014) and post-guideline (2015-2017) periods. Patient, tumor, treatment, and hospital factors associated with MSI/MMR testing were assessed by hierarchical multivariable logistic regression. RESULTS: A total of 280,099 patients at 1,348 hospitals were included. Overall, 30.3% received MSI/MMR testing. There was a significant increase in testing after guideline recommendations (pre: 25.2% vs post: 38.2%; OR 2.15, 95% CI 2.11-2.20). Patients were more likely to receive testing post-guideline release if younger (<50 vs 50-69 years: OR 1.27, 95% CI 1.21-1.34), later year of diagnosis (2017 vs 2015: OR 1.72, 95% CI 1.66-1.78), treated at an academic facility (OR 1.26, 95% CI 1.09-1.44), underwent surgery (OR 4.17, 95% CI 3.88-4.48), or received chemotherapy (OR 1.20, 95% CI 1.15-1.26). Among hospitals, the rates of MSI/MMR testing ranged from 0% to 100% (median 35.4%; IQR 13.0-60.5%). The greatest amount of variation in MSI/MMR testing occurred at the hospital level (47.1%). CONCLUSION: Rates of MSI/MMR testing has increased over time but adherence to guideline recommendations remains low. Predictors of low MSI/MMR testing included patient, tumor, and treatment factors; however, the majority of the variation occurred at the hospital-level. MSI/MMR testing is an ideal target for national quality improvement efforts to improve colorectal cancer care.

P83

Accessibility of Telehealth Services for Colorectal Cancer Care at Cancer Hospitals in the United States

V.A. Marks,[1]* W.R. Hsiang,[1] W. Umer,[2] A. Haleem,[2] D. Kim,[1] M.S. Leapman,[3] J.W. Kunstman,[4] K.M. Schuster.[5] *1. Yale School of Medicine, New Haven, CT; 2. The College of New Jersey, Ewing, NJ; 3. Urology, Yale School of Medicine, New Haven, CT; 4. Surgical Oncology, Yale School of Medicine, New Haven, CT; 5. General Surgery, Trauma & Surgical Critical Care, Yale School of Medicine, New Haven, CT.*

Introduction: The COVID-19 pandemic has underscored the importance of and accelerated existing efforts to provide telemedicine. We aimed to characterize access to and trends in telehealth services offered for colorectal cancer (CRC) care at Commission on Cancer (CoC) accredited hospitals across the United States. Methods: From March to August 2020, investigators successfully contacted 397 of over 1500 CoC-accredited hospitals to assess the availability of telehealth services for a new visit and for follow-up visits for CRC care using a secret shopper design. Hospital-level variables such as facility type (e.g., community, academic) were recorded. Additional facility characteristics from American Hospital Association (AHA) and Center for Medicare and Medicaid Service (CMS) databases were collected. We described telehealth access using univariate logistic regression to evaluate the association between facility characteristics and telehealth availability. Results: Of the 397 hospitals, 165 (41.6%) offered telehealth to new patients and 298 (75.1%) offered telehealth for follow-up visits with a colorectal surgeon. The table describes the inverse relationship between hospital volume and telehealth availability. NCI designated programs were significantly more likely to offer telehealth for new visits than comprehensive community (p<0.001), comprehensive academic (p<0.001), community cancer (p<0.001), and integrated network (p=0.023) cancer programs. Major teaching hospitals were significantly more likely to provide telehealth for new patients (55% versus 38%, OR 1.97, p=0.006) and follow-up visits (83% versus 73%, OR 1.86, p=0.049). Accountable care organizations (ACOs) were significantly more likely to provide telehealth for new visits (48% versus 37%, OR 1.58, p=0.042) and follow-up visits (80% versus 69%, OR, p=0.049). Conclusion: These findings highlight potential sources of disparity in access to telemedicine for CRC care, likely driven by hospital resources. Less access to telehealth services may reduce access to quality care for those patients concerned about potential disease exposure in the era of COVID-19.

	Offers Telehealth for New Visit			Offers Telehealth for Follow Up Visit		
	Unit Odds Ratio (95% CI)	ROC	P Value	Unit Odds Ratio (95% CI)	ROC	P Value
Total Medicaid Discharges (per 1,000 discharges)	0.925 (0.875, 0.979)	0.551	0.007	0.970 (0.910, 1.034)	0.508	0.352
Total Medicaid Inpatient Days (per 1,000 days)	0.987 (0.978, 0.996)	0.574	0.005	0.991 (0.980, 1.002)	0.538	0.114
Total Admitted Patients (per 1,000 patients)	0.975 (0.960, 0.990)	0.562	0.002	0.987 (0.969, 1.006)	0.536	0.170
Total Inpatient Days (per 1,000 days)	0.996 (0.993, 0.998)	0.573	0.001	0.997 (0.994, 1.000)	0.542	0.083
Total Outpatient Days (per 1,000 days)	0.999 (0.998, 0.999)	0.577	<0.001	0.999 (0.999, 1.000)	0.493	0.508
Total Surgical Operations (per 1,000 operations)	0.981 (0.966, 0.996)	0.570	0.011	0.983 (0.964, 1.00)	0.546	0.099

P84

Examining Patterns of and Reasons for Delays to Treatment in Colon Cancer

V. Arientyl,[1]* A. Kalam,[2] J.B. Schriner,[1] A. Kopp,[2] J. Qin,[2] P. Friedmann,[2] H. In.[1] *1. General Surgery, Montefiore Medical Center, Bronx, NY; 2. Albert Einstein College of Medicine, Bronx, NY.*

Background: Delays in colon cancer (CC) treatment can impact outcomes. Detailed examination into the reasons for delay are understudied, hindering the development of strategies to improve timeliness of care. Methods: CC patients diagnosed at an urban academic institution in 2018 were investigated. Chart review yielded presentation location, diagnostic-work up, treatment and patient characteristics. Time between presentation to the healthcare provider to treatment initiation of ≥ 60 days was considered a delay (Total_Delay). Total time further examined as 3 phases: presentation to diagnosis (PtoD), diagnosis to staging completion (DtoS), and staging completion to treatment (StoT). Delays for each phase was defined as ≥ 30 days. Results: Among 121 CC patients, the median time and interquartile range (IQR) between presentation and treatment initiation was 29 (IQR 8, 53) days. Total_Delay occurred in 21% of patients. The median time between presentation to treatment and interquartile range (IQR) for Total_Delay was 106 (IQR 82, 162) and 16 (IQR 6, 39) for non-Total_Delay. Age, sex, race, and comorbidities were similar between Total_Delay and non-Total_Delay. Total_Delay patients were generally more functionally independent (92% vs 74%, $p < .06$), presented to locations other than the emergency department (64% vs 42%, $p < .075$) and were less likely to have hospital admission work-up (20% vs 60%, $p < .001$) compared to non-Total_Delay. A logistic model showed that Total_Delay is associated with non-hospital work-up (OR 8.3, 95% CI 1.9-45.3), adjusting for comorbidities, symptoms, functional status, cancer severity, and insurance. Delays were similar in all three phases for Total_Delay patients; 48% had delay during PtoD, 60% during DtoS, and 48% during StoT. The most common reason for delay by phase were: scheduling an colonoscopy (6 of 11, 55%) for PtoD, and obtaining an outpatient specialty appointment for both DtoS and StoT, 6 of 15 (40%) and 5 of 11 (46%), respectively. Conclusions: Delays to treatment for CC are largely driven by health systems delays. Bundling of diagnostic evaluation and pre-treatment that mimics work-up during a hospital admission may overcome delays in cancer care.

P85

Review of Intestinal Leiomyosarcomas: Epidemiology and Survival

H. Senapathi,* M. Perry, A. Morada, C. Bertram, E. Yeung, D. Bertsch, B. Cagir. *Surgery, Guthrie Robert Packer Hospital, Sayre, PA.*

Introduction: Intestinal leiomyosarcomas (LMS) from intramural smooth muscle is extremely rare. This study evaluates overall and cancer specific survival of LMS of small intestine, colon, and rectum. Methods: Clinical data from SEER-18 registry from 2000 to 2015 were compared between primary tumor sites using the chi-squared test for categorical and ANOVA for continuous variables. 5-year survival rate analysis was performed for overall survival (OS) and cancer specific survival (CSS). Univariate and Multivariate Cox proportional hazard models were performed for age tumor site, grade, stage, and type of surgery. Results: A total of 376 patients were identified with LMS of small intestine (n=186, 49.5%), colon (n=143, 38.0%) and rectum (n=47, 12.5%). The mean age of diagnosis is 39.2±12.6 years for small intestine, 36.7±14.9 for colon, and 39.6±13.1 for rectum with no significant difference

(p=NS). The 5-year OS for lower GI tract LMS is 46.4% and CSS is 63.5%. When stratified by site of tumor, the 5-years CSS for small intestine, colon, and rectum is 57.2%, 70.3%, and 67.3% (p =NS), respectively. With Grade-I well-differentiated tumors as reference, the hazard ratios (HR) of grade-III poorly-differentiated and grade-IV undifferentiated tumors is 4.51 (CI 1.53-13.29) (p=0.006) and 4.72 (CI 1.65-13.49) (p=0.004), respectively. Patients who had local or oncologic resection had better prognosis than patients who did not get surgical therapy (HR of 3.50, CI of 1.38-8.88, p=0.008) when adjusted for site, sex, grade, and stage. There is no significant difference in survival between local and oncologic resection; HR of 1.60 CI of 0.73-3.55, (p=NS). Localized tumors at diagnosis had better survival than intestinal LMS with regional metastasis (HR of 2.15 95% CI of 1.36-3.40, p=0.001) or distant metastasis (HR of 4.51, 95% CI of 2.79-7.30, p<0.001). Conclusion: Intestinal leiomyosarcomas are diagnosed at a relatively early age, 4th decade. Patients with localized intestinal LMS have better survival than LMS with metastasis. Local or oncologic resection improves survival of patients with intestinal LMS.

Clinical Outcomes of Intestinal Leiomyosarcomas

		Overall	HR (univariable)	HR (multivariable)
Age at diagnosis	Mean (SD)	38.3 (13.6)	1.02 (1.01-1.03, p=0.002)	1.02 (1.01-1.04, p=0.001)
Site	Small Intestine	186 (100.0)	-	-
	Colon	143 (100.0)	0.69 (0.47-1.01, p=0.058)	0.81 (0.55-1.20, p=0.301)
	Rectum	47 (100.0)	0.84 (0.50-1.43, p=0.520)	1.18 (0.66-2.09, p=0.577)
Grade	Well differentiated; Grade I	23 (100.0)	-	-
	Moderately differentiated; Grade II	45 (100.0)	1.06 (0.33-3.45, p=0.919)	1.78 (0.54-5.91, p=0.345)
	Poorly differentiated; Grade III	57 (100.0)	3.30 (1.14-9.52, p=0.027)	4.51 (1.53-13.29, p=0.006)
	Undifferentiated; anaplastic; Grade IV	112 (100.0)	3.26 (1.17-9.04, p=0.023)	4.72 (1.65-13.49, p=0.004)
	Unknown	139 (100.0)	2.39 (0.86-6.62, p=0.095)	3.21 (1.11-9.27, p=0.031)
Surgery type	Local	31 (100.0)	-	-
	Invasive	300 (100.0)	1.59 (0.74-3.41, p=0.238)	1.60 (0.73-3.55, p=0.243)
	None	36 (100.0)	6.19 (2.56-14.94, p<0.001)	3.50 (1.38-8.88, p=0.008)
	NOS	9 (100.0)	3.33 (1.12-9.92, p=0.031)	1.93 (0.62-6.04, p=0.260)
Summary stage	Localized	164 (100.0)	-	-
	Distant	74 (100.0)	4.47 (2.87-6.95, p<0.001)	4.51 (2.79-7.30, p<0.001)
	Regional	111 (100.0)	2.19 (1.40-3.42, p=0.001)	2.15 (1.36-3.40, p=0.001)
	Unknown/ Unstaged	27 (100.0)	2.62 (1.26-5.47, p=0.010)	2.11 (0.94-4.75, p=0.070)

P86

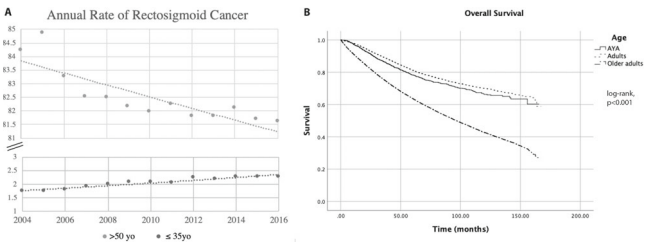
Assessment of Textbook Oncologic Outcomes Following Proctectomy for Rectal Cancer S.A. Naffouje,[3]* S.K. Kamarajah,[2] G.I. Salti,[1] M. Hanna,[4] F.S. Dahdaleh.[1] *1. General Surgery/Surgical Oncology, Edward-Elmhurst Health, Elmhurst, IL; 2. Queen Elizabeth Hospital, Birmingham, United Kingdom; 3. H. Lee Moffitt Cancer Cente, Tampa, FL; 4. City of Hope, San Bernandino, CA.*

Introduction: Outcomes of rectal adenocarcinoma (RAC) vary considerably. Composite "textbook oncologic outcome" (TOO) is a useful single metric which estimates optimal clinical performance for cancer surgery. We sought to evaluate TOO following proctectomy for RAC. Methods: The National Cancer Database 2004-2017 (NCDB) was utilized. Stage II/III RAC patients who underwent single-agent neoadjuvant chemoradiation to the rectum or pelvis followed by transabdominal proctectomy within 5-12 weeks of conclusion were selected. TOO was defined as achievement of negative distal and circumferential margins, retrieval of ≥12 nodes, no 90-day mortality, length of stay (LOS) <75th percentile of corresponding year's range, and receipt of adjuvant chemotherapy. Multivariate logistic regression was used to identify predictors of TOO. Kaplan-Meier method was used to estimate survival. Results: Among 318,225 patients, 10,674 met selection criteria. Mean age was 61.47 years and 62.5% were males. The most common procedure was low anterior resection (LAR, 7,276, 68.2%), and the most common approach was open (6,811, 63.8%). 6,910 patients (64.7%) were treated at low-volume centers (<20 proctectomy's/year). TOO was achieved in 1,249 patients (11.7%). Several components of TOO were attained commonly including negative circumferential resection margin (89.5%), no 90-day mortality (98.0%), no unplanned readmission (93.0%) and no prolonged hospitalization (78.5%). Conversely, receipt of adjuvant chemotherapy occurred in 24.1%. Logistic regression identified increasing age, black race, Charlson score ≥3, and abdominoperineal resection (APR) to be predictors of failure to achieve TOO, whereas private insurance, clinical stage III, laparoscopic resection, and treatment at high-volume center were associated with TOO. Independent of receipt of adjuvant chemotherapy, TOO patients had improved overall survival. Conclusions: RAC patients achieve TOO uncommonly owing largely to poor adherence to national guidelines for adjuvant chemotherapy. Disparities including insurance type and race contribute to TOO failure. Modifiable factors which impact TOO include center-volume and minimally-invasive approach.

P87

Contemporary Trends and Survival Outcomes of Young Adults and Adolescents with Rectal Cancer in the United States C.C. Baumrucker,[1]* A.L. Collier,[1] J. Mesquita-Neto,[2] J. Datta,[1] N.B. Merchant,[1] F.I. Macedo.[2] *1. University of Miami Miller School of Medicine, Miami, FL; 2. North Florida Regional Medical Center, University of Central Florida College of Medicine, Gainesville, FL.*

Introduction: The incidence of rectal cancer (RC) among adolescents and young adults (AYA) has been increasing in the past decade in the US. However, practice patterns and survival outcomes in these patients remains unclear. Methods: Patients with RC were queried (NCDB, 2004-2016) and stratified into age groups: AYA (18-35yo), adults (AD, 36-50yo), and older adults (OA, 51+yo). Student t-test and the Cochran-Armitage test for trend were used to assess changes in the proportion of AYA patients. Kaplan-Meier, log-rank, and Cox multivariable regression analysis were used for intergroup comparison. Results: A total of 377,229 patients with RC were included (mean age 63.6 ± 13.1y, 42.4% females, 10.1% African Americans). The proportion of AYA with RC increased by 0.043% (p=0.031) each year, whereas it remained stable in OA (-0.21%, p=0.101, Fig 1A). Mean age at diagnosis of RC decreased by 0.21 each year (95% CI -0.32, -0.09, p=0.001). AYA were more likely to present with metastasis than AD/OA (26.1%, 24.1%, 20.5%, p<0.001, respectively). Among patients with non-metastatic disease, OA were less likely to undergo surgery (AYA-88.5%, AD-89.2%, OA-83.7%, p<0.001), radiation therapy (RT, 63.6%, 64.6%, 55.5%, p<0.001, respectively), or chemotherapy (CT, 72.2%, 71.1%, 58.8%; p<0.001, respectively). There was no difference in access to surgery (p=0.172), RT (p=0.199), or CT (p=0.173) between AYA and AD. AYA had superior OS compared to OA, however, had worse OS than AD (AYA-126, OA-96.2 and AD-131mo, Fig 1B, p<0.001). AYA, OA, male gender, advanced clinical stage and comorbidity score, and lack of access to surgery, RT, and CT were independent predictors of mortality. Conclusion: The incidence of RC continues to rise in this contemporary series of AYA patients treated at accredited US cancer centers. AYA were more likely to be diagnosed with metastatic disease. Despite having similar access to multimodal treatment, AYA with RC had worse OS compared to AD. Further research is needed to investigate specific treatment options to address potentially unfavorable biological features of RC in AYA.



P88

Dynamic Prediction of 5-year Overall Survival in Stage I,II,III Colon Cancer Patients J. Battagello,[1] G. Capelli,[2]* A. Restivo,[3] Q. Bao,[2] S. Deidda,[3] L. Zorcolo,[3] S. Pucciarelli,[2] M. Zorzi,[1] G. Spolverato.[2] *1. Veneto Tumor Registry, Azienda Zero, Padova, Italy; 2. Department of Surgical, Oncological, and Gastroenterological Sciences, First Surgical Clinic, University of Padova, Padova, Italy; 3. University of Cagliari, Cagliari, Italy.*

INTRODUCTION Data on overall survival of patients affected by colon cancer are available. However, tailored prognostic estimators are needed, based on baseline characteristics and accounting for time dependent variables. METHODS We developed a dynamic prediction tool analysing patients who underwent curative-intent surgery for histologically confirmed colon cancer between 1985 and 2019 in two Italian centers. Patients who were metastatic or recurrent, non-radical, palliative or emergency surgery were excluded; in situ and appendix cancers were also excluded. The tool includes baseline variables (gender, age, CEA, ASA score, cancer site, pT and pN stage, grading, lymphatic-vascular-perineural invasion and adjuvant chemotherapy) and time-dependent predictors (local recurrence and distant metastases) and generates 5-year dynamic overall survival (DOS) estimates after surgery. Follow-up started from the date of surgery, and the DOS was obtained every 3 months up to 5 years. The best subset of covariates was selected through a landmark

Cox model which included linear and quadratic time effects using a forward selection approach; interaction coefficients were removed from the model in case of no significance. RESULTS A total of 2,197 patients with a median follow up of 6.42 years (IQR: 2.60-11.7) were included. A total of 444 patients died, 34 developed local recurrence and 164 distant metastases. All the covariates included in the model had a time-constant effect. Local and distant recurrence were the major predictors of DOS, with HR equal to 3.08 (95%CI: 1.55 – 6.13) and 8.37 (95%CI: 5.93- 11.83) respectively. Gender, age, pT, pN and adjuvant chemotherapy showed a strong relationship ($p<0.05$); the association of vascular invasion was borderline ($p=0.08$), while other clinic-pathological characteristics were excluded for no significance. The model performance was good both in terms of calibration and discrimination. CONCLUSIONS Due to the strong impact of time-dependent variables on survival, models used to estimate the OS should be updated after surgery. To our knowledge, this is the first model generating dynamic and individualized survival estimates for colon cancer patients.

P89

Access to Colorectal Cancer Care for Patients with Medicaid at Designated Cancer Hospitals V.A. Marks,[1]* W.R. Hsiang,[1] W. Umer,[2] A. Haleem,[2] D. Kim,[1] M.S. Leapman,[3] J.W. Kunstman,[4] K.M. Schuster.[5] *1. Yale School of Medicine, New Haven, CT; 2. The College of New Jersey, Ewing, NJ; 3. Urology, Yale School of Medicine, New Haven, CT; 4. Surgical Oncology, Yale School of Medicine, New Haven, CT; 5. General Surgery, Trauma & Surgical Critical Care, Yale School of Medicine, New Haven, CT.*

Introduction: Following Medicaid expansion under the Affordable Care Act, one in five Americans are now insured through Medicaid. We aimed to understand variation in Medicaid access to colorectal cancer (CRC) care and evaluate factors associated with hospital level Medicaid acceptance. Methods: From March to August 2020, investigators randomly selected and successfully contacted 397 of over 1500 Commission on Cancer (CoC) accredited hospitals to evaluate access to CRC care for Medicaid insurance using a secret shopper model. Hospital-level variables such as facility type (e.g., community, academic) were recorded. Additional characteristics from American Hospital Association (AHA) and Center for Medicare and Medicaid Service (CMS) databases were collected. We described the relationship between these variables and access to CRC care for Medicaid patients using frequency tables, descriptive statistics, and logistic regression. Results: Of the 397 hospitals, 359 (90.4%) accepted Medicaid. The table describes the relationship between key facility characteristics and Medicaid acceptance. Comprehensive community cancer programs were significantly less likely to accept Medicaid than academic and community cancer programs. For-profit hospitals were significantly less likely to accept Medicaid than government and nongovernment not-for-profit hospitals. Of note, facilities with Joint Commission accreditation were significantly less likely to accept Medicaid than those without accreditation. Facility volume (i.e., bed size, total admissions, total operations) and Medicaid patient volume (i.e., Medicaid discharges and days) were not significantly associated with Medicaid acceptance. Conclusion: We found that 9.6% of CoC-accredited hospitals sampled did not accept Medicaid-insured patients with suspected CRC. These cancer hospitals were more likely to be for-profit and comprehensive community programs. These findings highlight disparities in colorectal cancer care that may be increasingly relevant given the expanding Medicaid population.

		Accepts Medicaid (n=397)	Odds Ratio (95% CI)	P Value
Facility Type				0.011
	Comprehensive Community Cancer Program (n=173)	147 (85%)	Ref	-
	Academic Comprehensive Cancer Program (n=57)	56 (98%)	9.90 (1.31, 74.73)	0.026
	Community Cancer Program (n=94)	88 (94%)	2.59 (1.03, 6.55)	0.044
	Integrated Network Cancer Program (n=43)	40 (93%)	2.36 (0.68, 8.19)	0.177
	NCI Designated Program (n=30)	28 (93%)	2.47 (0.56, 11.03)	0.234
Hospital Ownership				0.016
	Investor-owned, For-profit (n=48)	38 (79%)	Ref	-
	Government (n=50)	47 (94%)	4.12 (1.06, 16.05)	0.041
	Nongovernment, Not-for-profit (n=299)	274 (92%)	2.88 (1.29, 6.57)	0.010
Bed Size				0.392
	100 or Less Beds (n=30)	26 (87%)	Ref	-
	100-199 Beds (n=71)	67 (94%)	2.58 (0.60, 11.07)	0.203
	200-299 Beds (n=95)	88 (93%)	1.93 (0.52, 7.12)	0.323
	300-399 Beds (n=64)	55 (86%)	0.94 (0.26, 3.34)	0.924
	400-499 Beds (n=40)	34 (85%)	0.87 (0.22, 3.41)	0.844
	500 or More Beds (n=97)	89 (92%)	1.71 (0.48, 6.14)	0.410
Accreditation by Joint Commission				0.013
	No (n=51)	51 (100%)	-	-
	Yes (n=346)	308 (89%)	-	-
Major Teaching Hospital				0.211
	No (n=313)	280 (89%)	Ref	-
	Yes (n=84)	79 (94%)	1.86 (0.70, 4.93)	0.211
Is Referral Necessary for Specialist Visit?				<0.001
	Referral Necessary (n=206)	198 (96%)	Ref	-
	No Referral Necessary (n=59)	56 (95%)	0.75 (0.19, 2.94)	0.6843
	Depends on Insurance Plan (n=132)	105 (80%)	0.16 (0.07, 0.36)	<0.001

P90

Evaluation of the Survival Outcomes of Intestinal Adenosquamous Carcinomas with SEER-18 Registry: What Do We Know? E. Yeung,* H. Senapathi, M. Perry, C. Bertram, A. Morada, D. Bertsch, B. Cagir. *Surgery, Guthrie Robert Packer Hospital, Sayre, PA.*

Introduction: Intestinal adenosquamous carcinoma is a rare malignancy. This study is to evaluate overall survival of this malignancy in the small intestine, colon, and rectum. Methods: The Surveillance Epidemiology End Results (SEER)-18 registry from 2000-2015 was analyzed by Cox-proportional hazards using a univariate and multivariate analysis adjusting for age of patient at diagnosis, primary site of tumor, Grade of tumor at diagnosis, and type of surgery performed to calculate the hazard ratios for overall survival. All analyses were performed on RStudio version 1.3 Results: 332 patients diagnosed with adenosquamous carcinomas were identified between the period of interest small intestine (n = 20, 6.02%), colon (n =200, 60.2%) and rectum (n =112, 33.7%). Age of diagnosis is significantly different between the 3 groups (44.6) vs () vs () for small intestine colon and rectum respectively ($p<0.05$). The 5-year overall survival for small intestine, colon and rectum are 5.0%, 24.9% and 42.5% respectively ($p<0.001$). Overall, 5-year survival based on grade of cancer at diagnosis is 61% for grade I, 39.9% for Grade II, 25.9% for Grade III, 25.9% for grade IV tumors and 24.1% for tumors of unknown grade with a significant difference ($p =0.006$). The overall hazard ratio in poorly differentiated grade III tumors is 3.17 times that of well differentiated tumors (95% CI 1.01- 9.96, $p <0.05$). Grade I and the overall hazard ratio for death in patients without any surgical intervention is 3.33 (95% CI: 2.34-4.72, $p<0.001$) compared to patients who had an invasive surgery. Conclusion: There is high rate of diagnosis in an advanced stage of intestinal adenosquamous carcinoma. The diagnosis at advanced age is associated with poor survival outcomes. Patients who undergo surgical intervention had better survival outcomes when adjusted for grade and site of tumor.

Clinical Outcomes of Gastrointestinal Adenosquamous Carcinoma

		All	HR (univariable)	HR (multivariable)
Age at diagnosis	Mean (SD)	39.0 (14.5)	1.02 (1.01-1.03, p<0.001)	1.02 (1.01-1.03, p<0.001)
Site	Colon	200 (100.0)	-	-
	Rectum	112 (100.0)	0.61 (0.46-0.82, p=0.001)	0.50 (0.37-0.69, p<0.001)
	Small Intestine	20 (100.0)	2.12 (1.31-3.43, p=0.002)	1.77 (1.07-2.92, p=0.027)
Grade	Well differentiated; Grade I	9 (100.0)	-	-
	Moderately differentiated; Grade II	74 (100.0)	2.37 (0.74-7.62, p=0.148)	2.51 (0.78-8.10, p=0.123)
	Poorly differentiated; Grade III	195 (100.0)	3.60 (1.15-11.31, p=0.028)	3.17 (1.01-9.96, p<0.05)
	Undifferentiated; anaplastic; Grade IV	18 (100.0)	4.27 (1.23-14.87, p=0.023)	4.31 (1.23-15.07, p=0.022)
	Unknown	36 (100.0)	4.39 (1.34-14.42, p=0.015)	4.19 (1.26-13.91, p=0.019)
Surgery type	Invasive	259 (100.0)	-	-
	Local	12 (100.0)	0.84 (0.41-1.70, p=0.622)	1.00 (0.48-2.09, p=1.000)
	None	60 (100.0)	2.59 (1.91-3.52, p<0.001)	3.33 (2.34-4.72, p<0.001)
	NOS	1 (100.0)	0.92 (0.13-6.58, p=0.934)	1.34 (0.18-10.15, p=0.774)

P91

Resection of Locally Recurrent Rectal Cancer Confers a Similar Survival as Resection of Locally Advanced Primary Rectal Cancer B.J. Hasjim,[1]* A. Uppal,[2] M.D. Jafari,[1] S. Mills,[1] J.C. Carmichael,[1] M.J. Stamos,[1] A. Pigazzi.[3] *1. Surgery, UC Irvine, Orange, CA; 2. University of Texas MD Anderson Cancer Center, Houston, TX; 3. Weill Cornell Medical College, New York, NY.*

INTRODUCTION: The treatment of locally recurrent rectal adenocarcinoma presents a significant clinical challenge due to anatomic considerations and risk of re-recurrence. We sought to compare outcomes of patients who underwent resection of patients with locally advanced primary rectal cancer (PRC) and local recurrence (LR) at our institution. METHODS: We performed a retrospective analysis of patients with rectal adenocarcinoma from 2010-2019 at a single institution. Patients with pT4 PRC or LR were included. Categorical comparisons of tumor and treatment characteristics were analyzed with chi-square tests, and continuous variables were analyzed with the Mann-Whitney test. Survival was analyzed with the Kaplan-Meier survival function and Cox proportional hazards models. RESULTS: Of 44 patients identified, 19 underwent a total mesorectal excision of a PRC and 25 patients underwent resection of a LR. Patient and tumor characteristics were similar between PRC and LR cohorts: there were no significant differences in age, sex, BMI, co-morbidities, neoadjuvant treatment, distance to anal verge, or pathologic nodal involvement. Sidewall or multi-organ involvement were present in 9 (47%) of PRC and 12 (48%) of LR cases (p=0.97). Circumferential margins were positive in 7 (37%) of PRC and 6 (25%) of LR resections (p=0.35). Among LR patients, 82% had a locally advanced (pT3-T4 or N1-N2) primary tumor. PRCs and LRs required abdominoperineal, multi-visceral and/or sidewall resection in 9 (47%) and 17 (70%) respectively (p=0.12). Complications requiring invasive interventions were similar between cohorts (1 [5.3%] vs. 1 [4.4%], p=0.89) and there were no 30-day mortalities. Median follow-up was 17 months and 3-year progression-free survival after PRC or LR resection were similar (68.2% vs. 64.9%, p=0.33). CONCLUSIONS: Radical resection of an isolated LR can confer similar survival to resection of a locally advanced PRC. Morbidity and mortality of both resection types were also are similar. Identification of patients with LR who may benefit from re-resection is warranted.

P92

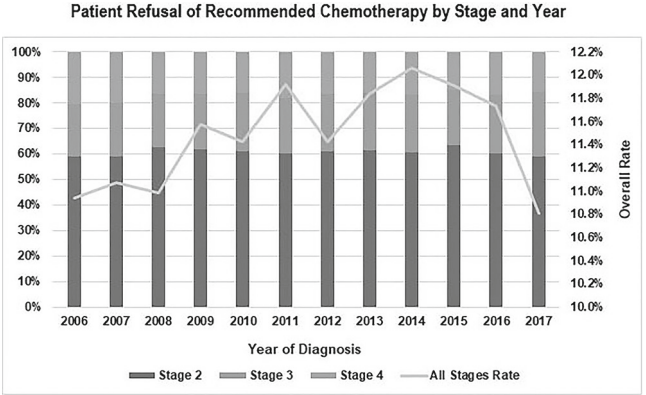
Survival Analysis and Treatment Approaches Amongst Older Patients with Microsattellite Unstable Colon Cancer L. Stockton,* M. Deng, E. Handorf, E. Dotan, J.M. Farma. *Fox Chase Cancer Center, Fort Washington, PA.*

Introduction: Older adults with colon cancer (CRC) are a common yet unique patient population requiring special considerations need to be made when discussing treatment options, however research in this population is limited. Testing for microsatellite instability (MSI) is recommended by guidelines for all patients diagnosed with CRC. Limited data is available to describe the rates and patterns of care of older adults with MSI-high (MSI-H) colon cancers, which is the aim of this analysis. Methods: A retrospective review of the National Cancer Database (NCDB) was performed of all patients diagnosed with CRC with documented MSI status. Patients were categorized into older (age >70) or young populations (age <70) and MSI status (stable/unstable low [MSS] vs unstable high [MSI-H]). Kaplan Meier curves and Cox proportional hazard models were used to assess overall survival. Treatment patterns were compared between groups using Chi-square tests. Results: 43,452 patients were identified with 34% of them over the age of 70. Median age amongst the older patients was 79 (71-90, SD 5.6). 2,997 patients (6.9%) of the total population reviewed were MSI-H. 8.8% of the older patients were MSI-H compared to 5.9% of the younger population (p<0.01). Of the patients with MSI-H tumors 69.8% had stage 1-3 colon cancer, and the rest had stage IV disease. Median overall survival (OS) was 87.9 months for MSI-H patients as compared to 66.5 months for MSS patients (p<0. 01). In the older population, MSI-H median OS was 59.8 months versus 46.6 months (p<0. 01). In younger patients with MSI-H colon cancer median OS was not reached (p<0. 01). Older adults were more likely to be treated with only surgery however there was no difference based on MSI status. Younger patients were more likely to receive adjuvant chemotherapy (p<0. 01). Conclusions: Older adults with MSI-H colon cancer had better overall survival as compared to similar aged MSS patients. Older patients were also less likely to receive chemotherapy and be treated with only surgery regardless of their MSI status. This may be attributed to concern for their tolerability of chemotherapy regimens.

P93

Who Refuses Chemotherapy? Disparities in a National Analysis of 531,706 Patients with Colon Cancer D.B. Hewitt,* M.F. Eskander, B. Oppong, S. Obeng-Gyasi, A. Tsung. *The Ohio State University Wexner Medical Center, Columbus, OH.*

Introduction: Despite significant advances in colon cancer treatment, there are racial and socioeconomic disparities in presentation, disease management, and survival. Refusal of guideline-concordant care (chemotherapy or surgery) portends a worse survival and could be a driver of existing disparities. The objectives of this study are to identify the refusal rate of recommended chemotherapy and examine associations between race/ethnicity, sociodemographic factors, and chemotherapy refusal. Methods: Using the National Cancer Database (NCDB), we examined the refusal of recommended chemotherapy in patients with Stage II-IV colonic adenocarcinoma. Multivariable logistic regression models were constructed to assess factors associated with chemotherapy refusal. Results: From 2006 to 2017, chemotherapy was offered to 297,248 of 531,706 (55.9%) patients with Stage II-IV colonic adenocarcinoma of which 11.5% (34,157/297,248) refused chemotherapy. Refusal rates peaked in 2014 at 12.1% and have since declined (Figure). Refusal rates were highest in Stage II and lowest in Stage IV (p<0.001). In adjusted analyses of patients offered chemotherapy, patients were more likely to refuse chemotherapy if they were older (80+ years 12.40, 95%CI 11.47-13.41 vs 18-49 years), female (OR 1.11, 95%CI 1.09-1.14), uninsured (OR 2.01, 95%CI 1.84-2.20), on Medicaid (OR 1.55, 95%CI 1.45-1.65), or Medicare (OR 1.33, 95%CI 1.26-1.40 vs private insurance), or had multiple comorbidities (Charlson/Deyo Score ≥1 OR 1.29, 95%CI 1.25-1.33). Hispanic patients (OR 0.70, 95%CI 0.64-0.77 vs Non-Hispanic), and those with longer travel distances (farthest distance quartile OR 0.84, 95%CI 0.79-0.88 vs closest distance) were less likely to refuse chemotherapy. Race was not associated with chemotherapy refusal. Conclusions: Increasing age, lack of insurance, government insurance status, and multiple comorbidities are associated with refusal of recommended chemotherapy in the NCDB. With an aging population and a tenuous insurance landscape, future studies should focus on identifying reasons for refusal of care, defining barriers to treatment, and understanding medical decision-making in these populations.



P94

Incidence and Outcomes of Patients >75 Years Old Diagnosed with Metastatic Colorectal Cancer C. Schuster,[1]* K. Busari,[1] J. Glasser,[1] R. Shridhar,[2] J. Huston,[3] K. Meredith.[1] *1. Florida State University College of Medicine, Sarasota, FL; 2. Florida Hospital Cancer Institute, Orlando, FL; 3. Sarasota Memorial Cancer Institute, Sarasota, FL.*

IIntroduction: There will be 147,950 new cases of colon and rectal cancers (CRC) diagnosed in 2020. Guidelines no longer recommend screening colonoscopy in patients >75 y/o. We sought to evaluate the incidence of colorectal cancer and treatment of patients with metastatic disease who were 75 years or older. Methods: Utilizing the National Cancer Database we identified patients diagnosed with colorectal cancer and stratified based upon age >75. We further stratified by treatment and location of treatment academic vs community center. Mann-Whitney U and Kruskal were used to compare continuous variables and Pearson's Chi-square test was used to compare categorical variables.

Unadjusted survival analyses were performed using the Kaplan-Meier method. Multivariate analysis (MVA) was performed to identify predictors of survival. All statistical tests were two-sided and $p<0.05$ was considered significant. Results: We identified 167,059 patients with CRC and 53,104 (31.8%) patients were >75 y/o. There were 23,951 (45.1%) males and 29,153 (54.9%) females, $p<0.001$. Stage III represented 8321 (15.7%) of patients and metastatic disease was diagnosed in 10,614 (20%) and this was less frequent then their 50-75 counterparts (18.8% and 25.8% respectively), $p<0.001$. The lower incidence of metastatic disease persisted amongst all sites. Of the patients with metastatic disease, 2,617 (24.7%) underwent no treatment, 872 (8.2%) underwent chemo or chemo XRT, 3,922 (36.9%) underwent surgery + chemo and 3,202 (30.2%) underwent surgery only. The median and 5-year overall survival in patients opting for no treatment was (2.6 mo and 5%) compared to those treated with chemo only (15.7 mo and 6%) and surgery/chemo 29.2 mo and 20%, $p<0.001$. Patients treated at community centers had median and 5 year survival of 43.8 mo and 39% compared to those treated at academic centers 49.1 mo and 43%, $p<0.001$. Conclusions: Patients >75 years have a high incidence of colon and rectal cancer despite changes in screening guidelines and a significant number of these patients will develop metastatic disease. Survival is benefited in these patients if they undergo surgery and if their treatment is at academic centers.

P95

The Impact of Calcitonin Trends in Medullary Thyroid Cancer T. Szabo Yamashita,* R.T. Rogers, T. Foster, M. Lyden, G. Thompson, J. Morris, T. McKenzie, B. Dy. *Surgery, Mayo Clinic Rochester, Rochester, MN.*

Background: Medullary Thyroid Cancer (MTC) is a neuroendocrine tumor associated with Multiple Endocrine Neoplasia 2A/B. MTC secretes Calcitonin, which is used as a tumor marker in surveillance. Patients often present biochemical recurrence without localization of disease. The impact of pre-operative calcitonin levels in loco-regional disease outcomes and on post-operative calcitonin trends remains unclear. Methods: Retrospective review (2000-2017) including patients undergoing surgical treatment for MTC. Basic demographic, clinical, and operative data was analyzed. Pre- and post-operative calcitonin levels were trended to evaluate its effect on disease free survival (DFS) and overall survival (OS). Results: 214 patients were identified (40% male sex, age 50±18 years). Pre-operative calcitonin median was 890pg/mL (IQR 0.3-3484) and 62% presented with positive cervical nodes in pathology. 36 patients developed recurrence, 6 were biochemical only without identifiable source, 13 loco-regional, and 17 systemic. DFS at 15 years was 77% for patients with pre-operative calcitonin <1000 pg/mL, vs 46%. HR for recurrence was 4.38 (CI 1.89-10.16, p=0.001) for pre-operative calcitonin >1000 pg/mL. Calcitonin as a time dependent covariate presented HR of 1.03 (0.99-1.07, p=0.12) for non-biochemical recurrence per 10% increase in calcitonin over time. OS for pre-operative calcitonin ≥1000 pg/mL was 71 vs 73%, and a HR of 2.37 (CI 0.96-5.83, p=0.06). Doubling of calcitonin showed HR of 1.32 (CI 1.06-1.64, p=0.01) for death. Doubling of calcitonin as a time dependent covariate for death in the post-operative period presented HR 1.61 (CI 1.41-1.83, p<0.0001). When comparing doubling of calcitonin from pre-operative period until last follow-up, HR was 2.14 (1.67-2.75, p<0.0001). The effect of initial calcitonin level and the doubling of it on mortality were similar when comparing clinical stages of MTC. Conclusion: Higher pre-operative calcitonin is associated with higher loco-regional and systemic recurrence, as well as shorter overall survival. Increased calcitonin in the post-operative period also correlates with higher chances of non-biochemical recurrence and decreased overall survival.

P96

Mutation Status in Medullary Thyroid Cancer: Are Outcomes Similar to Sporadic Cases? T. Szabo Yamashita,* R.T. Rogers, T. Foster, M. Lyden, G. Thompson, J. Morris, T. McKenzie, B. Dy. *Surgery, Mayo Clinic Rochester, Rochester, MN.*

Background: Medullary thyroid cancer (MTC) is a rare form of cancer which is associated to familial syndromes (MEN 2A/B) and genetic mutations (RET). MTC can present as an incidental finding or with early metastatic disease. Multiple mutations are known, however their clinical significance is unknown. Methods: Patients undergoing surgical treatment for MTC at Mayo Clinic (2000-2017) were included. Demographics, genetic associations, clinical, and imaging findings were analyzed. Disease free survival (DFS), recurrence rate (RR) and overall survival (OS) were analyzed based on presence of syndrome and mutation status. Results: 214 patients were included, mean age 50±18 years. 59.8% of patients were of female sex and 26% were associated with familial syndromes (FS), 95% MEN 2A. 115 patients were found to have MTC during prophylactic procedures. Genetic mutations were diagnosed in 31.5% (58) of cases. 20% of patients had metastatic disease at initial diagnosis, four associated with FS, odds ratio (OR) of 0.3 (CI 0.11-0.82, p=0.02). 24 different mutations were identified, G533C was the most common,(n=11). Median time to recurrence was 5 years for all patients. Patients with FS had a DFS of 89% at 10 years, vs 62.84% in sporadic. Patients with known genetic mutations had a DFS of 85.4% vs 61.79%. Hazard ratio (HR) for any recurrence was 0.39 (CI 0.15-1.01, p=0.05) for FS and 0.54 (CI0.23-1.26, p=0.15) for cases associated with known mutations. Median follow-up to death was 5.2 years. 10 year survival rate was 77.4% for sporadic cases, vs 93.1%. OS for cases with known genetic mutations was 94% vs 81.2% at 10 years. Cox Model for OS obtained HR=0.37 (CI 0.11-1.21, p=0.1) FS and 0.38 (CI 0.11-1.27, p=0.12) for patients with known genetic mutations. Conclusion: MTC often presents with genetic mutations associated with familial syndromes. When compared to sporadic cases, those with genetic mutations have longer DFS and OS, although not statistically significant in this study. Although similar, outcomes appear to have differences when grouping patients according to mutation status vs presence of syndrome, showing that there is much unknown to this day about genetics of MTC.

P97

Surveillance Patterns of Gastroenteropancreatic Neuroendocrine Tumors at Community and Tertiary Centres A. Watanabe,[1]* G.J. McKendry,[1] L. Yip,[1] J. Loree,[2] H.C. Stuart.[1] *1. University of British Columbia, Vancouver, BC, Canada; 2. BC Cancer Agency, Vancouver, BC, Canada.*

Introduction: Strategies for post-operative surveillance imaging following resection of gastroenteropancreatic neuroendocrine tumors (GEP-NETS) vary amongst institutions. This study compares patterns of surveillance imaging between community and tertiary cancer centres for small bowel (SB), colorectal (CR), and pancreatic (P) NETs and their associations with survival. Methods: Patients with fully resected GEP-NETs referred to a provincial cancer centre between 2004-2015 were reviewed. Baseline characteristics, follow-up setting, and imaging were recorded for SB, CR, and PNETs. Associations between follow-up setting, primary tumor location and imaging frequency were determined using Kaplan-Meier and Cox-regression analyses. Results: Among 369 GEP-NET patients, 195 had SB, 94 had CR, and 80 had PNETs. Mean age was 63, 59, and 58 years for SB, CR, and PNETs, respectively. 74% of SB, 53% of CR and 62% of PNETs were followed at tertiary centres. Independent t-tests showed that patients with SB and CR-NETs underwent more imaging at tertiary than community centres, while PNETs had similar imaging frequencies (Table 1). In univariate analyses, follow-up at a tertiary centre was associated with improved disease-free survival (DFS) for CR-NETs (HR 3.92, 95%CI 1.30-11.83, p=0.015; 5-year incidence of recurrence: tertiary 27% vs. community 12%). Follow-up at a tertiary centre was associated with improved overall survival (OS) for PNETs (HR 0.26, 95%CI 0.11-0.64, p=0.003; 5-year OS: tertiary 88% vs. community 68%). Follow-up setting was not associated with DFS or OS for SB-NETs. In multivariate analyses, follow-up at a tertiary centre predicted better OS in PNETs (HR 0.90, 95%CI 0.02-0.37, p=0.001) and increased imaging/year predicted worse OS in CR (HR 2.54, 95%CI 1.70-3.78, p<0.001) and PNETs (HR 1.98, 95%CI 1.42-2.74, p<0.001). Conclusions: Strategies for surveillance of SB, CR, and PNETs vary among institutions and should be guided by survival outcomes. Patients with PNETs may benefit from follow-up at a tertiary centre regardless of imaging frequency. Prolonging imaging frequency for SB and CR-NETs may be considered in certain patient populations.

Table 1. Average number of imaging per year

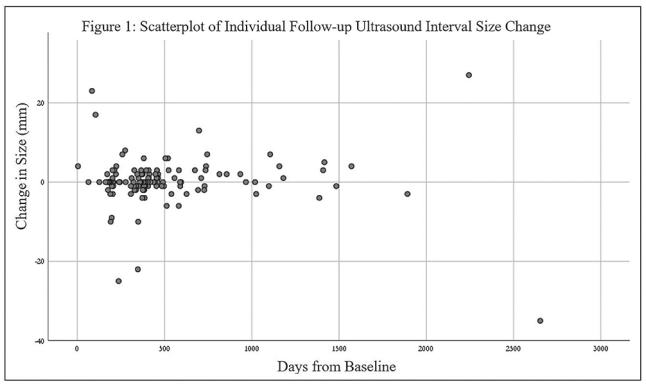
	Imaging per year (average +/- SD)		
Site	Tertiary	Community	P
Small Bowel	1.83 +/-1.12	0.82 +/- 0.96	<0.001
Colorectal	2.54 +/-2.71	0.69 +/- 0.98	<0.001
Pancreas	2.25 +/-1.70	2.19 +/- 4.37	0.923

P98

Ultrasound Follow-up After Benign Thyroid Biopsy: Is it too Frequent? W.T. Merritt,* K. Hitscherich, M. Hernandez, Y. Sheldon, R.A. dos Reis, N. Petrelli, G. Tiesi. *Helen F. Graham Cancer Center and Research Institute, Christiana Care Health System, Newark, DE.*

Introduction National Comprehensive Cancer Network guidelines recommend patients with benign Bethesda II cytology on fine needle aspirate (FNA) thyroid biopsy to undergo follow-up ultrasound (US) imaging within 6 – 12 months of biopsy. This review sought to understand if patients developed clinically relevant interval growth after their first benign FNA and if any correlation exists between size change and long-term follow-up duration. Methods A retrospective medical record review was performed on patients with Bethesda II FNA cytology and US surveillance from 2012-2019. Patient demographics, baseline nodule size, time to first follow-up US, change in nodule size, total long-term follow-up time, and rate of subsequent interventions were recorded. Results 64 patients were identified with 1+ follow-up US, 35 received a second US, and 3 had five or more US. Patients' mean age at biopsy was 63 +/- 12 years and most were female (n=55). Average baseline nodule size was 21.3mm +/- 11.9mm. Average time to first follow-up US was 21.4 +/- 27.2 months, and average nodule size decreased by 0.67mm (p=0.45) or -6.37% (p=0.08). The average total long-term follow-up duration was 35 +/- 33.6 months, and average size increase of 0.32mm (p=0.79) or 6.75% (p=0.09) was not significant (see Figure 1). Final nodule size showed 35 increased, 23 decreased, and 6 had no change from baseline. There was no correlation between length of follow-up and size change magnitude (r=-0.065, p=0.611), and no relationship was found between patient's age at diagnosis and size variation over time (r=0.070, p=0.584). 6 patients had surgery unrelated to growth change and no malignancies seen on final pathology. Two patients underwent repeat biopsy converted from Bethesda II to III (one returned to baseline after repeat FNA and one was lost to follow-up). Conclusions Patients with Bethesda II benign thyroid nodules saw a trend toward decreased size at the first US follow-up of nearly two years on average, and a non-significant small increase across a lengthy total follow-up period. Interventions were rare with no confirmed malignancies. Surveillance ultrasound recommendations can be relaxed without substantial risk to patients.

Figure 1: Scatterplot of Individual Follow-up Ultrasound Interval Size Change



P99

Utility of Selective Lateral Neck Dissection for Papillary Thyroid Cancer L. Selby,* T.J. Perry, C. Shen, W. Kellett, P. Brock, B. Miller, P. Dedhia, J. Phay. *The Ohio State University, Columbus, OH.*

Introduction: Patients with papillary thyroid cancer and lateral neck lymphatic metastasis traditionally undergo modified radical neck dissection (MRND, levels 2-4±5). We hypothesized that selective lateral neck dissection (SLND) may be oncologically acceptable in patients with isolated lymph node metastasis on preoperative ultrasound. Methods: Following IRB approval, patients who underwent thyroidectomy and lateral neck dissection for papillary thyroid cancer were identified in a prospective database. Operative and pathology reports were reviewed to classify patients as either having undergone MRND (levels 2–5) or SLND (either levels 2-3, 3-4, or 3-5). Patients were selected by their surgeon for SLND on preoperative imaging and intraoperative findings. Patient characteristics and post-operative complications were compared between groups using the t test or chi-square test, time to recurrence was compared using the Kaplan Meier method. Results: Since 2010, 105 patients underwent lateral neck dissection simultaneously or within 90 days of total thyroidectomy for papillary thyroid cancer; 20% (21/105) underwent SLND. Median age of diagnosis was 43, 59% (61/105) were female. Tumor characteristics including median tumor size, the presence of extrathyroidal extension, multifocal or bilateral thyroid tumors, or lymphovascular invasion, did not differ by surgical approach. The rate of chyle leak requiring reintervention was 7% for MRND and 0% for SLND; this and other complications did not differ significantly by approach. With median follow up of 47 months, neither reoperation in the ipsilateral neck (MRND: 7%, SLND 5%) or recurrence of any type (MRND: 25%, SLND: 29%) differed between groups ($p > 0.05$ for all measures). Discussion: In this retrospective study, SLND appears to be oncologically safe for patients with lateral lymphatic metastasis from papillary thyroid cancer. Besides extent of lateral neck disease preoperatively, we were unable to identify significant differences in preoperative characteristics, biochemical or imaging recurrence, or survival, between patients selected for SLND and MRND. Imaging based de-escalation of MRND for papillary thyroid cancer warrants prospective evaluation.

Patient, pathologic, and outcome characteristics of patients undergoing total thyroidectomy and lateral neck dissection for papillary thyroid cancer.

	Complete Neck Dissection (N=84; 80%)	Selective Neck Dissection (N=21; 20%)	p-value
Age at Diagnosis	40 (30, 53)	42 (32, 55)	0.5
Female Gender	49 (58%)	12 (57%)	0.9
Maximum tumor size	2.0 (1.3, 3.0)	2.4 (1.6, 3.1)	0.14
Extrathyroidal Extension (N=100)	42 (51%)	7 (39%)	0.3
Multifocal Thyroid Disease	59 (70%)	13 (62%)	0.5
Bilateral Thyroid Disease	25 (30%)	3 (14%)	0.2
Lymphovascular Invasion (N=104)	35 (42%)	10 (50%)	0.5
Lateral Neck Disease Burden on Preoperative Imaging			
Localized Nodal Disease	15 (19%)	16 (84%)	<0.0001
Diffuse Nodal Disease	64 (81%)	3 (16%)	
Any complication	31 (37%)	5 (24%)	0.3
Hypocalcemia	13 (15%)	3 (14%)	0.9
Any Recurrent Laryngeal Nerve Injury	8 (10%)	1 (4.8%)	0.5
Any lateral neck motor nerve injury	1 (1.2%)	1 (4.8%)	0.3
Chyle leak requiring intervention	6 (7.1%)	0 (0%)	0.2
Any wound complication	2 (2.4%)	0 (0%)	0.5
Received RAI (N=93)	74 (100%)	19 (100%)	
Any Recurrence	21 (25%)	6 (29%)	0.7
Reoperation on the ipsilateral neck	6 (7.1%)	1 (4.8%)	0.7
Months from Neck Dissection to Recurrence (N=27)	28.6 (15.0, 46.7)	26.0 (12.2, 59.2)	0.9

P100

C-terminal Hsp90 Inhibitor Targets Cancer Glycolysis and Fatty Acid Metabolism C. Subramanian,[1]* J. Zhu,[1] D. Lubman,[1] B.S. Blagg,[2] M.S. Cohen.[1] *1. Surgery, University of Michgian, Ann Arbor, MI; 2. University of NotreDame, NotreDame, IN.*

Introduction: Novel C-terminal heat shock protein 90 inhibitors (HSP90i) lack induction of the heat shock response that contributes to the clinical toxicities noted with N-terminal HSP90i. We have shown that a novel C-terminal HSP90i, KU757, has selective potency and efficacy targeting head and neck (HNSCC) cancer cells. To guide translational applications of KU757, we hypothesized that a comprehensive mass spectrometry-based proteomic analysis of HNSCC cells treated with KU757 will identify key cancer-specific pathways that are uniquely targeted by this C-terminal HSP90i. Methods: Two HNSCC cell lines, UMSCC22B and UMSCC108, were treated 24h with IC_{50} values of KU757. Proteins isolated from the cell pellet and enzyme digested with trypsin. Tryptic peptides were labelled by iTRAQ 8-plex reagent. The labeled samples were analyzed by Orbitrap LC-MS/MS. The m/z values of the experimental protein were searched using UniPortKB/Swiss-Port database of Homo sapiens at a mass tolerance of 0.1%. Pathway enrichment analysis was carried out using GSEA. Statistically significant proteins ($p<0.01$ for each comparison) in treatment groups vs. DMSO treated control group with the largest-fold change were calculated using a Volcano plot. Results: LC-MS/MS proteomic analysis resulted in >1900 differentially regulated proteins. Heat map analysis isolated the top 15% of proteins with the greatest-fold expression changes with treatment. Functional pathway enrichment analysis of the volcano plots of significantly regulated proteins indicated targeted alteration of key pathways involved in cellular differentiation, glycolysis, fatty acid metabolism, innate immune response, and IL2/STAT signaling. Conclusion: Treatment-based proteomic analysis revealed that KU757 acts on aggressive

HNSCC cells by targeting glycolysis, IL2/STAT signaling, and fatty acid metabolism. Identification of these key drug-mechanistic pathways allows for more functional translation of future in vivo studies with KU757 alone or in novel combination strategies designed for mechanism-targeted clinical development.

P101

Factors Contributing to Palliative Care Use in Pancreatic Cancer: A Review of the National Cancer Database G.L. Aitken,* P.T. Reynolds, C.J. Gannon, O.H. Llaguna. *Memorial Healthcare System, Hollywood, FL.*

Introduction: Palliative care (PC) is offered to patients with pancreatic cancer with the aim of providing symptomatic relief and enhancing quality of life. Despite its benefits, utilization varies. The purpose of this study was to determine factors associated with PC use amongst patients who died of pancreatic cancer. Methods: Deceased patients treated for pancreatic adenocarcinoma were identified using the 2016 National Cancer Database. Multivariable logistic regression was used to evaluate patient, disease, and institutional features associated with PC use. Patients were classified into three categories based on survival: <6 months, 6-12 months, and 12+ months. Results: A total of 296,617 patients were identified, of which 14.7% received PC. Patient characteristics with the largest percentages included: white (83.8%), Charlson-Deyo score of 0 (65.1%), Medicare (59.3%), metropolitan location with population 250,000-1 million (50.5%), stage IV cancer (45.2%), East Coast (43.3%), and treatment in an academic/research program (40.9%). Patients with Medicaid had significantly higher odds of PC use compared to private insurance if they survived >12 months. Patients with stage II, III, and IV cancer had increased odds of receiving PC in all survival groups compared to stages 0 and I. The percentage of patients receiving PC was significantly greater in those surviving <6 months vs >12 months (17.0% vs 9.7%, respectively). Multivariable logistic regression revealed that patients who received PC were more likely to be younger, Asian, recently diagnosed, not have a high school diploma, have a higher Charlson-Deyo score, report a median annual income <$38,000, and live in urban or rural areas. Conclusions: Amongst patients diagnosed with pancreatic cancer, there is a national underutilization of PC with <15% of patients engaging in these services. Disparities are known to exist in both access to and provision of PC services. Identifying patterns associated with PC use is the first step towards closing this gap in health equity, as these factors can be used to create interventions aimed at increasing patient participation in these adjuncts.

Table 1. Associations between palliative care use and patient characteristics using multivariate logistic regression for deceased patients with pancreatic cancer stratified by duration of survival.

Covariate	Survival<6 months		Survival 6-12 months		Survival>12 months	
	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Age	0.94 (0.90-0.97)	<0.001	0.99 (0.93-1.05)	0.69	1.01 (0.95-1.08)	0.71
Year of Diagnosis	1.07 (1.06-1.09)	<0.001	1.04 (1.01-1.07)	0.007	1.04 (1.01-1.07)	0.01
Male (ref female)	0.95 (0.89-1.01)	0.08	0.91 (0.83-1.00)	0.04	0.95 (0.87-1.04)	0.28
Race/ethnicity (ref white)						
Black	0.88 (0.80-0.97)	0.01	1.00 (0.87-1.16)	0.96	1.04 (0.89-1.21)	0.62
Hispanic	1.42 (0.90-2.23)	0.14	1.31 (0.57-2.99)	0.53	1.05 (0.45-2.45)	0.90
Asian	1.24 (1.02-1.51)	0.03	1.29 (0.93-1.77)	0.13	1.52 (1.15-2.01)	0.003
Other/Unknown	0.94 (0.74-1.18)	0.58	1.08 (0.77-1.53)	0.65	1.24 (0.91-1.69)	0.17
Primary payer (ref private)						
Medicaid	1.16 (1.02-1.33)	0.02	1.07 (0.87-1.32)	0.55	1.34 (1.09-1.64)	0.005
Medicare	1.03 (0.96-1.12)	0.41	1.11 (0.98-1.25)	0.10	1.07 (0.95-1.21)	0.28
Other government insurance	0.86 (0.64-1.15)	0.31	1.46 (0.99-2.14)	0.06	1.02 (0.66-1.58)	0.93
Not insured	1.00 (0.86-1.18)	0.98	1.14 (0.88-1.49)	0.32	1.13 (0.85-1.49)	0.39
Insurance status unknown	0.70 (0.52-0.87)	0.003	0.79 (0.51-1.22)	0.29	0.61 (0.39-0.95)	0.03
Median income quartiles 2008-2012 (ref <US$38000)						
US$38000-US$47999	0.97 (0.89-1.07)	0.57	0.88 (0.76-1.02)	0.09	1.04 (0.90-1.21)	0.60
US$48000-US$62999	0.97 (0.87-1.07)	0.53	0.83 (0.71-0.97)	0.02	0.86 (0.73-1.01)	0.06
≥US$63000	0.89 (0.79-1.01)	0.07	0.61 (0.50-0.74)	<0.001	0.71 (0.59-0.86)	0.001
Percentage with no high school diploma (2008-2012)	1.10 (1.06-1.15)	<0.001	1.17 (1.10-1.24)	<0.001	1.14 (1.07-1.21)	<0.001
Great circle distance (ref <2), miles						
2-4	0.98 (0.89-1.11)	0.96	1.04 (0.86-1.25)	0.70	0.94 (0.77-1.15)	0.54
5-9	1.10 (0.98-1.23)	0.10	1.00 (0.83-1.19)	0.96	1.06 (0.87-1.29)	0.55
10-20	1.05 (0.93-1.17)	0.44	0.96 (0.80-1.16)	0.68	0.96 (0.79-1.18)	0.72
21-45	1.06 (0.94-1.20)	0.36	0.84 (0.70-1.02)	0.09	0.95 (0.77-1.16)	0.59
>45	0.85 (0.74-0.97)	0.02	0.69 (0.56-0.85)	0.001	0.81 (0.66-1.00)	0.05
Urban/rural 2013 (ref metro >1 million)						
Metro 250000-1 million	1.03 (0.96-1.12)	0.39	1.04 (0.92-1.18)	0.50	1.09 (0.97-1.23)	0.15
Metro <250000	1.24 (1.12-1.37)	<0.001	1.13 (0.96-1.33)	0.13	1.18 (1.00-1.39)	0.05
Urban >20000 adjacent to metro	1.23 (1.05-1.42)	0.008	1.08 (0.85-1.35)	0.53	1.36 (1.10-1.68)	0.005
Urban >20000 not adjacent to metro	1.29 (1.00-1.65)	0.05	1.66 (1.18-2.35)	0.004	1.14 (0.76-1.71)	0.52
Urban 2500-19999 adjacent to metro	1.50 (1.30-1.73)	<0.001	1.43 (1.15-1.77)	0.001	1.16 (0.93-1.45)	0.19
Urban 2500-19999 not adjacent to metro	1.47 (1.20-1.80)	<0.001	1.19 (0.87-1.63)	0.27	1.73 (1.32-2.28)	<0.001
Rural/urban <2500 adjacent to metro	1.55 (1.16-2.07)	0.003	1.07 (0.63-1.80)	0.80	0.92 (0.54-1.58)	0.77
Rural/urban <2500 not adjacent to metro	1.44 (1.07-1.94)	0.02	1.95 (1.27-3.00)	0.002	1.60 (1.04-2.46)	0.03
Charlson-Deyo score	1.10 (1.06-1.14)	<0.001	1.05 (0.99-1.12)	0.12	1.10 (1.03-1.17)	0.004
Geographic region (ref East Coast)						
Central	0.93 (0.88-1.00)	0.04	0.93 (0.85-1.03)	0.18	0.87 (0.78-0.95)	0.004
Mountain	0.99 (0.85-1.15)	0.88	1.14 (0.92-1.41)	0.23	0.98 (0.78-1.21)	0.83
Pacific	0.74 (0.66-0.83)	<0.001	0.66 (0.55-0.79)	<0.001	0.72 (0.61-0.85)	<0.001
Facility type (ref community cancer program)						
Comprehensive Community cancer program	0.95 (0.85-1.06)	0.33	0.95 (0.79-1.15)	0.63	1.04 (0.84-1.29)	0.71
Academic/research program	1.10 (0.98-1.23)	0.11	1.05 (0.87-1.28)	0.60	1.17 (0.94-1.45)	0.16
Integrated Network Cancer Program	1.09 (0.96-1.23)	0.19	1.10 (0.89-1.37)	0.38	1.22 (0.96-1.54)	0.11
Grade of tumor	1.00 (0.96-1.04)	0.99	0.98 (0.92-1.04)	0.46	1.06 (1.00-1.12)	0.06
AJCC stage of tumor (ref occult/0/I)						
II	1.40 (1.20-1.64)	<0.001	1.20 (1.00-1.43)	0.05	1.40 (1.21-1.62)	<0.001
III	2.04 (1.74-2.40)	<0.001	2.55 (2.12-3.07)	<0.001	2.84 (2.40-3.36)	<0.001
IV	2.08 (1.82-2.38)	<0.001	2.83 (2.41-3.32)	<0.001	4.00 (3.45-4.63)	<0.001
NA/unknown	1.06 (0.91-1.24)	0.46	0.91 (0.75-1.10)	0.31	0.95 (0.82-1.12)	0.56

Abbreviations: AJCC, American Joint Committee on Cancer; CI, confidence interval; metro, metropolitan area; NA, not available; ref, reference. Age categories (<50, 50-64, 65-74, 75-84, ≥85 years), year of diagnosis in 2-year categories (2004-2013), percentage with no high school diploma categories (≥21%, 13%-20%, 7%-12%, <7%), Charlson-Deyo score categories (0, 1, ≥2), and grade categories for differentiation (well, moderately, or poorly, and undifferentiated) are modelled ordinally.

P102

Outcomes of Neoadjuvant Radiation Therapy for Resectable Pancreatic Adenocarcinoma M.C. Tee,[1]* L. Chen,[2] M. Segedi,[2] B. Ferrel,[1] P. Kim,[2] S. Chartier-Plante,[2] S. Chung,[2] J. Franko.[1] *1. Surgery, Mercy Clinic, Des Moines, IA; 2. University of British Columbia, Vancouver, BC, Canada.*

Introduction: Treatment paradigms for pancreatic adenocarcinoma (PAC) continue to evolve, including increased interest in neoadjuvant therapy prior to definitive surgical resection. We aim to examine differences in perioperative and survival outcomes of short versus long course neoadjuvant radiation therapy (NRT) in patients with resectable PAC. Methods: 35,348 patients undergoing pancreatectomy for Stage I or II PAC were identified in the National Cancer Data Base (2006-2016) and stratified by receipt of NRT (none, short-course ≤2 weeks, or long-course ≥4 weeks). Differences in receipt of chemotherapy, facility type, and patient demographics were identified. Main outcomes included: length of stay, 30 day readmission, 90 day mortality, and survival. Results: 3953 (11.3%) patients received NRT, of which 197 (5.0%) received short-course while 3756 (95.0%) received long-course. Facilities located in the Pacific (5.9%), East South Central (6.4%), and Mountain (8.2%) regions are less likely to offer NRT (P<0.001). Patients at academic facilities are more likely to receive NRT (13.6%; P<0.001) and a greater proportion of these were long course (94.2%). Long course NRT is correlated with improved survival (HR=0.92, 95%CI: 0.88-0.96, P<0.001). Short course NRT shows a trend for survival benefit that is not significant (HR=0.85, 95%CI: 0.70-1.03, P=0.097). NRT is associated with increased length of stay (10.3 vs. 9.4 days, P<0.001), 90-day mortality (OR=6.35, 95%CI: 5.18-7.77, P<0.001), and 30-day readmission (OR=1.28, 95%CI: 1.12-1.45, P<0.001), following pancreatectomy. Use of NRT correlates with decreased survival (HR=1.34, 95%CI: 1.21-1.47, P<0.001) among patients with Stage I disease and improved survival (HR=0.92, 95%CI: 0.88-0.97, P<0.001) among patients with Stage II disease. Use of NRT increased from 9.5% to 12.2%, after year of diagnosis 2010 (P<0.001). Conclusions: NRT appears to be gaining traction for resectable PAC. It appears to confer survival benefit in Stage II disease but increased perioperative risks and decreased survival with Stage I disease. While the trend for NRT is increasing, there appear to be differences in its administration by facility type and region.

P103

Acinar Cell Carcinoma of the Pancreas: Natural History and Predictors of Survival M.C. Tee,[1]* L. Chen,[2] J. Franko,[1] M. Silva,[1] P. Kim,[2] S. Chartier-Plante,[2] S. Chung,[2] M. Segedi.[2] *1. Surgery, Mercy Clinic, Des Moines, IA; 2. University of British Columbia, Vancouver, BC, Canada.*

Introduction: Acinar cell carcinoma (ACC) is a rare subtype of pancreatic cancer, for which the most common subtype is adenocarcinoma (AC). We aimed to identify surgical outcomes and predictors of survival of ACC. Methods: 58,631 patients undergoing pancreatectomy for Stage I-III pancreatic ACC (n=578, 1%) or AC (n=58,053, 99%) were identified in the National Cancer Data Base (2004-2016). Perioperative outcomes and long-term survival were analyzed. Predictors of survival outcomes were identified on multivariable Cox Proportional Hazard models. Results: There were no perioperative differences in 90-day mortality, 30-day readmission, or length of hospital stay comparing AC to ACC. Median survival was 20.8 months in patients with AC compared to 45.8 months in patients with ACC (P<0.001). 5-year survival was 33.9% for AC and 54.7% for ACC (P<0.001). Stratified by stage, only patients with Stage II ACC received survival benefit with any chemotherapy or radiation therapy (HR=0.74, 95%CI: 0.56-0.98, P=0.04). Independent predictors of long-term survival for AC include: black race (HR=2.01, 95%CI: 1.15-3.51, P=0.014), stage (HR=3.06, 95%CI: 1.97-4.74, P<0.001 Stage II vs. I; HR=3.68, 95%CI: 1.51-8.97, P=0.004 Stage III vs. I), grade (HR=1.78, 95%CI: 1.08-2.97, P=0.026, moderate vs. well; HR=2.83, 95%CI: 1.68-4.76, P<0.001, poor vs. well), comprehensive community cancer program compared to academic facility (HR=1.50, 95%CI: 1.04-2.16, P=0.03), and rural residence (HR=3.78, 95%CI: 2.02-7.08, P<0.001). On this same multivariable survival analysis, receipt of any chemotherapy or radiation therapy did not alter long-term survival for ACC. Conclusions: ACC appears to have more favorable survival than AC with no differences in perioperative outcomes following definitive pancreatic resection. Significant negative prognostic predictors of survival in ACC include: black race, increased stage of disease, aggressive

grade, comprehensive community cancer program versus academic facility, and rural residence. Receipt of any chemotherapy or radiation therapy is associated with improved survival among patients with Stage II ACC, however, this effect does not persist on multivariable survival analysis.

P104

The Impact of Multi-Agent Chemotherapy in Metastatic Pancreatic Adenocarcinoma: A Population Based Study Utilizing the SEER Database K. Sugumar,[1]* S. Gupta,[1] J.J. Hue,[1] L. Cao,[1] L.M. Ocuin,[2] L.D. Rothermel,[1] J.M. Hardacre,[1] J.B. Ammori,[1] J.M. Winter.[1]
1. University Hospitals Seidman Cancer Center and the Department of Surgery, Cleveland, OH; 2. Department of Surgery, Division of Hepaatobiliary and Pancreatric Surgery, Atrium Health, Charlotte, NC.

Background: Over the last decade, various landmark trials have demonstrated the impact of multi-agent chemotherapy in the treatment of PDAC. However, the impact in the 'real world' has been less clear. The ACCORD trial (2011) was a phase III trial comparing combination chemotherapy (FOLFIRINOX) and single-agent (gemcitabine) for advanced disease. Subsequently, multi-agent chemotherapy became the standard of care for medically appropriate patients. Methods: We used the Surveillance, Epidemiology, and End Results (SEER) database to identify patients diagnosed with PDAC between 1998 and 2017. The cohort was divided into two groups: 1998-2011 (pre-ACCORD) and 2012-2017 (post-ACCORD). We analyzed all patients with metastatic PDAC for overall survival and compared results in the two groups using Kaplan Meier analysis and multivariate Cox proportional hazards models. An interrupted time series analysis was also used to compare the temporal trends in 2-year survival between 1998 and 2017. Results: A total of 47,134 patients were diagnosed with PDAC between 1998 and 2017. Nearly two-thirds of patients (26,438; 57%) had distant disease. On univariate survival analysis, there was a significantly increased overall survival probability in the 2012-17 group compared to the 1998-2011 group ($p<0.05$). The one- and two-year survival rates were 11% and 3% in the pre-ACCORD period compared to 14% and 4 % after the ACCORD trial respectively. This difference remained significant on multivariate analysis while adjusting for covariates (HR=0.08, 0.78-0.92, p=0.05). On interrupted time series analysis, we observed a steady rise in 2- year survival between 1998 and 2017 (Figure 1). There was a significant jump in the two-year survival probability from 16% in 2011 to 20% in 2012 in metastatic PDAC (β=0.02, 0.009-0.03, $p<0.0001$). Conclusion: Beyond the randomized clinical trial arena, overall survival has increased over time, with a statistically significant jump around the time multi-agent chemotherapy regimens became the standard of care. However, the absolute increase in the 'real world' is smaller than the gains observed in prospective clinical trials.

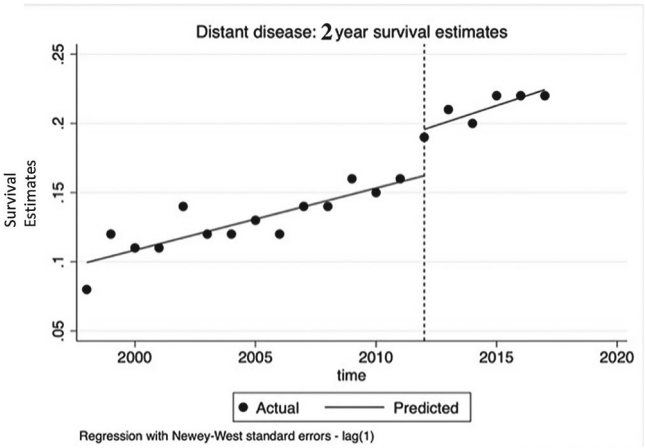
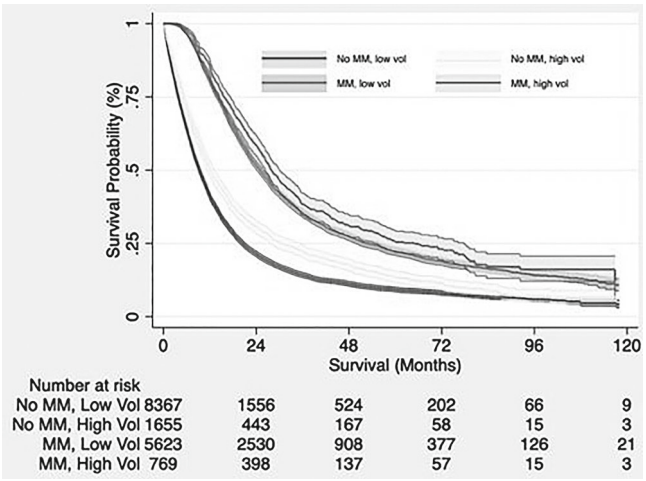


Figure 1. Interrupted time series analysis of two-year survival estimates between 1998-2017.

P105

Assessing Structure Versus Process in Localized Pancreatic Cancer Treatment Quality: A National Retrospective Cohort Study J.D. McDonald,[1]* J.W. Denbo,[2] J.B. Permuth,[3] J. Pimiento,[2] D.W. Kim,[2] P.J. Hodul,[2] M.P. Malafa,[2] D.A. Anaya,[2] J.B. Fleming,[2] B.D. Powers.[2]
1. Department of Surgery, University of South Florida Morsani School of Medicine, Tampa, FL; 2. Department of Gastrointestinal Oncology, Moffitt Cancer Center, Tampa, FL; 3. Department of Health Outcomes and Behavior, Moffitt Cancer Center, Tampa, FL.

Introduction Localized pancreatic ductal adenocarcinoma (PDAC) is increasingly viewed as a systemic disease with optimal outcomes achieved through multimodal treatment (MM). While MM is the standard of care for localized PDAC, structural factors such as hospital surgical volume (HSV) are used by watchdog groups to assess treatment quality. We analyzed the impact of structure—measured by HSV —and process—measured by hospital MM volume—to assess localized PDAC outcomes. Methods The NCDB was used to identify stage I PDAC patients; we excluded non-surgical candidates, those who received neoadjuvant treatment or treatment outside of the reporting facility, and those with missing data were. MM was defined as receipt of curative-intent surgery and adjuvant chemotherapy. The predictor variable was the proportion of patients receiving MM by hospital. SV was assessed using Leapfrog volume recommendations. Kaplan-Meier survival curves and multivariable Cox models were constructed with MM by hospital as a time-dependent covariate to account for immortal time bias. Results 17,116 cases from 2004 to 2016 were identified. 10,040 (58.7%) patients failed to receive MM; 6,279 failed to receive surgery and 3,761 failed to receive adjuvant chemotherapy. By Leapfrog SV recommendations, 8,497 (60.2%), 876 (53.3%), and 667 (49.4%) of patients at low-, moderate-, and high-volume hospitals failed to complete MM ($p<0.001$). After adjusting for potential confounders, the hazard of death increased at hospitals that failed to deliver MM (HR 3.38; 95% CI, 3.11-3.68) or those with low MM delivery (HR 1.55; 95%CI, 1.45-1.67) relative to high MM completion hospitals. SV was not associated with overall survival; (HR 1.07; 95% CI, 1.00-1.15 for low-volume hospitals and HR 0.95; 95% CI, 0.88-1.04 for moderate-volume hospitals vs. high-volume hospitals). Conclusion With improved systemic treatment and growing consensus that localized PDAC is a systemic disease best treated with MM, we should reconsider the current quality paradigm. Process measures, such as care coordination and receipt of MM, may be better markers of treatment quality compared to structural measures such as HSV.

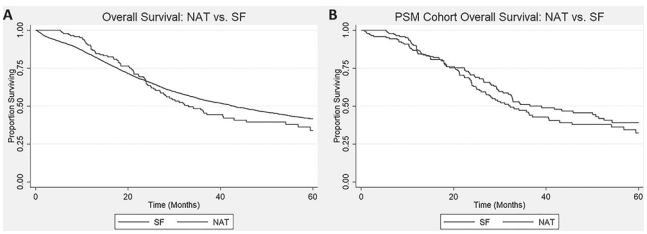


P106

What is the Role of Neoadjuvant Therapy for Ampullary Carcinoma? A Propensity Score Matched Analysis of the NCDB

E.W. Beal,* M. Guo, E. Miller, T. Williams, A. Tsung, M. Dillhoff, A. Ejaz, T.M. Pawlik, J. Cloyd. *Surgery - Surgical Oncology, The Ohio State University Wexner Medical Center and James Comprehensive Cancer Center, Columbus, OH.*

Background. Although neoadjuvant therapy (NT) is increasingly used in the treatment of pancreatic ductal adenocarcinoma, the role of NT for ampullary carcinoma (AC) has not been clearly established. Methods. Among patients with localized AC in the National Cancer Database between 2004-2016, those who underwent neoadjuvant chemotherapy and/or chemoradiation followed by pancreatoduodenectomy were compared with individuals who underwent surgery first (SF). Overall survival (OS) analysis was performed using the Kaplan-Meier method and multivariable Cox proportional hazards regression models controlling for sex, age, race, insurance status, year of diagnosis, income, facility type, differentiation, margin status, Charlson/Deyo score, pathologic stage, and adjuvant therapy. Propensity score matching (PSM) was performed using age, pathologic T and N stage, and tumor differentiation. Results. Among 8,688 patients with AC, only 175 (2.0%) received NT prior to surgery while 8,513 (98.0%) underwent SF. NT consisted of chemotherapy alone (n=116, 66.3%) or chemotherapy and radiation therapy (n=59, 33.7%). While patients who received NT were younger (p=0.022) and more likely to have lymph node metastasis (43.3% vs 35.1% p<0.001) versus patients who underwent SF. There was no difference in OS on univariate (43 vs. 33 months; HR 1.10, 95% CI 0.88-1.37, p=0.401, Figure 1A) or multivariable (HR 1.09, 95% CI 0.88-1.36, p=0.416) analysis. After PSM, there was no difference in OS among patients who received NT (n=171) versus patients who underwent SF (n=171) on univariate (37 vs. 32 months; HR 1.20, 95% CI 0.87-1.64, p=0.350, Figure 1B) or multivariable (HR 0.99; 95% CI 0.71-1.38, p=0.943) analysis. Conclusion. In this population based analysis, NT followed by surgery was not associated with improved survival outcomes versus SF for patients with localized AC. While NT is an acceptable alternative for patients with advanced disease, SF should remain the standard of care for AC.



P107

Repeat Hepatectomy is Associated with Improved Oncologic Outcomes Compared to Systemic Therapy Alone in Patients with Recurrent Colorectal Liver Metastases: A Propensity-Matched Analysis

T.L. Sutton,* L. Wong, B.S. Walker, E.N. Dewey, R. Eil, C.D. Lopez, D. Herzig, A. Kardosh, E. Chen, V. Tsikitis, K.G. Billingsley, S.C. Mayo. *Surgery, Oregon Health and Science University, Portland, OR.*

Introduction: Following resection of colorectal liver metastasis (CRLM) the majority of patients have disease recurrence, most commonly intrahepatic. While the role of resection in CRLM is well-established, there has been limited investigations assessing the benefit of repeat hepatic resection (RHR) compared to systemic treatment (SYS)-alone for intrahepatic recurrence. Methods: We reviewed patients with recurrent CRLM following curative-intent hepatectomy from 2003-2019. Clinicopathological features, treatment, and outcome data were collected. Oncologic outcomes including post-recurrence overall survival (prOS) were evaluated using Kaplan-Meier and Cox proportional hazards modeling. Patients undergoing RHR were propensity-matched with patients receiving SYS-alone based on relevant clinicopathologic variables. Results: n=338 patients underwent hepatic resection for CRLM over the study period. 145 (43%) patients had liver recurrence at a median time of 10 months from prior resection. Median prOS was 29 months. 37 patients underwent RHR; 33 (89%) received peri-operative chemotherapy. On multivariable analysis, the number of lesions at recurrence (HR 1.19, 95% CI 1.11-1.28) and recurrent lesion ≥3cm (HR 2.34, 95% CI 1.50-3.64) were associated with lower 5-year prOS, while RHR (HR 0.11, 95% CI 0.05-0.23) and SYS-alone (HR 0.15, 95% CI 0.08-0.27) were both associated with improved 5-year prOS (all P<0.01). We propensity-matched 37 patients having RHR and SYS alone; there were no significant clinicopathologic differences between groups. RHR was independently associated with improved 5-year prOS compared to SYS-alone (median OS 41 vs. 35 months, 5-year OS 19% vs. 3%, P=0.048, Figure). Conclusions: Disease characteristics of patients with intrahepatic recurrence of CRLM, specifically the number of liver lesions and size of the largest lesion, are most predictive of survival and response to systemic therapy. Patients who recur with oligometastatic liver disease experience improved outcomes, and derive benefit from curative-intent RHR with integrated peri-operative systemic therapy.

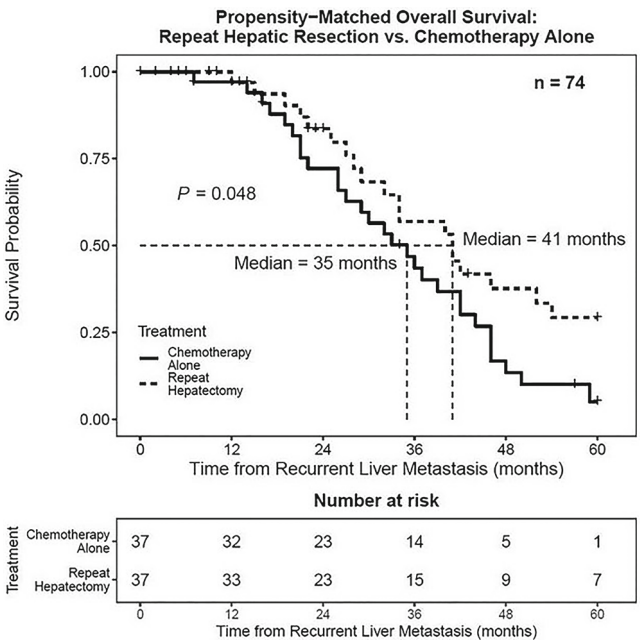


Figure: Propensity-matched analysis of n=74 patients with recurrent CLRM treated with repeat hepatic resection (n=37; median OS = 41 months) compared to chemotherapy alone (n=37; median OS = 35 months) (P = 0.048).

P108

Trends and Disparities in the Use of Neoadjuvant Systemic Chemotherapy for Resectable Pancreas Cancer

T.J. Mouw,* J. Kaikaus, M. Fromer, R.C. Martin, P. Philips, K.M. McMasters, C.R. Scoggins, M.E. Egger. *University of Louisville, Louisville, KY.*

Introduction – Stage 1-2 pancreatic adenocarcinoma is potentially resectable. As our understanding of tumor biology and the efficacy of chemotherapy have improved, more patients are being treated with a neoadjuvant therapy strategy. We aim to assess the adoption of neoadjuvant therapy for early stage pancreatic adenocarcinoma over time and identify disparities in its adoption. Methods – A query of the National Cancer Database was performed selecting stage I-II pancreatic adenocarcinomas for the years 2004-2016 who underwent definitive resection. Management trends were analyzed by year and included neoadjuvant and surgery-first approaches. A comparative analysis was conducted using time periods of 2004-2006 and 2014-2016. Neoadjuvant was further defined by chemotherapy alone (NAC) vs chemoradiation (NCR). Interval changes in the therapeutic approach were evaluated with chi square, Kaplan-Meier survival, and logistic regression analyses. Results – The query returned 36,425 records. From 2004-2016 neoadjuvant therapy use increased from 6.8% to 28.1% and 79.5% of this increase was due to NAC use (range 1.4% to 17.9%, p<0.01). There was only a modest increase in NCR use between study periods (6.6% vs 9.7%, p<0.01). The rate of adjuvant chemotherapy remained relatively constant (48.0% to 51.8% p<0.01), but the proportion of surgery-only cases decreased significantly (44.1% to 24.6% p<0.01). On multivariate analysis, on-white race (OR 0.78 p<0.01), community cancer centers (OR 0.57 p<0.01), and

county population >250K (OR 0.83 p=.02) were associated with significantly less NAC use. Median survival between time periods increased from 18.3 months to 21.4 months (p=0.006). Conclusions –The increase in neoadjuvant management since 2004 was specifically due to the use of NAC. An increased proportion of patients are now receiving chemotherapy at some point in their management. There has been an associated survival benefit between time periods. We identified racial and socioeconomic disparities with respect to NAC use, and further work to understand these differences may lead to improved care for vulnerable populations.

P109

Trends and Prognostic Significance of Time-to-Treatment in Pancreatic Cancer: A Population-Based Study K. Sugumar,[1]* J.J. Hue,[1] S. Gupta,[1] L.D. Rothermel,[1] L.M. Ocuin,[2] J.B. Ammori,[1] J.M. Hardacre,[1] J. Winter.[1] *1. University Hospitals Seidman Cancer Center and Case Comprehensive Cancer Center, Department of Surgery, Cleveland, OH; 2. Department of Surgery, Division of Hepatobiliary and Pancreatic Surgery, Atrium Health, Charlotte, NC.*

Introduction: Time-to-treatment (TTT) is an important quality of care metric in the management of cancer patients. In this study, we evaluate the recent trends in TTT for pancreatic adenocarcinoma (PDAC), causes for delay and its effect on long-term survival. Methods: We included patients with PDAC of all stages from the National Cancer Data Base (NCDB, 2006-16), who either underwent resection or chemotherapy/radiotherapy (CT/RT). TTT was considered as the duration between the tissue diagnosis and treatment. For patients who did not receive a biopsy prior to surgery, treatment and biopsy are synonymous and TTT is recorded as 0 days in the NCDB. Results: A total of 149,284 patients were included. The median TTT was 24 days. Patients that received neoadjuvant CT/RT had a longer TTT (27 days) compared to upfront surgery (15 days, Table 1). On multivariable logistic regression, increasing age (OR: 1.48, p<0.001), black race (OR: 1.3, p<0.001), lower educational status (OR: 1.2, p<0.001), Medicaid insurance (OR: 1.4, p<0.001), treatment at academic centers (OR: 1.3, p<0.001), higher Charlson Comorbidity Index (OR: 1.2, p<0.001), and CT/RT (OR: 1.5, p<0.001) were associated with an increased TTT. There was a steady rise in TTT from 22 to 26 days over the study period (β=0.4, p<0.001). On subgroup analysis, the increase was more evident for stage I (β=1.4, p<0.001) and II (β=0.74, p<0.001) disease. Concurrently, there was also an increasing trend in neoadjuvant CT/RT use in early-stage PDAC. TTT delay was associated with poor overall survival in stage I (HR: 1.5, p<0.001) & II (HR: 1.1, p<0.001) patients, but better survival in stage III (HR: 0.93, p<0.001) & IV (HR: 0.64, p<0.001) patients. Conclusion: While TTT is reasonable for the majority of patients, delayed treatment approaching 2 months was observed in 10% of the population. The rising temporal trend in TTT may be attributed due to the increasing shift toward neoadjuvant CT/RT in early-stage PDAC and/or the increasing use of endoscopic biopsy prior to surgery. We also underscore the detrimental effect on the survival with delay in treatment of early-stage PDAC.

Table 1. Time-to-treatment (time duration from tissue diagnosis to initial treatment, days)

Parameter	Mean	10th percentile	25th percentile	50th percentile	75th percentile	90th percentile
Overall time-to-treatment (days)	30.22	4	13	24	39	59
Time-to-treatment by stage (days)						
Stage I	33.87	0	13	27	43	69
Stage II	27.35	0	9	22	36	56
Stage III	36.85	11	19	29	45	69
Stage IV	30.07	8	14	24	37	56
Time-to-treatment by type of initial treatment (days)						
Surgery	20.57	0	0	15	29	46
Chemotherapy or radiotherapy	34.04	10	17	27	42	63

P110

Locally Advanced Pancreatic Cancer: Frequent Deviation from the Standard-of-Care Decreases Survival A. Mohamed,[1]* T.L. Fitzgerald.[2] *1. Surgical Oncology, Tufts University School Of Medicine, Portland, ME; 2. Maine Medical Center, Portland, ME.*

Introduction: Contemporary multiagent chemotherapy regimens have revolutionized the treatment of patients with localized pancreatic cancer. Current NCCN guidelines recommend neoadjuvant multiagent chemotherapy (MAC) for patients with borderline resectable or locally advanced pancreatic cancer. Methods: The study is a retrospective cohort study of NCDB data for localized pancreatic with vascular involvement. Results: A total of 23,903 patients with vascular involvement were included; 40.6% received no treatment, 36.6% received medical management, and 22.8 % underwent resection. Of the patients undergoing resection, 31.3% received neoadjuvant multiagent chemotherapy (MAC). The remainder were treated with postoperative treatment (33.8%), surgery alone (24.9%), preoperative radiotherapy (8.3%), or single preoperative agent chemotherapy (1.7%). Median survival for neoadjuvant MAC was superior (28.42 months) when compared to neoadjuvant radiotherapy (20.72 months), neoadjuvant single-agent chemotherapy (20.8 months), postoperative adjuvant therapy (17.87 months), and surgery alone (10.12 months). Neoadjuvant MAC was associated with improved survival compared to the postoperative MAC (28.4 vs. 16.95, HR 1.82; CI 1.64-2.02, p < 0.001). The addition of radiation therapy to neoadjuvant MAC did not improve survival (27.4 vs. 29.8, HR 0.93; CI 0.83-1.05, p=0.3). Clinical downstaging occurred in 40% of patients treated with neoadjuvant MAC and downstaging was associated with improved survival (HR .74; CI .64-.85, p < 0.001). Neoadjuvant MAC patients were more likely to undergo an R0 resection compared to postoperative MAC (74% v. 48, p < 0.001). Conclusions: Despite evidence and clear guidelines, the vast majority of pancreatic cancer patients with vascular involvement receive either postoperative or no adjuvant therapy. Neoadjuvant MAC increases downstaging, R0 resection rates, and survival compared to alternative treatment regimens. The addition of radiotherapy to the regimen does not, however, appear to impact survival.

P111

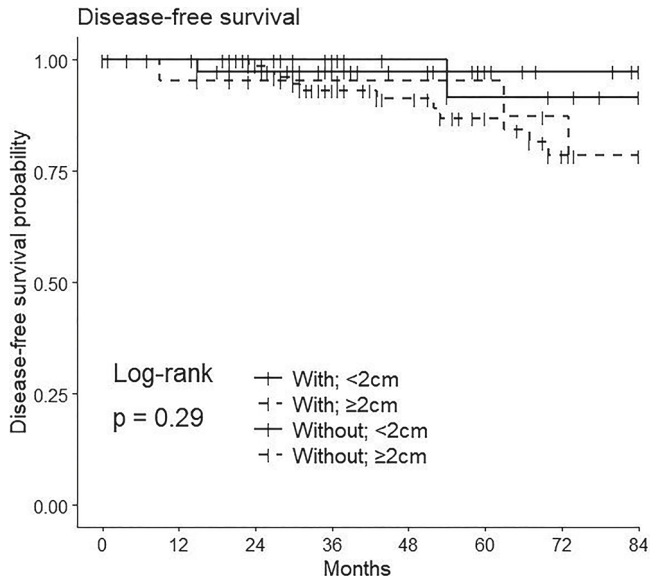
Inhibiting TGF-β and IL-6 Receptors Enhance Pancreatic Cancer Apoptosis M. Rana,* R.G. Kansal, J.L. Deneve, P.V. Dickson, D. Yakoub, D. Shibata, J.A. Carson, E.S. Glazer. *University of Health Science Center, Memphis, TN.*

INTRODUCTION: The immunosuppressive tumor microenvironment of Pancreatic Ductal Adenocarcinoma (PDAC) is a major therapeutic obstacle. High levels of the key cytokines Transforming Growth Factor- beta (TGF-β) and interleukin-6 (IL-6) are associated with worse patient survival with the latter also being a mediator of cancer-induced cachexia. We hypothesized that inhibition of TGF-β and IL-6 signaling would increase cancer cell apoptosis, decrease cell proliferation, and minimize cellular mechanisms of cachexia. METHODS: We determined IL-6 expression (ELISA assay) in a patient-derived PDAC cell line (PD002) and multiple commercially available PDAC cell lines (PANC-1, AsPC1, Capan-1, Capan-2) at baseline and following treatment with TGF-β or galunisertib (TGF-β receptor inhibitor). We examined the impact of galunisertib, tocilizumab (anti-IL-6-receptor antibody), and gemcitabine on cell proliferation as measured by phospho-p38MAPK and phospho-STAT3 (p-p38MAPK, pSTAT3) expression and on an anti-apoptotic pathway component (Bcl-xL) expression. RESULTS: TGF-β treatment increased IL-6 expression while galunisertib reduced IL-6 expression. Unexpectedly, galunisertib increased activated p-p38MAPK in all pancreatic cancer cell lines with no change in total p38MAPK levels. Increasing concentrations of tocilizumab resulted in dose-dependent reductions in the expression of pSTAT3, p-p38MAPK, and Bcl-xL. Tocilizumab and galunisertib, in combination with gemcitabine, yielded the lowest expression of activated p-p38MAPK. CONCLUSIONS: We demonstrated that blockade of TGF-β signaling alone results in a reduction of IL-6 expression. We potentially identified a poorly understood off-target effect of galunisertib activating p38MAPK which may have untoward clinical effects. TGF-β receptor inhibition in combination with IL-6 receptor inhibition and chemotherapy was significantly anti-proliferative and pro-apoptotic overall suggesting a mechanism to overcome the untoward effects of TGF-β receptor inhibition. These findings provide a novel potential strategy to improve therapeutic efficacy by addressing cellular processes of proliferation and apoptosis in addition to cancer-induced cachexia signaling.

P112

Less Is More: Spleen-Preserving Distal Pancreatectomy for Neuroendocrine Tumors M.A. Attiyeh,* T. Tran, S.G. Warner, L. Melstrom, P.H. Ituarte, Y. Fong, G. Singh. *City of Hope National Medical Center, Duarte, CA.*

INTRODUCTION: Spleen preservation during a distal pancreatectomy for a neuroendocrine tumor (NET) is currently only performed in a minority of cases such as peripheral insulinomas or small (<2cm) non-functional tumors. The objective of the current study was to assess how concurrent splenectomy and spleen-preserving surgery impact overall survival, disease-specific survival, and recurrence rates in all cases of non-metastatic NETs of the distal pancreas. METHODS: Using the California Cancer Registry (CCR), we identified patients who were diagnosed with a NET in the body or tail of the pancreas and underwent a distal pancreatectomy with or without a splenectomy between 2000 and 2012. Overall, disease-specific, and disease-free survival were calculated for both groups. We also stratified recurrence by tumor size using a cutoff of 2cm. RESULTS: A total of 176 patients were identified from the CCR as having had a distal pancreatectomy "with" (n=125; 71%) or "without" (n=51; 29%) a splenectomy for a non-metastatic distal pancreatic NET. Gender was balanced between the two groups (50% and 43% male in each group, respectively), and the median age was 58 [interquartile range (IQR) = 49–68]. The median numbers of lymph nodes that were positive/examined were 1/6 ("with") and 0/0 ("without"). The median follow-up was 44 months (IQR: 30–80). The proportions of patients in each group that were "free from tumor" at their most recent follow-up were identical (80%); the rates of recurrence in the "with" and "without" groups were 15% and 16%, respectively. The 5-year overall survivals were 89% and 94%, respectively; 5-year disease-free survivals were similar as well: 90% and 94%, respectively. Finally, there was no significant difference in recurrence rates when we stratified by tumor size (see figure). CONCLUSIONS: Despite yielding more lymph nodes, concurrent splenectomy did not translate to a longer survival or a longer time to recurrence. Larger prospective trials are necessary to determine whether patients with NETs benefit from splenectomy or can undergo distal pancreatectomy only.

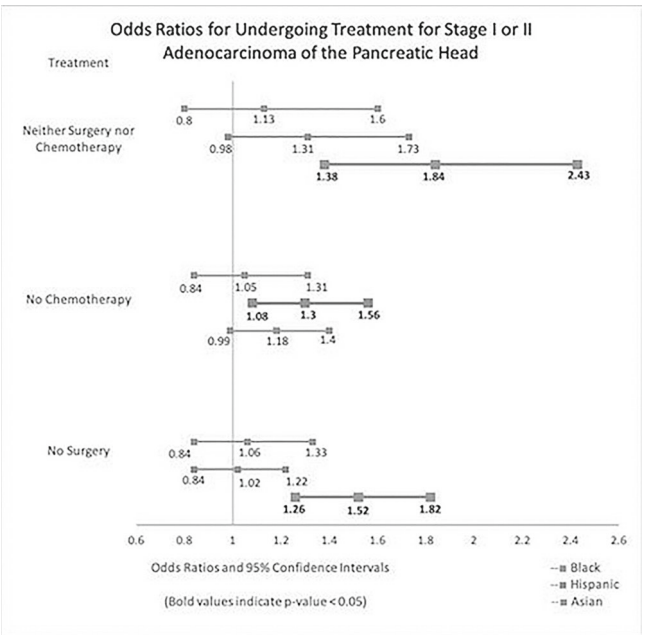


Kaplan–Meier curve showing disease-free survival in patients who underwent distal pancreatectomy "with" and "without" a concurrent splenectomy. Data stratified by tumor size (2cm).

P113

Disparities Persist in the Treatment of Pancreatic Adenocarcinoma A.S. Moten,[1]* E. Blay,[1] H. Pitt,[2] K. Lau.[1] *1. Surgery, Temple University Hospital, Philadelphia, PA; 2. Rutgers-Robert Wood Johnson Medical School, New Brunswick, NJ.*

Introduction: Prior research has shown racial differences in the treatment of pancreatic cancer. The aim of this study was to use current, nationally representative data to determine if disparities in treatment persisted. Methods: The Surveillance, Epidemiology and End Results database was used to obtain data on patients with pancreatic ductal adenocarcinoma (PDAC) diagnosed years 2012 to 2016. Associations between race/ethnicity and treatment types were assessed using chi-square tests and logistic regression. Survival among racial/ethnic groups was compared using Cox regression. Results: The study sample included 35,940 patients with PDAC, of which 69.7% were white, 51.8% were male and the mean age was 69.3 years. PDAC was located in the head of the pancreas for 49.9% of whites, 48.6% of blacks, 49.3% of Hispanics, and 46.2% of Asians ($p < 0.001$). Blacks were 52% more likely than whites to be treated non-operatively for stage I or II PA of the head (OR = 1.52; 95% CI: 1.26 – 1.82). Also, blacks were 84% more likely than whites to receive neither surgery nor chemotherapy (OR = 1.84; 95% CI: 1.38 – 2.43). Hispanics were 30% more likely to not receive chemotherapy than whites (OR = 1.30; 95% CI: 1.08 – 1.56). For all patients who received neither surgery nor chemotherapy, the risk of death was six times that of those treated with surgery and chemotherapy (HR = 6.10; 95% CI: 4.83 – 7.70). For black patients in particular, the risk of death for those who received neither surgery nor chemotherapy was seven times that of those treated with surgery and chemotherapy (HR = 7.05; 95% CI: 3.21 – 15.47). Conclusion: Survival is considerably improved when patients with early stage PDAC of the pancreatic head receive both surgery and chemotherapy. However, our analysis demonstrated that racial disparities in treatment continue to exist, particularly among black patients, who were more likely to go untreated. This suggests that racial minorities continue to have decreased access to care, and more work must be done to provide adequate and equitable care to minorities in order to improve their outcomes.



Odds ratios (OR) and 95% confidence intervals (CI) for undergoing treatment for stage I or II pancreatic adenocarcinoma of the head. Notes: referent = white race/ethnicity.

P114

Determining Hospital Volume Threshold for the Safety of Minimally Invasive Pancreaticoduodenectomy: A Contemporary Cutpoint Analysis P.C. Conroy,[1]* J. Lin,[1] A. Kim,[2] C. Corvera,[1] K. Kirkwood,[1] A. Alseidi,[1] M. Adam.[1] *1. Surgery, UCSF, San Francisco, CA; 2. Ohio State University, Columbus, OH.*

Introduction: Guidelines recommend limiting minimally invasive pancreaticoduodenectomy (MIPD) to high-volume centers. The definition of a high-volume center is unclear, with prior studies using various thresholds ranging from 10-25 cases/yr. Leveraging a cutpoint methodology, we aimed to objectively define a minimum number of annual MIPD cases per hospital associated with improved outcomes in a contemporary cohort to reflect the increased adoption of MIPD. Methods: Resectable pancreatic adenocarcinoma patients undergoing MIPD (laparoscopic or robotic) were included from the National Cancer Database (2010-17). Multivariate modeling with restricted cubic splines was used to identify a MIPD annual hospital volume threshold

associated with improved 90-day mortality. Outcomes were then compared between patients treated at low- (<model-identified threshold) and high-volume (>threshold) centers. Results: Of 3,079 MIPD patients, 141 (5%) died within 90 days. Median hospital volume was 6 (range 1-73) cases/yr. MIPD use increased by >100% from 2010 (206 cases) to 2017 (522). After adjustment for clinico-pathologic, treatment, and hospital factors, increasing hospital volume was associated with decreasing 90-day mortality for up to 20 cases/yr (Fig. 1). Most MIPD cases (82%) were done at low-volume (<20 cases/yr) centers, where conversion to open was higher (25% vs. 21%; p=0.02). With adjustment, MIPD at low-volume centers was associated with increased risk of 90-day mortality (OR 2.7; p<0.05). LOS, 30-day readmission, and overall survival were similar. On analysis of the most recent 2 years (n=1031), patients undergoing MIPD at high-volume centers (21.8%) were older and had advanced tumors, but had shorter LOS (7 vs. 8 days; p<0.05) and improved 90-day mortality (2% vs. 7%; p<0.05). On subset analysis, the threshold was similar for laparoscopic and robotic techniques. Conclusions: The cutpoint analysis identified a threshold of at least 20 MIPD cases/year associated with improved postoperative mortality. This threshold may inform national guidelines and institution-level protocols aiming at the safe implementation of this complex procedure.

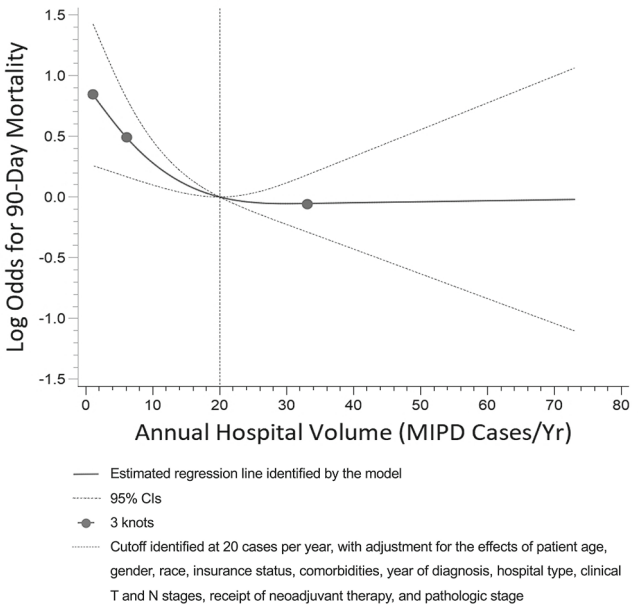


Figure 1: Smoothed restricted cubic splines plot of the adjusted log odds ratio of 90-day mortality by increasing annual number of minimally invasive pancreaticoduodenectomy cases performed per hospital.

P115

The Timing and the Dose of Advanced Care Planning in Patients with Resectable Pancreatic Cancer: Who Makes the Call?

L. Demyan,[1]* G. Wu,[2] D. Moumin,[2] G. Deutsch,[1] J. Herman,[1] W. Nealon,[1] M. Weiss,[1] D. Deperalta.[1] *1. Northwell Health, Queens, NY; 2. Zucker School of Medicine, New Hyda Park, NY.*

Background: The timing and the extent of Advanced Care Planning (ACP) in patients with pancreatic ductal adenocarcinoma (PDAC) undergoing curative-intent resection are generally dictated by the surgeon performing the operation. This study aims to evaluate surgeons' insights, perceptions, and biases regarding preoperative ACP. We hypothesize that many surgeons harbor significant reservations about preoperative ACP. Methods: A qualitative study using 1:1 interviews with 40 open-ended questions were conducted with a convenience sample. Data accrual continued until theme saturation was achieved. Grounded theory approach was used for data coding and analysis. Results: A total of 4 females and 6 males, expert pancreatic surgeons from 6 medical centers participated. The median number of years in practice was 15(IQR 13-30) and the median number of pancreatic cancer cases performed per year was 52(IQR 39-75). All surgeons acknowledge the importance of end of life conversations when death is imminent, but most perceived that in-depth preoperative ACP is not appropriate for patients undergoing curative-intent resection. All surgeons emphasized that ACP should be led by a physician that both knows the patient well and understands the nuances of PDAC management. 90% of surgeons recognized the potential benefits of preoperative ACP, particularly the delivery of care aligned with patient's goals (50%). 30% report in-depth ACP related to perioperative complications, but not long-term oncologic outcomes. 90% of surgeons do not emphasize preoperative ACP and 60% admit actively steering the conversation away. Major barriers to in-depth ACP reported by surgeons are listed in Table1. Discussion: Despite recognizing potential benefits, most pancreatic surgeons report actively avoiding in-depth ACP conversations prior to curative-intent surgery. Surgeons had difficulty articulating the best time for ACP and felt that ACP should occur as a continuum throughout the course of treatment, with the depth of the discussion echoing the disease progression and patients' readiness for such conversation. Future studies should evaluate patients' perspective on timing and dose of ACP.

Surgeons' Reported Barriers to Preoperative ACP

Barrier (% of surgeons reported)	Representative Quotations
Defeating Hope (60%)	"I think preop is the time for creating enthusiasm, will to live, will to fight, and not necessarily chase them away with thoughts of end of life care" "…talking about end of life, defeating the optimism and hope that surgeons provide in overall disease management for pancreatic cancer"
Emotional Burden for Surgeons (60%)	"It takes a lot of emotional energy and I think a lot of physicians have run out of that energy over time or they may never have had it" "There is a lot to cover prior to embarking on pancreatic surgery and this would be one more thing that is very time consuming as well as emotionally and mentally draining for patients, family, and surgeon"
Overwhelming Patients (50%)	"I feel like I talk a lot and I give them so much information that they are just looking at me... Some patients say I'm a little overwhelmed ... if I were then to launch into these end of life questions that is... a lot." "I think it's just going to terrify people. Everyone is telling them it's a death sentence and having one more person telling them it's a death sentence. I think it would be very emotionally undermining"
Confusion/Mixed Messages (40%)	"…worry about mixed messages, why is the surgeon telling me to consider surgery if I am still going to die anyway" "I don't know if it would confuse them. The doctor just said they may be able to get this out and I may be cured, but if I'm not cured I have the chance of living longer… It's maybe a mixed message that is hard to swallow"

P116

Patient Factors and Tumor Genomics Associated with Selection of Hepatic Artery Infusion (HAI) Chemotherapy in Unresectable Colorectal Liver Metastasis (CRLM)

J.P. Kronenfeld,* V. Dudeja, A.L. Collier, L.N. Gallegos, K. Kelly, V. McGhee, A. Naveda, H. Ng-Chen, N. Ezenwajiaku, N.B. Merchant, A. Pimentel, J. Datta. *Surgery, University of Miami Miller School of Medicine, Miami, FL.*

Introduction: In patients with unresectable liver-confined CRLM, regional chemotherapy (CT) via HAI combined with systemic CT can achieve hepatic disease control and expand resectability. We describe patient selection, tumor genomics, and early outcomes following HAI program implementation at our tertiary referral center. Methods: We analyzed demographics, systemic treatment, primary tumor location, molecular profiling, extent of disease, perioperative HAI outcomes, and overall survival (OS) in CRLM patients selected for HAI treatment (1/2018-6/2020). Results: Of 35 unresectable CRLM patients (primary: colon, n=24; rectum, n=11) selected for HAI, 57% were heavily pre-treated (≥ 2 CT lines), 71% had Fong clinical risk scores ≥3, 86% had synchronous disease, 80% had bilobar metastasis, and 86% had >5 tumors. All tumors were microsatellite stable, 8 (24%) harbored KRAS/NRAS mutations, and 5 (17%) had co-altered RAS-TP53; only one (3%) had a $BRAF^{V600E}$ mutation. HAI was initiated at a median 14 (IQR 3, 64) months after CRLM diagnosis, and administered for a median of 7 (range 2, 16) cycles; 91% received concurrent HAI/CT. Although most (69%) patients experienced some degree of hepatic toxicity, biliary sclerosis requiring intervention occurred in only 3 (9%) of patients. The perioperative morbidity was 17% with no surgical-related 90-day mortalities. Excluding patients who initiated HAI treatment within the last 3 months of the study period (n=3), 13 patients (41%) were disease-free in the liver after complete resection and/or ablation following HAI/CT; in the remaining 19 patients (59%), hepatic progression-free survival was 7.3 months (IQR 4, 12). At a median follow-up of 11.2 months, post-HAI median OS for the overall cohort was 12.3 (IQR 7, 20) months. Patients undergoing complete resection/ablation demonstrated improved survival compared with those with progressive disease (median 20 vs 12 months). Conclusion: Implementation of a HAI program for multimodality liver-directed management of unresectable CRLM in heavily pre-treated, but carefully selected, patients is associated with meaningful clinical outcomes.

P117

Rising Incidence and Trends of Hepatocellular Cancer in an Impoverished Southern State: A Report from the Louisiana Cancer Consortium J.M. Lyons,[1]* D.M. Danos,[1] E. Kandil,[2] R. Corsetti,[3] J. Gnerlich,[1] L. Maniscalco,[1] Y. Yi,[1] X. Wu,[1] Q.D. Chu.[4] *1. LSUHSC-New Orleans, New Orleans, LA; 2. Tulane University, New Orleans, LA; 3. Ochsner Clinic, New Orleans, LA; 4. LSUHSC - Shreveport, Shreveport, LA.*

Introduction: Louisiana has one of the highest incidence and mortality rates of hepatocellular cancer (HCC) in the nation. The aim of this study was to analyze time trends regarding HCC in Louisiana in order to formulate strategies to improve outcomes. Methods: Data on primary invasive HCC diagnosed between 2005 and 2015 in patients 20 years or older were obtained from National Cancer Institute's Surveillance, Epidemiology and End Results (SEER) database and Louisiana Tumor Registry (LTR). Time trends in age-adjusted incidence rates and 12-month relative survival were analyzed using Joinpoint regression. Case characteristics were compared on 2 time periods (2005-2009 and 2010-2015) using Fisher-exact tests. Overall survival was analyzed via log-rank and Cox proportional hazard models. Results: Louisiana showed constant growth in HCC incidence, while national trends showed a more tempered growth beginning in 2009 (Figure 1). Over the study period, the average annual percent change (AAPC) in age-adjusted HCC incidence in Louisiana was nearly double that of the national estimate (6%, 95% CI: 4.7,7.3 vs. 3.1%, 95% CI: 2.4,3.7). Overall 12-month relative survival (RS) among Louisiana HCC patients over the whole study period was 40.7% which was statistically lower than the US rate of 48.2%. Relative survival improved in Louisiana (2.9% per year) from 2005 to 2015 at a rate similar to that of the US (2.7% per year). In multivariate analysis, factors associated with worse survival included African American race, advanced stage, lack of surgical therapy, treatment at a non-accredited center or in a low volume parish. Conclusion: Although HCC incidence seems to be plateauing nationally, it continues to rise dramatically in Louisiana. While some modest improvements have been realized, outcomes for HCC patients remain dismal. This consortium will focus on identifying the most at-risk populations in order to prioritize state-wide public health initiatives.

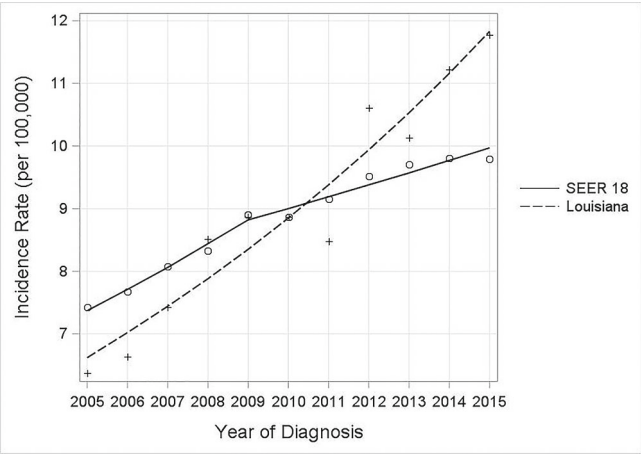


Figure 1. Age-adjusted incidence of HCC in Louisiana vs the US

P118

Defining the Role of Adjuvant Therapy Following Inadequate Surgery for Early Stage Gallbladder Cancer E.H. Jensen, J.S. Ankeny, C.J. LaRocca, J.Y. Hui, T.M. Tuttle, M.J. Akers,* S. Marmor. *Surgery, University of Minnesota, Minneapolis, MN.*

Introduction: Despite current guidelines, many patients do not undergo liver resection and portal lymph node (LN) dissection following cholecystectomy for T1b-T3 gallbladder cancer (GBC). The purpose of this study is to evaluate the role of adjuvant therapy after "inadequate surgery" (cholecystectomy alone) for early stage GBC (T1b-T3). Methods: We used the National Cancer Database to identify individuals who had surgery for T1b-T3 GBC between 2004-2016. Patients were stratified by receipt of cholecystectomy alone, and receipt of adjuvant chemotherapy (CT) or chemoradiotherapy (CRT). Survival was evaluated using Kaplan-Meier and Cox proportional hazard models. Results: We identified 3,151 patients who underwent surgery for T1b-T3 GBC, with 2115 (67%) receiving cholecystectomy alone. Median age was 70 (Standard Deviation (SD); 12.21), most were Non-Hispanic White (64%) and female (72%) while 31% had a Charlson comorbidity index score>1. The strongest predictors of receipt of inadequate surgery were older age (>65 years old), more recent year (2009-2016), margin positive, no LN examined ($p<0.05$). Following cholecystectomy, 1,278 (62%) had no further treatment, while 465 (26%) had CT and 317 (15%) had CRT. For patients with T1b and T2 tumors, CRT was significantly associated with improved survival over cholecystectomy alone (50 months versus 34 months, $p<0.05$). For T3 tumors, adjuvant CT and CRT were also significantly associated with improved survival compared to cholecystectomy alone (8 months versus 13 months versus 17 months, $p<0.001$). For all T-stages, CRT was significantly associated with improved survival for LN positive or margin positive disease over surgery alone. For all T stages, CRT was superior to CT after inadequate surgery ($p<0.001$). Conclusions: Adjuvant CRT is associated with improved survival after cholecystectomy alone for T1b/T2 and T3 GBC. Although we continue to recommend liver resection and portal LN dissection for medically fit patients, those who do not undergo radical resection should be offered CRT in order to optimize survival outcomes.

P119

Palliative Care Reduces ER Visits and Improves Survival in Patients with Metastatic HPB and GI Malignancies A. Billiot,[1]* D.M. Danos,[1] J. Stevens,[1] K. Vance,[2] M. Raven,[3] J.M. Lyons.[1] *1. Surgery, LSUHSC, Baton Rouge, LA; 2. Our Lady of the Lake-Division of Academic Affairs, Baton Rouge, LA; 3. Our Lady of the Lake-Mary Bird Perkins Cancer Center, Baton Rouge, LA.*

Introduction: Palliative care services (PCS) have improved quality of life for terminal patients across various cancer subtypes. Minimal data exists, however, regarding PCS exclusively within metastatic hepatopancreaticobiliary (HPB) and gastrointestinal (GI) malignancies. We sought to assess the impact of PCS on emergency room (ER) visits, hospital admissions, and survival among patients with terminal HPB and GI malignancies. Methods: All patients with metastatic GI and HPB malignancies referred to outpatient PCS for end-of-life care at our institution between 2014 and 2018 were identified. We compared patient demographics, outcomes, and end of life indicators between those who received PCS versus those that did not. Models of patient outcomes used inverse probability of treatment weighting to control for confounding. Results: A total of 181 patients with metastatic HPB or GI malignancies were referred to PCS. Most patients either had metastatic colorectal (mCRC) (41.4%) or pancreas (18.2%) cancers. 118 (65.2%) received PCS; 63 (34.8%) did not. No difference was noted in age, gender, race, marital status, or insurance coverage between these two groups. Those receiving PCS were more likely to have mCRC (49% vs. 27%, $p = 0.0077$) and were more likely to be receiving chemotherapy (80.5% vs. 65.1, $p = 0.0299$). PCS was associated with fewer ER visits ($p = 0.0475$), hospital admissions ($p = 0.0002$), and total inpatient days ($p = 0.0001$) per 30 days of life. Overall survival was greater among patients receiving PCS (HR = 0.7, 95% CI: 0.6-0.9, $p=0.0052$). Conclusion: Outpatient PCS for patients with metastatic HPB and GI malignancies is associated with fewer ER visits, fewer hospital admissions, fewer inpatient days, and improved overall survival.

Table 1: Effects of palliative care services on survival and end of life indicators

	RR*	95% CI	P
ER visits/30 lifedays	0.7	0.4 - 1.0	0.0475
Hospital admissions/30 lifedays	0.5	0.3 - 0.7	0.0002
Inpatient days/30 lifedays	0.3	0.2 - 0.5	<0.0001
	HR±	95% CI	P
Overall Survival	0.7	0.6 - 0.9	0.0052

RR = Risk ratio; HR = Hazard ratio; CI = Confidence Interval;
* Marginal risk estimate of PCS vs. no PCS using negative binomial regression;
± Cox proportional hazard model

P120

Genome-Wide CRISPR-CAS Screen in Pancreatic Cancer Cells Reveals Novel Regulators of Cellular Adhesion E. Paulus,* L. Dehart, J. Bakke. *Surgery, Central Michigan University, Saginaw, MI.*

Introduction: Pancreatic cancer encompasses a broad spectrum of biologically unique tumors that arise from precursor lesions in different locations and cells in the pancreas. Pancreatic ductal adenocarcinoma (PDAC) is a leading cause of cancer deaths with a poor 5-year survival rate. One of the primary reasons for the low survival rate is a failure to detect PDAC prior to metastatic events leaving curative treatment including surgical resection out of the equation. A genome-wide CRISPR-Cas knockout screen was conducted to uncover novel regulators of PDAC cell attachment/adhesion. Methods: A knock-out screen was performed using the Brunello library, and two pools of cells were selected based on the rate of adherence (12 min and 4 hours). Next-gen sequencing data was collected on these cells and a control population was then analyzed using CRISPRanalyzeR. Results: Five gene targets were identified that will be further examined for possible pharmaceutical targets. These genes were Aryl Hydrocarbon Receptor (AHR), AXL receptor tyrosine kinase, SPEN, TATA-box binding protein associated factor 6 like (TAF6L), and SPT20 Homolog, SAGA complex Component (SUPT20H). Conclusions: Using the genome-wide CRISPR screen and next-gen sequencing in pancreatic cancer cells, several candidate genes were identified that either delay or promote cellular attachment and adhesion. These five genes will be further validated using both PDAC cell models as well as patient-derived cell models. This will provide further detail regarding the function of the genes in pancreatic cancer adherence and metastasis and allow further targeted therapy to be developed.

P121

Time to Initial Treatment in Pancreatic Adenocarcinoma at a Single Institution: Factors Affecting Delay and its Effect on Long-term Outcomes K. Sugumar,[1]* S. Gendi,[2] H.A. Quereshy,[2] J.J. Hue,[1] S. Gupta,[1] L.D. Rothermel,[1] L.M. Ocuin,[3] J.M. Hardacre,[1] J.B. Ammori,[1] J.M. Winter.[1] *1. University Hospitals Seidman Cancer Center and Case Comprehensive Cancer Center, Department of Surgery, Cleveland, OH; 2. Case Western Reserve University, School of Medicine, Cleveland, OH; 3. Department of Surgery, Division of Hepatobiliary and Pancreatic Surgery, Atrium Health, Cleveland, OH.*

Background: Currently, there are no guidelines regarding an appropriate time from diagnosis to first treatment among patients with pancreatic adenocarcinoma (PDAC), given its aggressive nature. Herein, we aim to define the average time-to-treatment (TTT) in PDAC, factors associated with delay, and prognostic significance. Methods: We conducted a retrospective study of patients evaluated for PDAC at our institution (2017-2020). All stages were included. Patient demographics and various healthcare parameters were recorded. We sub-divided TTT (in days) into four categories: (i) T_1: Time from symptom onset to initial provider visit, (ii) T_2: Time from initial provider visit to tissue diagnosis, (iii) T_3: Time from diagnosis to treating specialist consultation, (iv) T_4: Time from specialist visit to first treatment, (v) and overall TTT ($T_{1+2+3+4}$). Results: 217 patients met inclusion criteria. The median T_1, T_2, T_3, T_4 was 30, 7, 4, and 14 days respectively (Table 1). Patients presenting with weight loss (β =108.6, p=0.002) had greater T_1. More frequent hospitalization (β =19.5, p<0.0001) and misdiagnosis (β =33.4, p=0.002) resulted in longer T_2. Admission at diagnosis (β= -11.5, p=0.03) resulted in shorter T_2. Patients with history of malignancy (β=15, p=0.007) or under active treatment for a second disease (β=19.4, p=0.04) had longer T_3. Patients with poor performance status (β=6.2, p=0.03) and those with private insurance (β=50.2, p<0.0001) had longer T_4. Black patients (β=100, p=0.01) had longer overall $T_{1+2+3+4}$ and admission at diagnosis (β= -87.5, p=0.01) had shorter $T_{1+2+3+4}$. There was no significant association between various TTT intervals and overall survival (p>0.05). Conclusion: It takes a median time of less than a month for a patient with PDAC to start treatment once they visit a primary provider. This should be the bar, however, 50% of patients exceed this standard and 25% of patients take longer than 50 days. Various patient and healthcare parameters can identify patients at risk for treatment delay. The greatest opportunity to shorten overall TTT is by having patients seek medical attention earlier (T_1).

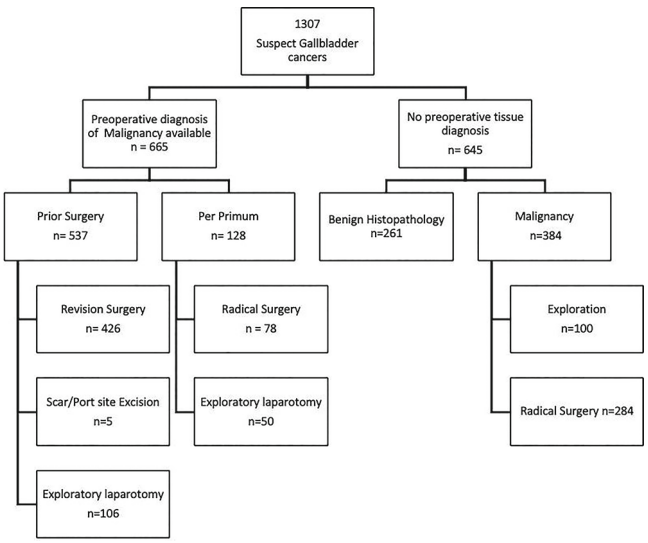
Time-to-treatment (days)

Time duration (days)	Mean	10th percentile	25th percentile	50th percentile	75th percentile	90th percentile
T1	65.86	1	10	30	60	140
T2	17.09	1	1	7	17	45
T3	14.26	0	1	4	13	40
T4	17.44	5	9	14	22	34
T1+2+3+4	111.76	22	45	70	138	233

P122

1300 Consecutive Resections for Gallbladder Cancer (GBC): Ten-Year Audit from a Tertiary Care Oncology Centre S. Patel,* S. Patkar, A. Gupta, A. Ramaswamy, M. Goel. *Deparment of GI & HPB Surgery, Tata Memorial Hospital & Homi Bhabha National University, Mumbai, India.*

Introduction: Evidence based management protocols for GBC from endemic zones are the need of the hour to improve the survival outcomes. This is the largest single centre experience from the Indian subcontinent, an area endemic to GBC. Methods: Retrospective analysis of the institutional database from 2009 till 2019 was performed. 1307 patients who were taken up for surgical exploration with a provisional preoperative diagnosis of GBC and patients with incidental GBC (iGBC) were analysed. Results: Of the 1307 patients, 261 patients (19.97%) had a benign etiology on final histopathology and were subsequently excluded from the survival analysis. Frozen section analysis was routinely used in patients with no preoperative tissue diagnosis to identify such patients with benign etiology, with a false negative rate of less than 2%. 532 patients (50.9%) were incidental GBCs who were restaged at presentation and then underwent revision surgery with or without neoadjuvant systemic therapy. 16% of all GBC patients had distant metastases on exploration with remaining 64% patients undergoing radical curative surgery. With changing practice, increasing number of patients 332 (31.8%) have been operated after neoadjuvant treatment. Survival analyses showed superior outcomes with the use of neoadjuvant chemotherapy(NACT), 3-year OS being 41.0% versus 34.2%, p = 0.03 and 3-year DFS being 31.7% versus 26.2%, p=0.03 for NACT versus no NACT respectively. Minimally Invasive Surgery(MIS) was used for 58 cases with a conversion rate of 10.34%, mainly to perform biliary-enteric anastomosis. Overall surgical morbidity was around 13% predominated by biliary leaks with less than 1% mortality rate. The 1yr, 2yr, 5yr OS rates were 82.5%, 63.5% and 44%. Corresponding DFS rates were 60.7%, 49% and 37.7%. Advance stage, node positive disease and poorly differentiated grade correlated with inferior survival outcomes. Conclusion: Multimodal treatment approach with appropriate use of neoadjuvant treatment following judicious patient selection is the key to improving outcomes in GBC. MIS may become part of surgical armamentarium but needs time and expertise to establish equivalence as of now.



Cohort Diagram

P123

Racial Ethnic Disparities in Access to Neoadjuvant Therapy for Pancreatic Adenocarcinoma A.W. Kangas-Dick,[1]* A.A. Greenbaum,[1] V.P. Gazivoda,[1] P.D. Hilden,[2] V.A. Gall,[1] J. Sesti,[2] S. Paul,[2] D.A. August,[1] T.J. Kennedy,[1] M.S. Grandhi,[1] H.R. Alexander,[1] J.C. Maggi,[2] R.C. Langan.[2] *1. Rutgers Cancer Institute of New Jersey, New Brunswick, NJ; 2. Saint Barnabas Medical Center, Livingston, NJ.*

Introduction Neoadjuvant therapy has been increasingly offered to patients with both borderline and up-front resectable pancreatic adenocarcinoma (PDA). Studies have found that the incidence of PDA is higher in black patients however survival remains less than their white counterparts. Studies have suggested that survival may be improved when patients have access to academic research programs. The aim of this study was to determine factors associated with access to neoadjuvant therapy for patients with PDA. Methods The National Cancer Database (NCDB) was queried for all patients from 2010-2016 who underwent surgery for PDA. The primary outcome was receipt of neoadjuvant therapy (nAT) prior to surgery. Patients of differing racial ethnic backgrounds were compared and a multivariate odds ratio analysis was performed to identify independent risk factors for receipt of nAT. Results Approximately 25% of patients received nAT (n=2974/11,834). The proportion receiving nAT increased from 18.1% in 2010 to 37.0% in 2016. Patients given nAT were younger (median 64 versus 66 years, p<0.001), male (56.2% versus 47.4%, p=0.033), had private insurance (47.8% versus 38.8%, p<0.001) and were treated at an academic center (59.2% versus 48.9%, p<0.0001). Of those who received nAT, 84.3% were white, 9.4% black and 3.9% Hispanic. In those who did not receive nAT, 80.8% were white, 10.5% black, and 5.1% Hispanic (all p<0.001). Univariate and Multivariate analysis of factors predictive of receipt of therapy are noted in Table 1. When controlling for all other factors on multivariate analysis, including tumor stage and medical comorbidities, Black patients, Hispanic patients and patients of other races were less likely to receive neoadjuvant therapy (OR 0.84 (95%CI 0.71-0.98), OR 0.63 (0.50-0.79), and 0.65 (0.48-0.86), respectively, all p<0.001). Conclusions Significant racial-ethnic disparities exist in patients undergoing nAT for pancreatic adenocarcinoma. Non-White patients were less likely to receive nAT even when controlling for tumor characteristics and practice setting, with Hispanic patients having the lowest rates of nAT. Societal outreach programs should be explored to increase the use of nAT.

Selected Factors Associated with Access to Neoadjuvant Therapy

Factor		Univariate OR	P-value	Multivariate OR	P-value
Race	Non-hispanic White	Reference	<0.001	Reference	<0.001
	Non-hispanic Black	0.86 (0.75-1.00)		0.84 (0.71-0.98)	
	Hispanic	0.74 (0.59-0.91)		0.63 (0.50-0.79)	
	Other	0.63 (0.48-0.81)		0.65 (0.48-0.86)	
Facility Type	Academic Research	Reference	<0.001	Reference	<0.001
	Community Cancer	0.53 (0.41-0.67)		0.49 (0.38-0.64)	
	Comprehensive Community Cancer	0.60 (0.54-0.66)		0.58 (0.52-0.65)	
	Integrated Network Cancer Program	0.84 (0.74-0.95)		0.84 (0.73-0.97)	

P124

Hepatocellular Carcinoma in Black Patients is Associated with a More Aggressive Phenotype T. Shaltiel,[2]* Y. Berger,[2] D. Cha,[2] E.R. Pletcher,[2] S. Zheng,[1] C.C. Siderides,[1] E.M. Gleeson,[2] R. Macfie,[2] N. Cohen,[2] B. Golas,[2] D. Labow,[2] A.D. Branch,[3] U. Sarpel.[2] *1. Icahn School of Medicine at Mount Sinai, New York, NY; 2. Department of Surgery, Division of Surgical Oncology, Icahn School of Medicine at Mount Sinai, New York, NY; 3. Department of Medicine, Division of Liver Diseases, Icahn School of Medicine at Mount Sinai, New York, NY.*

Introduction: In the United States, Hepatoceullar Carcinoma (HCC) related mortality is higher in Black patients. A previous study from our group demonstrated a unique profile of HCC in Black patients with Hepatitis C virus exposure, consisting of lower hepatic fibrosis stage and more aggressive tumors. This study aims to explore whether this profile remains true in Black patients with other underlying liver diseases. Methods: Records of HCC patients with exposure to Hepatitis B virus, Alcoholic liver disease or Nonalcoholic steatohepatitis, at our healthcare center, 2003-2018, were reviewed retrospectively. Race/ethnicity was self-identified. Laboratory, imaging and pathological data were compared between Black and non-Black cohorts. Results: A total of 362 patients were identified; of these, 163 patients were Black and 199 were from other populations. Black patients were younger, sex and BMI were similar in both cohorts. Observing tumor characteristics on imaging, Black patients had larger tumors and presented more often with gross vascular invasion and metastatic disease. Black patients' tumors were less within Milan criteria upon diagnosis). 121 patients underwent a resection or transplantation. Analysis of their pathological reports revealed that tumors in the Black patients had higher incidence of poor differentiation, microvascular invasion and dysplastic nodules or satellite lesions. Fewer black patients presented with early stage (T1) disease. Examining liver function upon diagnosis of HCC, Black patients had higher median platelets levelsFIB-4 index higher that 3.25 to predict significant fibrosis, 41.1% of the Black patients had Fib-4 score below 3.25, compared to 33.7% of the Non-Black patients (p=0.08). APRI score below cutoff of 0.5 is a high negative predictive value for cirrhosis. Of Black patients, 54.6% had an APRI score below 0.5, compared to 42.2% (p=0.03) of non-Black patients. Conclusion: Black patients with HCC have more aggressive tumors with poor pathologic prognosticators despite a lower fibrosis stage in the surrounding liver and regardless of the underlying liver disease. Molecular studies are needed to characterize their biological properties.

Indicators of Liver Function and Tumor Characteristics at Time of HCC Diagnosis in Black patients vs. Non-Black Patients

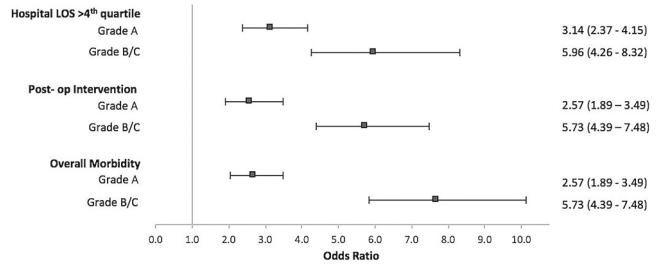
	Black n=163	Non-Black n=199	p value
Age, median (IQR)	54 (46-63)	60 (52-67)	<0.01
BMI, median (IQR)	25.93 (22.51- 29.68)	27 (23.53-30.26)	0.55
Liver function on diagnosis			
FIB-4 score, median (IQR)	3.9 (2.16-6.54)	4.71 (2.39-7.46)	0.14
FIB-4 score < 3.25	67 (41.1%)	67 (33.7%)	0.08
APRI score > 0.5	89 (54.6%)	84 (42.2%)	0.03
Platelets (103/mm3), median (IQR)	152 (99-240)	133 (87-187)	<0.01
Tumor imaging characteristics			
Size of largest tumor on imaging, median (IQR)	4.3 (2.3-10.4)	3.6 (2.3-6.3)	<0.01
Number of tumors on CT, Median (IQR)	1 (1-1)	1 (1-1)	0.78
Gross vascular invasion on imaging	62 (38%)	46 (23.1%)	<0.01
Metastasis on imaging	24 (14.7%)	14 (7.0%)	0.05
Within Milan criteria	58 (35.6%)	97 (48.7%)	0.01
Tumor pathological characteristics	Black n=51	Non-Black n=70	
Presence of dysplastic nodules/ satellite lesions	23 (45.1%)	18 (25.7%)	0.05
Microvascular invasion	40 (78.4%)	42 (60.0%)	0.04
Gross vascular invasion	3 (5.9%)	7 (9.0%)	0.70
Poor differentiation	17 (33.3%)	16 (22.9%)	0.05
Pathological AJCC TMN stage 1	9 (17.6%)	28 (40.0%)	<0.01

P125

Is Grade A Posthepatectomy Liver Failure Clinically Relevant? B. Ko,[1]* B.C. Brajcich,[1] R.P. Merkow,[1] H. Pitt,[2] K.Y. Bilimoria,[1] D. Bentrem.[1] *1. Northwestern University, Chicago, IL; 2. Rutgers Cancer Institute of New Jersey, New Brunswick, NJ.*

INTRODUCTION: The International Study Group of Liver Surgery's (ISGLS) definition of post-hepatectomy liver failure (PHLF) stratifies patients into three grades: A (mild), B (moderate), and C (severe). The clinical significance of the grading system has not been studied. Our objective was to evaluate differences in postoperative complication rates among patients with grade A PHLF against those with grade B/C PHLF and those without PHLF. METHODS: Patients who underwent elective major hepatectomies (total left, total right, and tri-segmentectomy) from 2014 to 2018 were identified in the ACS NSQIP hepatectomy-targeted dataset. PHLF was graded according to the ISGLS definition. The outcomes assessed included 30-day mortality, postoperative morbidity, need for postoperative intervention, and total hospital length of stay (LOS) in the fourth quartile. Multivariable logistic regression was used to evaluate the association between PHLF grade and 30-day outcomes. RESULTS: A total of 6274 patients were identified. The incidence of grade A PHLF was 4.3% and grade B/C PHLF was 5.3%, making the overall incidence of PHLF 9.6%. The rate of 30-day mortality was 1.2% in patients without PHLF, 1.1 % in patients with grade A PHLF, and 25.4% in patients with grade B/C PHLF (P<0.001). On adjusted analysis, compared to patients without PHLF, grade A was associated with increased LOS (grade A: OR 3.1 [95% CI 2.4-4.5]; grade B/C: OR 5.9 [95% CI 4.3-8.3]), readmission (grade A: OR 1.9 [95% CI 1.4-2.6]; grade B/C: OR 1.4 [95%CI 1.0-1.9]), need for postoperative intervention (grade A: OR 2.6 [95% CI 1.9-3.5]; grade B/C: OR 5.7 [95% CI 4.4-7.5]), overall morbidity (grade A: OR 2.7 [95% CI 2.0-3.5]; grade B/C: OR 7.7 [95% CI 5.8-10.1]), and serious morbidity (grade A: OR 2.6 [95% CI 1.9-3.4]; grade B/C: OR 8.8 [95% CI 6.6-11.7]). CONCLUSIONS: Our analysis shows a high incidence of PHLF following major hepatectomy.

Although mortality was similar between patients without PHLF and with grade A PHLF, other postoperative outcomes for grade A patients were notably worse. Continued monitoring of the outcomes of grade A PHLF is important for the evaluation of hepatectomy quality.



P126

Predictors and Benefits of Multi-Agent Chemotherapy for Pancreatic Adenocarcinoma: Timing Matters A.M. Adams,[1]* A.E. O'Shea,[1] P.M. Kemp Bohan,[1] P.M. McCarthy,[1] J.O. Bader,[2] R.W. Krell,[1] G.E. Peoples,[3] G.T. Clifton,[1] D.W. Nelson,[2] T.J. Vreeland.[1] *1. Department of General Surgery, Brooke Army Medical Center, San Antonio, TX; 2. William Beaumont Army Medical Center, El Paso, TX; 3. Cancer Vaccine Development Program, San Antonio, TX.*

INTRODUCTION: The benefit of multi-agent chemotherapy (MC) has been demonstrated for patients with pancreatic adenocarcinoma (PAC) in the adjuvant (A) setting. However, MC may be difficult to tolerate following a morbid operation, and may be better tolerated in the neoadjuvant (NA) setting. This study examined the effect of type and timing of chemotherapy on overall survival in non-metastatic PAC. METHODS: The National Cancer Database was queried from 2006-17 for patients with non-metastatic PAC who underwent surgical resection and received MC or single-agent chemotherapy (SC) pre- or post-resection. Predictors of receipt of MC were determined using multivariable logistic regression. Five-year overall survival (OS) was evaluated using Kaplan-Meier and Cox proportional hazards modeling. RESULTS: 12,440 patients (NA SC n=663; NA MC n=2313; A SC n=6152; A MC n=3312) were included. MC utilization increased from 2006-10 to 2011-17 (33.1 to 49.7%, OR 0.59, p<0.001). Younger age, fewer comorbidities, higher clinical stage, and larger tumor size were all associated with receipt of MC (all p<0.001), but receipt of NA chemotherapy was the greatest predictor of receiving MC (OR 5.18, CI 4.63-5.80, p<0.001). Despite association with more advanced clinical stage, MC was associated with increased median five-year OS (26.0 vs 23.9 months, HR 0.92, CI 0.88-0.96, Figure 1A) and NA MC was associated with the highest survival (28.2mo) compared to NA SC (23.3mo), A SC (24.0mo), and A MC (24.6mo; p<0.001, Figure 1B). Direct comparison of NA MC to A MC resulted in a 4.4 month increase in median 5-year OS (HR 0.87, CI 0.81-0.94, p value<0.001). CONCLUSIONS: Both timing and choice of chemotherapy regimen contribute to overall survival in PAC. MC is associated with improved 5-year OS compared to SC, with the greatest survival benefit demonstrated in the NA MC subgroup. The greatest predictor of MC is receiving NA therapy, suggesting that providing MC prior to surgery ensures that more patients will receive optimal therapy. Randomized studies evaluating timing of effective MC in PAC are needed.

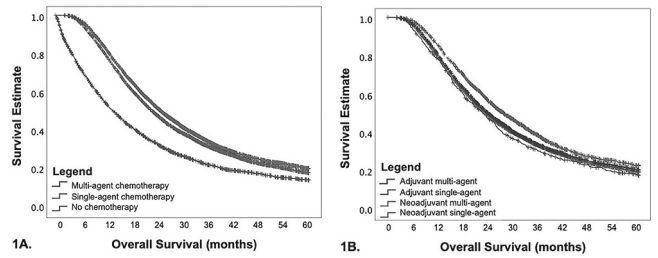


Figure 1. Kaplan-Meier analysis of overall survival of patients with non-metastatic pancreatic adenocarcinoma, with comparisons between single-agent vs multi-agent vs no chemotherapy (1A) and between neoadjuvant multi-agent, neoadjuvant single-agent, adjuvant multi-agent, and adjuvant single-agent (1B).

P127

Social Disparities Predict Successful Implementation of Neoadjuvant Chemotherapy in Resectable Pancreatic Adenocarcinoma M.W. Fromer,* T.J. Mouw, M.E. Egger, C.R. Scoggins, P. Philips, K.M. McMasters, R.C. Martin. *Surgery, University of Louisville, Louisville, KY.*

INTRODUCTION: The use of neoadjuvant chemotherapy (NAC) for resectable pancreatic adenocarcinoma has increased in recent years, but a subset of these patients never reach the operating room. This study aims to determine whether social disparities play a role in the successful implantation of definitive surgical therapy after NAC. METHODS: The ACS NCDB registry (2012-2016) was queried for stage I and II (resectable) pancreatic adenocarcinomas who received chemotherapy as a first course of treatment. Those patients who refused surgery, had vascular extension of their tumor, had disease progression on chemotherapy, or were deemed too comorbid for resection were excluded. Univariate testing, multivariable logistic regression, and survival analyses were performed. RESULTS: Of the 10,007 patients eligible for resection, 50.9% were male, and the median age was 68 years (IQR=16). 80.4% of patients were White, and 16.1% were Black or Hispanic. The group who made it to surgery (Group 1) was younger (64.6 vs. 69.5 years; p<0.001) and had a slightly lower mean comorbidity index (0.41 vs. 0.45; p<0.001) than the group that did not (Group 2). Group 2 was composed of a higher percentage of Black and Hispanic patients (17.5 vs. 13.1%; p<0.001). After adjusting for age and comorbidities, the significant factors that decreased the probability of achieving definitive resection after chemotherapy were evaluation at a community hospital (OR 2.4), Black or Hispanic race (OR 1.6), areas of increased high school drop-out rates (OR 1.4), and lack of private health insurance (OR 1.3)(p<0.001). The median overall survival for Group 2 was markedly worse than the surgical cohort (10.6 [95%CI 10.3, 10.9] vs. 26.6 [95%CI 25.5, 27.9 months; p<0.001). CONCLUSIONS: Racial, economic, and educational disparities have a considerable influence on the successful completion of a neoadjuvant approach for resectable pancreatic cancer and an associated impact on survival. A greater focus on the barriers to effective multimodal care is necessary to ensure the best outcomes for all patients diagnosed with this devastating disease.

Predictors of Successful Completion of Surgery after Chemotherapy for Pancreatic Adenocarcinoma

	Chemotherapy + Surgery	Definitive Chemotherapy			
Factor	n (%)	n (%)	p-value	Adjusted OR (95%CI)	p-value
Male Gender	1593 (48.3)	3324 (49.6)	0.226		
Black or Hispanic Race	433 (13.1)	1174 (17.5)	<0.001	1.63 (1.43, 1.86)	<0.001
Charlson-Deyo Score <2	3019 (91.5)	6707 (89.0)	<0.001	0.85 (0.73, 0.99)	0.045
Private Health Insurance	1380 (42.7)	1822 (27.5)	<0.001	0.80 (0.72, 0.89)	<0.001
High Income Area	2298 (71.5)	6521 (68.0)	<0.001	1.04 (0.94, 1.16)	0.445
High Graduation Rate Area	2129 (66.2)	3929 (60.3)	<0.001	0.75 (0.67, 0.83)	<0.001
Community Hospital Setting	746 (22.8)	2839 (42.5)	<0.001	2.42 (2.19, 2.67)	<0.001
Rural Area	64 (2.0)	103 (1.6)	0.143		
Factor	mean (SD)	mean (SD)	p-value	Adjusted OR (95%CI)	p-value
Age (years)	64.6 (9.6)	69.5 (11.1)	<0.001	1.04 (1.04, 1.05)	<0.001

P128

Predicting Prolonged Survival After Pancreatic Cancer Resection M.D. Williams,* A. Becerra, M.W. Grunvald, C. O'Donoghue, S. Pappas. *Surgery, Rush University Medical Center, Chicago, IL.*

Intro: Despite advances in therapy and improved surgical outcomes, pancreatic cancer remains a lethal disease. Recurrence after resection is common, making long-term survival difficult to predict. We aimed to identify predictors of prolonged survival after pancreatic cancer resection. Methods: Patients in the National Cancer Database who underwent pancreatic resection for adenocarcinoma from 2004-2016 were included. We identified 3, 5, and 10-year survivors. A multivariable logistic regression model of variables associated with survival was used for each cohort. We estimated odds ratios with 95% confidence intervals. We calculated changes in concordance statistic (C-score) to determine each variable's contribution to the overall predictive model. Results: 6069/22921 (26.5%) patients survived 3 years. 2733/19836 (13.8%) survived 5 years. 440/9156 (4.8%) survived 10 years. Changes in C-scores indicated that lymph node positivity ratio and pathologic T stage were the greatest contributors to each predictive model. Lymph node ratio was the strongest predictor of survival in both 3 and 5-year models; however, T stage was the strongest predictor in the 10-year model. T1 tumors were associated

with 7.1 times the odds of surviving 10 years, compared to T4 (OR=7.1, 95% CI= 2.1-23.5). Patients with negative lymph nodes had 3.7 times the odds of surviving 5 years, compared to those with greater than 20% positive nodes (OR=3.7, 95% CI=3.3-4.1). Adjuvant chemotherapy and radiation were associated with survival in all three cohorts. The association between neoadjuvant chemotherapy and survival was statistically significant in the 3-year model, but not in the 5 or 10-year models. C-scores were 0.729, 0.759, 0.845 for 3, 5, and 10-year models, respectively. Conclusions: Lymph node positivity ratio and pathologic T stage are the most important predictors of 3, 5, and 10-year survival. While treatment factors are important, they are not as predictive as pathologic staging. Nomograms and risk stratification tools can potentially help guide patient management and counseling regarding prolonged survival after pancreatic resection.

Table 1: Multivariable Logistic Regression Models Predicting Survival

	3-year survival model		5-year survival model		10-year survival model	
Total C Score	0.729		0.759		0.845	
	OR (95% CI)	**C-score contribution**	**OR (95% CI)**	**C Score Contribution**	**OR (95% CI)**	**C Score Contribution**
Lymph Node Ratio		0.041		0.055		0.042
>20%	1 (reference)		1 (reference)		1 (reference)	
1% to 20%	1.5 (1.3-1.7)		1.7 (1.4-2.0)		2.2 (1.4-3.4)	
0%	2.8 (2.6-3.0)		3.7 (3.3-4.1)		4.7 (3.6-6.1)	
T Stage		0.053		0.012		0.009
4	1 (reference)		1 (reference)		1 (reference)	
3	1.8 (1.4-2.4)		1.8 (2.3-3.8)		3.1 (1.0-10.1)	
2	2.2 (1.6-2.9)		2.6 (1.7-3.9)		3.6 (1.1-12.0)	
1	4.1 (3.0-5.4)		4.1 (2.7-6.2)		7.1 (2.1-23.5)	
0/X	1.2 (0.9-1.6)		1.1 (0.6-1.0)		0.4 (0.1-1.3)	
Margins		0.008		0.009		0.009
Positive	1 (reference)		1 (reference)		1 (reference)	
Negative	2.0 (1.8-2.2)		2.1 (1.9-2.4)		2.7 (1.9-3.8)	
M stage		0.007		0.003		0.003
1	1 (reference)		1 (reference)		1 (reference)	
0	2.8 (2.2-3.7)		3.9 (2.5-6.3)		undefined	
Grade, differentiated		0.003		0.007		0.010
Anaplastic	1 (reference)		1 (reference)		1 (reference)	
Poorly	0.8 (0.6-1.1)		0.7 (0.5-1.0)		1.1 (0.4-3.0))	
Moderately	1.3 (1.0-1.7)		1.0 (0.7-1.4)		1.4 (0.5-3.8)	
Well	2.1 (1.6-2.8)		1.6 (1.1-2.3)		2.1 (0.8-5.8)	
Chemo		0.002		0.002		0.004
None	1 (reference)		1 (reference)		1 (reference)	
Neoadjuvant	1.2 (1.1-1.4)		0.8 (0.6-1.0)		0.6 (0.2-1.5)	
Adjuvant	1.6 (1.5-1.6)		1.3 (1.2-1.5)		1.5 (1.1-1.9)	
Radiation		0.002		0.002		0.001
None	1 (reference)		1 (reference)		1 (reference)	
Neoadjuvant	0.9 (0.8 - 1.1)		1.1 (0.8-1.5)		1.4 (0.5-3.7)	
Adjuvant	1.2 (1.1 - 1.3)		1.4 (1.2-1.5)		1.4 (1.1-1.8)	

P129

Anti-Netrin-1 Therapy Sensitizes Pancreatic Cancer to Immune Checkpoint Inhibition: Pre-Clinical Studies to Support Translation to the Clinic A. Casabianca,[1]* C. Dudgeon,[2] F. Soliman,[3] T. Withers,[2] P. Mehlen,[4] D. Carpizo.[1] *1. General Surgery, University of Rochester, Rochester, NY; 2. Rutgers Cancer Institute of New Jersey, New Brunswick, NJ; 3. Rutgers-Robert Wood Johnson Medical School, New Brunswick, NJ; 4. Centre Léon-Bérard, Lyon, France.*

Introduction: Metastatic pancreatic cancer (PC) is largely driven by epigenetic mechanisms contributing to its recalcitrance and immunosuppressive tumor microenvironment. One alteration is the upregulation of Netrin-1, an axonal guidance molecule expressed during embryogenesis that functions as a survival mechanism for disseminated PC cells. Currently an antibody to Netrin-1 is in clinical trials (NP137, Netris Pharma Inc.) for several solid organ cancers where deprivation of Netrin-1 signaling causes tumor apoptosis. A more recent mechanism of anti-Netrin-1 therapy is its ability to induce an epithelial-like differentiation which sensitizes tumors to immune checkpoint inhibition (CPI). We sought to evaluate the therapeutic potential of anti-Netrin-1 therapy in PC. Methods: Using gene and protein expression analyses we characterized the expression of Netrin-1 in human and mouse primary and metastatic primary tumors. Additionally, we studied the effects of Netrin-1 signaling interference in several murine PC models using an antibody to Netrin-1 and the immune CPI, CTLA-4. Results: Netrin-1 is upregulated in metastatic as compared to primary tumors in both murine and human samples. Interfering with Netrin-1 signaling at the level of the ligand or its receptor Unc5 resulted in tumor cell death. Additionally, in a genetically engineered model of pancreatic cancer (KPC), Netrin-1 inhibition resulted in doubling of the median survival. In a liver metastatic model, Anti-Netrin-1 therapy increased overall survival and reduced liver metastases. Anti-Netrin-1 therapy also induced an epithelial-like phenotype, which sensitized tumors to the immune CPI CTLA-4. Conclusion: We have validated Netrin-1 as a novel therapeutic target in metastatic PC. Inhibiting Netrin-1 signaling prevents tumor progression and improves survival in mice. Moreover, Netrin-1 therapy sensitizes PC to immune CPI's. These data provide important pre-clinical justification for a clinical trial of NP137 combination with immune CPI in PC.

P130

High Expression of CXCR2 is Associated with Aggressive Cancer Biology and Both Pro- and Anti-Cancer Immune Infiltration in Pancreas Cancer A. Patel,* Y. Tokumaru, K. Takabe. *Roswell Park Cancer Institute, Buffalo, NY.*

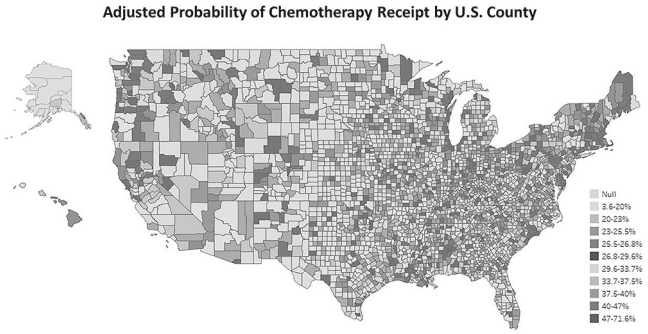
Introduction: CXCR2 expressing tumor-associated neutrophils (TAN) are recruited to create a pro-cancer tumor microenvironment (TME) in pancreatic ductal adenocarcinoma (PDAC). Targeting CXCR2 on TAN has been shown to improve anti-cancer immunity in preclinical models, but none have shown translation in human PDAC. In this study, we hypothesized that high expression of CXCR2 is associated with aggressive cancer biology and worse survival in human PDAC. Methods: Utilizing The Cancer Genome Atlas PDAC cohort with 146 patients, we found that all patients expressed CXCR2 gene other than one. The entire cohort was divided into high or low CXCR2 expression by median value. Results: Surprisingly, CXCR2 expression was not associated with cancer stage, grade or mKI67 expression. CXCR2 expression was also not associated with worse disease specific, disease free or overall survival. Notably, CXCR2 expression high PDAC enriched 48/50 hallmark gene sets including immune response, growth signaling, metastasis, and cell proliferation related genes such as IL2, KRAS, complement and inflammatory response, IL6 and epithelial mesenchymal transition. Given this correlation with pro-cancer signaling, we explored the association of CXCR2 expression and the TME. High CXCR2 expression was associated with high infiltration of pro-cancer immune cells, such as M2 macrophages and regulatory T cells, but also anti-cancer CD8 cells, M1 macrophages and dendritic cells. Notably, CXCR2 expression correlated significantly but weakly with neutrophil infiltration estimated by xCell in PDAC (Spearman $R=0.281$, $p<0.01$), as well as weakly with its corresponding ligand expression (CXCL1,2,3,5,7,8). This presupposes the presence of other immune cells in the pro-cancer TME that overshadow the CXCR2-CXCL chemokine axis. Conclusion: We found that PDAC with high CXCR2 expression is associated with aggressive cancer biology, but with both pro-cancer and anti-cancer immune cells, which may be the reason for no survival difference. In pursuing a future direction, inhibiting the CXCR2 pathway alone may not create a survival benefit, as it may also inhibit anti-cancer immunity.

P131

Regional Variation in Perioperative Chemotherapy Utilization Among Medicare Beneficiaries Undergoing Pancreatic Cancer Resection C.T. Aquina,[1]* A. Hamad,[1] B.N. Reames,[2] J. Cloyd,[1] A. Tsung,[1] T.M. Pawlik,[1] A. Ejaz.[1] *1. Surgery, Ohio State University Wexner Medical Center, Columbus, OH; 2. University of Nebraska Medical Center, Omaha, NE.*

Introduction: Systemic chemotherapy is recommended for all patients who undergo resection of pancreatic ductal adenocarcinoma (PDAC). While previous research suggests wide variation in cancer-directed therapy for patients with PDAC, national variation in the use of chemotherapy has not been investigated. Methods: Patients who underwent pancreatectomy for PDAC were identified using inpatient claims within the Medicare 100% Standard Analytic File for the period 7/1/2013-6/30/2017. Patients were characterized as receiving perioperative chemotherapy if they had a preoperative or postoperative inpatient or outpatient claim within 6 months of the date of surgery for systemic chemotherapy. Regional variation was assessed by estimating the adjusted rate of chemotherapy receipt for U.S. counties based on patient residence after controlling for patient age, sex, race, comorbidities, procedure type, and year of surgery. Results: Among the 16,757 patients who underwent pancreatic cancer resection, only one-third of patients (N=5,963; 34%) received perioperative chemotherapy. Of those who received chemotherapy, 9% (N=540) received neoadjuvant chemotherapy only, 72.8% (N=4,340) received adjuvant chemotherapy only, and 18.2% (N=1,083) received both neoadjuvant and adjuvant chemotherapy. Adjusted county-level rates of chemotherapy receipt ranged from 3.6%-71.6% (Figure). After risk adjustment, patients who were older, had a higher comorbidity burden, or lived in a county with low education status (≥20% of population with less than high

school education) were associated with lower odds of chemotherapy receipt (all P<0.05). Conclusions: Though systemic chemotherapy is considered standard of care for all patients with PDAC who undergo surgical resection, there is wide variation in chemotherapy utilization across U.S. counties for Medicare beneficiaries. Additional research is needed to better understand reasons for this variation and to develop interventions to reduce unwarranted variation among eligible patients.



P132

Antibiotic Induced Resistance to Nivolumab in Patients with Hepatocellular Carcinoma Z.J. Brown,* A. Onuma, C. Shen, A. Tsung. *Division of Surgical Oncology, Department of Surgery, The Ohio State University Wexner Medical Center, Columbus, OH.*

Introduction: The gut microbiome is linked to the development and maintenance of a healthy immune system. Dysbiosis secondary to antibiotics (abx) may cause dampened responses to immunotherapy and promote progression of hepatocellular carcinoma (HCC). Nivolumab, an anti-PD1 immune checkpoint inhibitor, is now approved for patients with advanced HCC. The purpose of this study was to investigate the effect of abx in HCC patients treated with nivolumab. Methods: A retrospective review of patients with advanced HCC treated with nivolumab at a single institution was performed. Abx use was defined as abx given within three months from initiation of nivolumab. Fisher's exact test, Rank Sum test and log-rank test were used to analyze the data. RESIST criteria was used to evaluate to responders (complete response, partial response or stable disease) versus non-responders (progressive disease). Results: Thirty-seven patients with advanced HCC treated with nivolumab were available for analysis; 8 patients responded while 29 patients did not respond to therapy. Age, race, gender, ECOG status, Child-Pugh Score, cause of liver disease, history of sorafenib, or locoregional therapy were not associated with response to nivolumab. Patients who responded to nivolumab were on therapy for a greater length of time than non-responders (p=0.010). Interestingly, abx use within three months from initiation of nivolumab was associated with no response to therapy (p=0.042). (Table 1). The length of time between starting nivolumab and death was not significantly different between the groups (p= 0.053). There was also no association with Child-Pugh classification (p=0.510) or ECOG status (p=0.530) in patients who received abx from those who did not, indicating that abx was not a surrogate for unfit patients. Conclusion: Patients with HCC and advanced liver disease are administered abx for a variety of health conditions. We demonstrate an association between abx and no response to nivolumab in patients with HCC. As portovenous blood from the gut is the main blood supply to the liver, additional studies are required of the interplay between the gut microbiome, immunotherapy, and hepatocellular carcinoma.

Table 1: Characteristics of patients who responded or did not respond to nivolumab

	Non-Responder n=29	Responder n=8	P-Value
Age at Diagnosis	60.10±9.91	57.75±14.03	0.590
Race			0.290
Asian	1 (3%)	1 (13%)	
Black	7 (24%)	3 (38%)	
White	21 (72%)	4 (50%)	
Gender			0.660
Male	7 (24%)	1 (13%)	
Female	22 (76%)	7 (88%)	
ECOG			1.00
0	2 (7%)	1 (13%)	
1	15 (52%)	4 (50%)	
2	12 (41%)	3 (38%)	
Cause of Liver Disease			0.570
Alcohol	5 (17%)	2 (25%)	
Viral Hepatitis	10 (34%)	1 (13%)	
Other	14 (48%)	5 (63%)	
Child-Pugh Score			0.790
A	20 (69%)	7 (88%)	
B	7 (24%)	1 (13%)	
C	2 (7%)	0 (0%)	
Hx of Sorafenib			0.079
No	10 (34%)	0 (0%)	
Yes	19 (66%)	8 (100%)	
Hx Locoregional Therapy			1.00
No	13 (45%)	3 (38%)	
Yes	16 (55%)	5 (63%)	
Antibiotic Use: 3 month			0.042
No	9 (31%)	6 (75%)	
Yes	20 (69%)	2 (25%)	

P133

Evaluation of the Current Treatment Strategies for Pancreatic Neuroendocrine Tumors <1 cm J. Glasser,[1]* C. Schuster,[1] R. Shridhar,[2] J. Huston,[3] K. Meredith.[1] *1. Florida State College of Medicine, Sarasota, FL; 2. Florida Hospital Cancer Institute, Orlando, FL; 3. Sarasota Memorial Cancer Institute, Sarasota, FL.*

Purpose: The management of pancreatic neuroendocrine tumors (PNET) varies between observation (O), pancreatic resection (PR) and enucleation (E). Currently, size, grade and location are used to determine which treatment strategy may be employed. We sought to evaluate each strategy and further clarify the role for surgery. Methods: Utilizing the National Cancer Database we identified patients with pancreatic neuroendocrine tumors and stratified based upon size <1cm. Mann-Whitney U and Kruskal were used to compare continuous variables and Pearson's Chi-square test was used to compare categorical variables. Unadjusted survival analyses were performed using the Kaplan-Meier method. Multivariate analysis (MVA) was performed to identify predictors of survival. All statistical tests were two-sided and p<0.05 was considered significant. Results: We identified 1,214 patients with a median age of 62 (18-90). There were 540 (44.5%) males and 674 (55.5%) females, p<0.001. Tumors were more often located in the body/tail 54.1% vs head 19.2% or other 26.7%, p<0.001. Tumors were well differentiated (WD) 61.8% vs 6.9% poorly differentiated (PD), p<0.001. Patients were treated via PR 749(61.7%), E 79(6.5%), or O 386 (31.8%), p<0.001. Node positive disease was identified in 1.2% of patients. R0 resections were performed in 90.6% of patients. Univariate and multivariate analysis revealed age p<0.001, tumor location p<0.001, grade p<0.001, stage p<0.001, and surgery (E or PR) p<0.001 were all predictors of survival. The median and 5-year survival in the O group with WD tumors was not reached (NR) (77%) vs 142.6 months (87%) in the surgery groups, p<0.04. Similarly in the PD tumors the median and overall survival was 32.9 months and 24% in the O vs NR and 81%, p<001 in the surgery cohort. There were no differences in survival in patients undergoing PR or E, p=0.09. Conclusions: While observation is an acceptable option for the management of small <1cm WD PNET, we found an improvement in survival in the patients undergoing surgery. Enucleation and pancreatic resection did not differ in overall survival. Surgery for PNET should be considered as the first line treatment of these patients.

P134

Adjuvant Chemotherapy is Associated with Improved Survival Following Neoadjuvant Chemotherapy and Pancreatectomy for Pancreatic Ductal Adenocarcinoma: A Population-Based Cohort Study S.K. Kamarajah,[2]* S.A. Naffouje,[3] S.A. White,[2] G.I. Salti,[1] F.S. Dahdaleh.[1] *1. General Surgery/Surgical Oncology, Edward-Elmhurst Health, Elmhurst, IL; 2. Department of HPB and Transplant Surgery, The Freeman Hospital, Tyne and Wear, United Kingdom; 3. Department of Surgical Oncology, H. Lee Moffitt Cancer and Research Institute, Tampa, FL.*

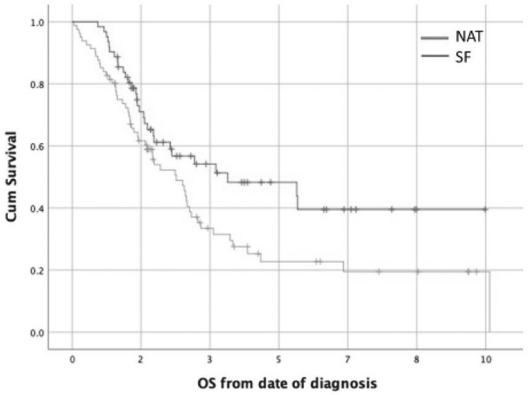
Introduction: Data to support routine use of adjuvant chemotherapy (AC) compared to no AC (noAC) following neoadjuvant chemotherapy (NAC) and resection (i.e. pancreaticoduodenectomy (PD) or distal pancreatectomy (DP)) for patients with pancreatic ductal adenocarcinoma (PDAC) are lacking. This study aimed to determine whether AC improves long-term survival in patients receiving NAC and resection. Methods: All patients with PDAC who underwent resection following NAC between 2004 and 2016 were identified from the National Cancer Data Base (NCDB). Patients with survival <6 months were excluded to account for immortal time bias. Propensity score matching (PSM) was performed to account for selection bias and Cox regression was used to analyse the impact of AC on overall survival. Findings: Of 4,449 (68%) noAC and 2,111 (32%) AC, 2,016 noAC and 2,016 AC patients remained in the cohort after PSM. Clinicopathologic variables were well balanced after matching. After matching, AC was associated with improved survival (median: 29.4 vs 24.9 months, p<0.001), which remained after multivariable adjustment (HR: 0.81, $CI_{95\%}$: 0.75 - 0.88, p<0.001). On multivariable interaction analyses, this benefit persisted irrespective of nodal status: N0 (HR: 0.80, $CI_{95\%}$: 0.72 - 0.90, p<0.001), N1 (HR: 0.76, $CI_{95\%}$: 0.67 - 0.86, p<0.001), margin status: R0 (HR: 0.82, $CI_{95\%}$: 0.75 - 0.89, p<0.001), R1 (HR: 0.77, $CI_{95\%}$: 0.64 - 0.93, p=0.007) and use of neoadjuvant radiotherapy (NART): no (HR: 0.84, $CI_{95\%}$: 0.74 - 0.96, p=0.009), yes (HR: 0.80, $CI_{95\%}$: 0.73 - 0.88, p<0.001). Stratified analysis by nodal, margin and NART status demonstrated consistent results. Conclusions: AC following NAC and resection is associated with improved survival in PDAC patients receiving NAC, even in margin-negative and node-negative disease. These findings suggest that completing planned systemic treatment should be considered in all resected PDAC patients previously treated with NAC.

P135

Neoadjuvant Therapy in Distal Pancreatic Ductal Adenocarcinoma: An 11-Year Single-Institution Experience A. Chopra,* I. Nassour, S.S. AlMasri, A.L. Desilva, N. Bahary, A. Singhi, K.K. Lee, A. Zureikat, A. Paniccia. *University of Pittsburgh, Pittsburgh, PA.*

Introduction: Pancreatic ductal adenocarcinoma (PDAC) involving the distal pancreas is associated with late presentation and early metastasis. The use of neoadjuvant therapy (NAT) in distal PDAC remains limited and understudied. We aimed to characterize utilization patterns of NAT and its impact on the prognostic factors, recurrence, and survival of patients with PDAC. Methods: A single-center, retrospective analysis of patients with distal PDAC, who underwent distal pancreatectomy between 2008 and 2019, was performed. Patients were stratified based on treatment sequence as NAT or surgery first (SF). ANOVA (analysis of variance), Fisher-exact test, and Chi-square test were used to compare outcomes. Disease-free survival (DFS) and overall survival (OS) were estimated using Kaplan-Meier curves and Cox-regression analysis. Results: A total of 144 patients (mean age 68years, 56% females) were included in the study; 62 (43%) received NAT, and 82 (57%) underwent SF. Patients receiving NAT were significantly younger (65 vs. 70 years, p=0.002) with a higher incidence of borderline-resectable disease (21 vs. 2%, p<0.001) than those undergoing SF. The NAT group had a higher percentage of pancreatic neck and body tumors compared to the SF group (10 vs. 1% and 61 vs. 49% respectively, p=0.007). On survival analysis, patients receiving NAT had significantly higher DFS (20 vs. 15 months; HR=0.631, p=0.042) and OS (45 vs. 30 months; HR=0.491, p=0.004; Figure 1), compared to patients undergoing SF. Conclusion: NAT is associated with a significant delay in recurrence and improvement in OS rates following distal pancreatectomy for PDAC. These findings warrant further validation in prospective studies.

Figure 1: Overall survival of patient with distal PDAC treated with NAT versus SF depicted by KM curve (above) and Cox-regression analysis (below)



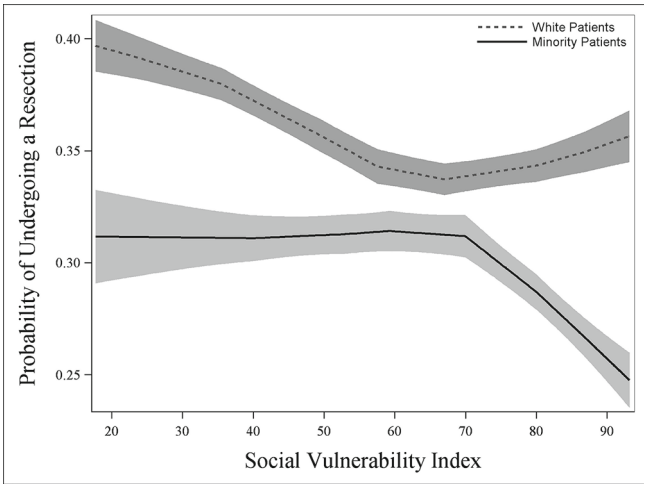
VARIABLE	HAZARD RATIO	95% CI	P-VALUE
NAT	0.491	0.302- 0.799	0.004
Vascular resection	2.416	1.120-5.211	0.025
CCI age-adjusted	1.181	1.058- 1.319	0.003
AJCC 8TH (I =reference)			
Stage II	1.200	0.641- 2.246	0.568
stage III	2.177	1.062- 4.464	0.034
LVI	2.816	1.407- 5.638	0.003
Adjuvant chemotherapy	0.454	0.274- 0.754	0.002

Figure 1: Overall survival of patient with distal PDAC treated with NAT versus SF depicted by KM curve (above) and Cox-regression analysis (below)

P136

Impact of Race and County-Level Vulnerability on Receipt of Surgery Among Medicare Beneficiaries Diagnosed with Pancreatic Cancer R. Azap,* A. Diaz, M. Hyer, D.I. Tsilimigras, R. Mirdad, A. Tsung, M. Dillhoff, J. Cloyd, A. Ejaz, T.M. Pawlik. *Department of Surgery, The Ohio State University Wexner Medical Center, Columbus, OH.*

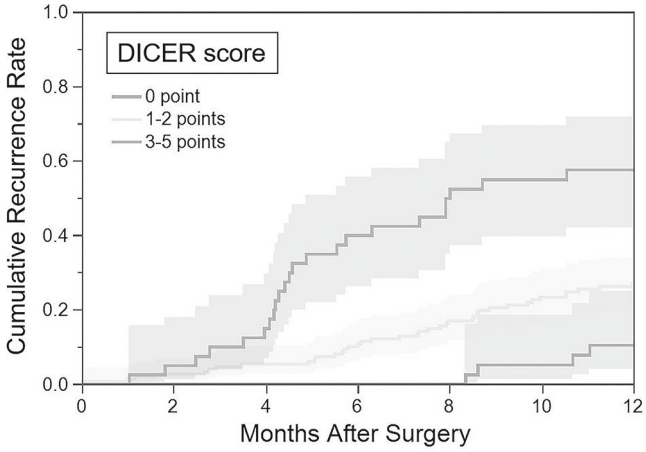
Introduction: Patients can experience barriers to access high-quality cancer care in the US. We sought to characterize receipt of surgery among Medicare beneficiaries diagnosed with early-stage pancreatic adenocarcinoma cancer (PDAC) relative to race/ethnicity and social vulnerability. Methods: Patients diagnosed with early stage (Stage I/II) PDAC between 2004–2017 were identified in the SEER-Medicare database. Data were merged with CDC social vulnerability index (SVI) at the level of each beneficiary's county of residence. Multivariable, mixed-effects logistic regression was utilized to assess the association of SVI with receipt of resection. Results: Among 15,931 patients with early-stage PDAC, median patient age was 77 yrs (IQR 71-82) and 9,001 (56.5%) were female; the majority were White (n=12,737, 80.0%), while a smaller subset was Black or Latino (racial/ethnic minority: n=3,194, 20.0%). While patient age, sex, and comorbidity burden were not associated with social vulnerability (all p>0.05), minority patients were more likely to live in highly vulnerable communities (low SVI: 9.5% vs high SVI: 28.1%; p<0.001). Resection of early stage PDAC was lowest among patients who resided in high SVI areas (low: 38.0% vs high: 31.9%; p<0.001). Racial/ethnic minority patients were less likely to undergo resection compared with White patients (no resection: White, 64.1% vs minority, 70.7%; p<0.001). Increased social vulnerability resulted in a sharp decline in the likelihood of resection, especially among minority patients (Figure). On multivariable analysis, minority patients from a high SVI county had a lower odds of resection vs White patients from a low SVI neighborhood (OR 0.61 95%CI 0.52-0.72; p<0.001). Racial/ethnic differences persisted even among only patients residing in low SVI counties (OR 0.71 95%CI 0.55-0.90; p=0.006). Conclusions: Medicare beneficiaries with early-stage PDAC residing in counties with higher social vulnerability had lower odds of undergoing pancreatic resection, especially among minority patients. Surgeons and policymakers need to focus on social determinants of health to address inequitable access to healthcare.



P137

Early Recurrence Following Curative-Intent Resection and Adjuvant Therapy for Distal Cholangiocarcinoma K. Sahara,[1]* D.I. Tsilimigras,[1] C. Ethun,[2] S. Maithel,[2] D.E. Abbott,[3] G. Poultsides,[4] I. Hatzaras,[5] R.C. Fields,[6] M. Weiss,[7] C.R. Scoggins,[8] C. Isom,[9] K. Idrees,[9] P. Shen,[10] R. Matsuyama,[11] I. Endo,[11] T.M. Pawlik.[1]
1. Department of Surgery, The Ohio State University Wexner Medical Center, Columbus, OH; 2. Emory University, Atlanta, GA; 3. University of Wisconsin, Wisconsin, WI; 4. Stanford University, Palo Alto, CA; 5. New York University, New York, NY; 6. Washington University School of Medicine, St Louis, MO; 7. Northwell, New York, NY; 8. University of Louisville, Louisville, KY; 9. Vanderbilt University Medical Center, Nashville, TN; 10. Wake Forest University, Winston-Salem, NC; 11. Yokohama City University School of Medicine, Yokohama, Japan.

Introduction: Although adjuvant therapy (AT) has been increasingly utilized for biliary tract cancers, patients with distal cholangiocarcinoma (DCC) can still recur after curative-intent surgery and adjuvant chemotherapy +/- radiotherapy. We sought to define the incidence of early recurrence (ER), as well as develop a score to predict patients at highest risk of ER following surgery+AT. Methods: Patients who underwent resection for DCC between 2000-2015 were identified from the US Extrahepatic Biliary Malignancy Consortium. ER was defined as recurrence within 12 months of resection. Cox regression analysis was used to identify clinicopathological factors for the ER predictive score. Results: Among 314 patients with DCC who underwent resection, 169(53.8%) patients received AT (gemcitabine-based: n=51, 16.2%; chemoradiotherapy: n=118, 37.6%). Among patients who underwent resection+AT, 43(27.7%) patients had ER. Median OS among patients with ER was markedly shorter (13.8 months, IQR:8.6-15.9) vs patients who developed late recurrence (31.2 months, IQR:21.7-54.7) or no recurrence (71.8 months, IQR:25.0-NA)(p<0.001). On multivariable analysis, several preoperative factors were associated with risk of ER including neutrophil/lymphocyte ratio (NLR)(HR 3.00, 95%CI:1.70-5.30), total bilirubin (HR 2.35, 95%CI:1.01-5.49), and major vascular invasion (HR 3.82, 95%CI:1.97-7.42). A DIstal Cholangiocarcinoma Early Recurrence (DICER) Score was constructed using beta-coefficients to allocate weighted points according to each factor [NLR>9.0 (2 points); peak preoperative total bilirubin>1.5 (mg/dL) (1 point); major vascular invasion (2 points)]. Cumulative risk of ER increased incrementally among patients who were low (0 points; 10.5%), intermediate (1-2 points; 26.8%), or high (3-5 points) risk (p<0.001)(Figure). The DICER score performed well on internal validation (AUC 0.685, IQR:0.662-0.707). Conclusion: Approximately 1 in 4 patients with DCC experienced an ER following curative-intent resection despite receipt of AT. Use of neoadjuvant chemotherapy should be considered for patients with DCC, especially among individuals at high risk for ER in the preoperative setting.



P138

Guideline Compliant Disparities Among Patients Undergoing Resection of Cholangiocarcinoma at Minority-Serving Hospitals A. Abbas,* D. Dalmacy, D.I. Tsilimigras, M. Hyer, A. Tsung, M. Dillhoff, J. Cloyd, A. Ejaz, T.M. Pawlik. *Department of Surgery, The Ohio State University Wexner Medical Center, Columbus, OH.*

Introduction: Racial/ethnic disparities in cancer outcomes may relate to variations in guideline compliant care. We sought to define compliance with National Committee on Cancer Network(NCCN) guidelines among patients undergoing surgical resection of cholangiocarcinoma (CCA) at minority-serving hospitals(MSH), as well as the impact of NCCN-compliant care on long-term outcomes. Methods: Patients undergoing resection of CCA between 2004-2016 were identified in the National Cancer Database. Institutions treating Black and Hispanic patients within the top decile were categorized as MSH. Care was considered NCCN compliant if patients received adjuvant chemotherapy+chemoradiation for locally advanced disease, lymph node metastasis, or positive surgical margin. Factors associated with NCCN-compliant care, and the impact of NCCN compliance on overall survival(OS) were evaluated. Results: Among 16,116 patients who underwent resection of CCA, most patients were treated at non-MSH (91.8%), while a smaller subset of individuals underwent surgery at MSH (8.2%). Patients treated at MSH facilities tended to be Black or Hispanic (MSH, 59.9% vs non-MSH, 13.4%) and be uninsured (MSH, 11.6% vs non-MSH, 2.2%). The incidence of lymph node metastasis (MSH, 42.5% vs non-MSH, 44.8%) and positive resection margin (MSH, 14.8% vs non-MSH, 14.4%) were comparable. While overall compliance with NCCN care was 73.0% (n=11,766), guideline compliant care was less common at MSH (MSH, 68.8% vs non-MSH, 73.4%; p<0.001). On multivariable analyses, odds of receiving non-NCCN compliant care remained lower at MSH (OR 0.77, 95%CI 0.68-0.88; p<0.001). Failure to receive NCCN-compliant care was associated with a higher chance of death long-term (HR 1.82, 95%CI 1.74-1.91; p<0.001). In contrast, receipt of NCCN-compliant care mitigated survival differences among patients receiving care at MSH vs non-MSH (HR 1.04, 95%CI 0.93–1.17; p=0.50). Conclusions: Patients treated at MSH had decreased odds to receive NCCN-compliant care following resection of CCA. The worse long-term survival among patients treated at MSH was largely attributable to failure to comply with guideline-based cancer care.

P139

Microsatellite Instability is Associated with Worse Overall Survival in Resectable Colorectal Liver Metastases K.M. Turner,* A.M. Delman, K. Wima, D. Sohal, R.C. Quillin 3rd, S.A. Shah, S.A. Ahmad, S. Patel, G.C. Wilson. *Surgery, University of Cincinnati, Cincinnati, OH.*

Introduction: Resection of Colorectal Liver Metastases (CRLM) is a curative therapy for patients with stage IV disease, with reported 5 year survival rates as high as 50%. Microsatellite instability (MSI) has been associated with improved overall survival in locoregional disease; however, the effects of microsatellite instability (MSI) on CRLM has not been well studied. Methods: The National Cancer Database (NCDB) was queried from 2010-2016

for patients with liver-only, metastatic colorectal cancer that underwent metastectomy with available data for microsatellite instability. Patients with microsatellite stable tumors (n=2,323) were compared those with microsatellite instability (n=431). Results: Patients grouped into MSS compared with MSI were similar in terms of sex, race, insurance status and underlying comorbidities. MSS patients were significantly less likely to have colon as the primary site compared with MSI patients (79.6% v. 86.5%, p=0.0007). MSS patients had better tumor characteristics, with lower rates of high grade tumors, high risk histologic features (mucinous/signet ring cell tumors) and lymphovascular invasion. Microsatellite stable patients had higher rates of multi-agent chemotherapy (81.7% v. 74.2%, p=0.0004) and neoadjuvant approaches (36.2% v. 27.2%, p<0.0001). MSS patients had significantly lower number of positive regional lymph nodes (3.6 v. 4.8, p<0.0001) from primary resection. After adjusting for confounding variables, MSI status remained significantly associated with decreased overall survival (aHR: 1.22 95% CI: 1.02-1.45) in patients who underwent resection for CRLM. Median overall survival in the MSS group was 40.9 months compared with 33.2 months in the MSI group (p<0.0001). (Figure 1) Conclusion: Microsatellite instability is independently associated with poor prognosis in a large national cohort of patients with resected colorectal liver metastasis. Further studies are needed to validate MSI status as a biomarker to guide clinical decision making regarding resection of CRLM.

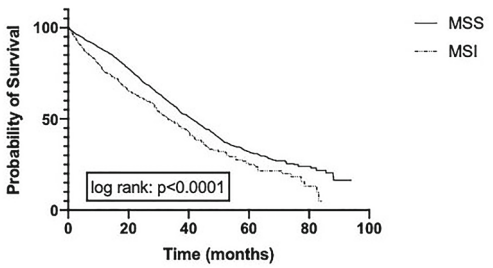


Figure 1 – Kaplan-Meier curve comparing overall survival between microsatellite stable (MSS) and microsatellite stable (MSI) patients.

P140

Recurrence Patterns and Survival After Curative Intent Treatment for Colorectal Liver Metastases: Implications for Adjuvant Liver-Directed Regional Chemotherapy

H.M. Kolbeinsson,[1]* A. Hoppe,[4] J. Walker,[4] S. Chandana,[2] M. Assifi,[3] M. Chung,[3] G. Wright.[3] *1. Spectrum Health General Surgery Residency, Grand Rapids, MI; 2. Cancer and Hematology Centers of West Michigan, Grand Rapids, MI; 3. Spectrum Health Medical Group, Division of Surgical Oncology, Grand Rapids, MI; 4. Michigan State University, Department of Surgery, Grand Rapids, MI.*

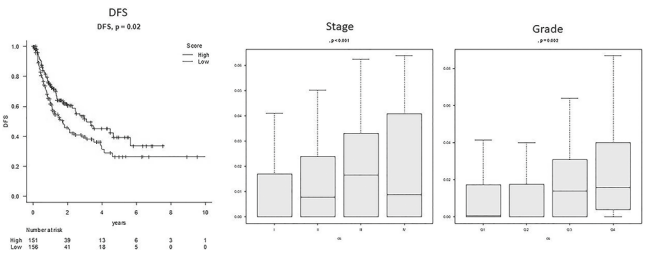
INTRODUCTION: Curative intent treatment of colorectal liver metastases (CRLM) has improved survival compared with systemic therapy alone. Controversy remains over use of other treatments such as adjuvant hepatic arterial infusion chemotherapy. This study investigates tumor recurrence patterns and the effect on post-recurrence survival following curative intent treatment of CRLM. METHODS: This is a retrospective analysis of all patients that underwent liver resection and/or ablation for CRLM between January 2007 and June 2019. Clinicopathologic, operative, systemic therapy and outcome data were gathered. Multivariate analysis was performed to evaluate predictive factors of site-specific recurrence. RESULTS: There were 227 patients included in the study, mean age was 60 (SD+11.0) and 58.2% were male. Median number of liver lesions was 2 (Interquartile range: 1 - 50) and 85% were resectable at diagnosis. Thirty-seven patients (16.3%) had extrahepatic disease, most commonly in portal lymph nodes (n=16) and 178 (78.4%) received chemotherapy before liver surgery. Majority were treated with resection (71.0%) while combination of resection/ablation (18.9%) and ablation alone (11.0%) were less common. At a median follow up of 3 years, recurrence was observed in 151 (66.5%). Of those, liver, lung and peritoneal recurrences were most common at 67.5%, 49.6% and 9.2%, respectively. Five-year overall survival based on site of recurrence was 33.2% (95% CI 15.5%, 52.1%), 53.5% (95% CI 26.2%, 74.6%) and 27.4% (95% CI 14.9%, 41.4%) for liver, lung and multi-site recurrence, respectively. Log-rank comparison of survival between liver, lung and multi-site recurrence revealed no survival difference. Liver recurrence correlated with higher tumor grade (p<0.05) and perineural invasion (p<0.05). CONCLUSIONS: Liver recurrence after curative intent treatment of CRLM is high despite modern systemic chemotherapy. Primary tumor grade and perineural invasion were associated with increased risk of liver metastases and may represent a target for selection of patients that could benefit from adjuvant liver-directed regional chemotherapy.

P141

Intratumoral Mast Cells in HCC are Associated with Aggressive Tumor Biology and Poor Survival

E. Abdelfatah,* M. Oshi, K. Takabe. *Surgical Oncology, Roswell Park Cancer Institute, Buffalo, NY.*

Introduction: Mast cells (MC) are increased in tumor tissue compared to normal tissue in various cancers. In hepatocellular carcinoma (HCC), MC have been shown to have a pro-tumorigenic effect, hypothesized in prior studies to occur through angiogenesis. MC also have an association with the pro-inflammatory cytokine IL-17, another suggested tumorigenic mechanism. Here, we hypothesized that MC level is associated with aggressive cancer biology and worse survival in HCC. Methods: A total of 355 HCC patients with clinical and transcriptome data in The Cancer Genome Atlas (TCGA) were analyzed. A computational algorithm (xCell) was used to estimate the amount of MC and the cohort was divided into MC high (MCH) and MC low (MCL) based on the median value. Kaplan-Meier was used for survival analysis and Gene Set Enrichment Assay (GSEA) was used to elucidate the involved mechanisms. Results: Higher levels of MC were associated with more advanced cancer stage (p < 0.001) and more aggressive grade (p = 0.002). MKi67, the most commonly used marker of cell proliferation, weakly correlated with MC levels (Pearson r=0.378, p<0.01). The pro-inflammatory marker IL-17 was poorly correlated with MC (Pearson r = 0.131, p=0.01) and did not have a significant effect on survival. GSEA demonstrated a number of enriched gene sets including Hallmark cell proliferation gene sets (G2M checkpoints, E2F Targets, MYC targets v1 and v2, mitotic spindle), Wnt-beta catenin signaling, DNA repair, and PI3K-AKT-mTOR signaling. Notably absent was the angiogenesis gene set. MCH was significantly associated with worse disease-free survival compared to MCL (p = 0.02). Conclusion: Our results suggest that higher levels of MC in HCC have a pro-tumorigenic effect, and are associated with accelerated cell proliferation, more aggressive tumor biology and worse disease-free survival.



P142

Systemic Therapy for Resected Pancreatic Adenocarcinoma: How Much is Enough?

K.M. Turner,* A.M. Delman, D.J. Hanseman, D. Sohal, G.C. Wilson, S.A. Ahmad, S. Patel. *Surgery, University of Cincinnati, Cincinnati, OH.*

Introduction: Systemic therapy is an essential part of treatment for pancreatic ductal adenocarcinoma (PDAC). However, not all patients receive every cycle of chemotherapy and even if they do, the impact of dose reductions on survival is not known. Methods: A single institutional prospective database was queried for patients with PDAC who underwent curative resection with complete chemotherapy records. Primary outcome was dose density (DD) of chemotherapy, defined as exact percent of total chemotherapy received over percent of chemotherapy planned, and associated overall survival (OS). Results: 157 patients were included, of which 68 underwent neoadjuvant therapy. Patients in neoadjuvant and adjuvant groups were evenly matched for age, race, sex, BMI and ECOG status. The neoadjuvant group had significantly more advanced tumors, with 48.5% borderline resectable compared to 2.2% of adjuvant. Pathologic stage and margin positivity rates were significantly increased in the adjuvant group. Neoadjuvant treatment led to significantly more completed cycles of chemotherapy (6.60 cycles v. 3.76 cycles, p<0.0001) and higher rates of median total DD (92.0% v. 58.3%, p<0.0001). Adjuvant

chemotherapy was poorly tolerated in both groups, with average DD of 38.5% and 54.9% (p=0.0147) in the neoadjuvant and adjuvant groups, respectively. After sequential survival analysis based on varying DD, patients who received at least 80% of DD had significantly improved median OS (28.1 months v. 20.6 months, p=0.0061), after which there was no significant improvement in OS. However, after normalizing dose density by comparing only patients who completed all cycles of chemotherapy, no significant difference in OS were seen. Conclusion: Patients with PDAC who received a dose density of systemic chemotherapy < 80% had significantly worse OS compared to those who did not. However, when patients were able to receive all cycles, even in the setting of dose reductions, there were no survival differences. Finally, this study found that chemotherapy is better tolerated in the neoadjuvant setting, and given the importance of cycle number and dose density on outcomes, is the preferred approach for PDAC treatment.

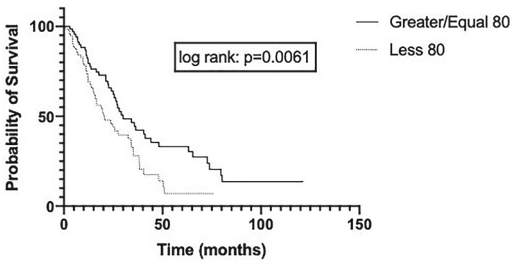


Figure 1 – Kaplan-Meier curve comparing overall survival between those patients who received greater than or equal to 80% dose density with patients who received less than 80% dose density.

P143

Downstaging of Pancreatic Adenocarcinoma with Either Neoadjuvant Chemotherapy or Chemoradiotherapy Improves Survival A.E. O'Shea,[1]* P.M. Kemp Bohan,[1] P.M. McCarthy,[1] A.M. Adams,[1] J.O. Bader,[2] R.W. Krell,[1] G.E. Peoples,[3] G.T. Clifton,[1] D.W. Nelson,[2] T.J. Vreeland.[1] *1. Brooke Army Medical Center, Fort Sam Houston, TX; 2. William Beaumont Army Medical Center, El Paso, TX; 3. Cancer Vaccine Development Program, San Antonio, TX.*

Introduction: Neoadjuvant chemotherapy (NAC) or chemoradiation (NAC+XRT) is increasingly incorporated into the treatment of localized pancreatic adenocarcinoma (PAC), often with the goal of downstaging prior to resection. However, the effect of downstaging on overall survival (OS), particularly differential effects of NAC and NAC+XRT, remains undefined. This study examined the impact of downstaging from NAC and NAC+XRT on OS. Methods: The National Cancer Data Base was queried from 2006-2015 for patients with non-metastatic PAC who received either NAC or NAC+XRT prior to surgical resection. Rates of overall and nodal downstaging, and pathologic complete response (pCR) were assessed. Predictors of downstaging were evaluated using multivariable logistic regression. Overall survival (OS) was assessed with Kaplan-Meier and Cox proportional hazards modeling. Results: 2,475 patients (NAC: n=975; NAC+XRT: n=1500) were included. Compared to NAC, NAC+XRT was associated with increased rates of overall downstaging (38.3% vs. 23.6%; p≤0.001), downstaging from cN+ to ypN0 (cN+->ypN0) (16.0% vs 7.8%, p≤0.001), and pCR (1.7% vs 0.7%; p=0.041). Receipt of NAC+XRT was independently predictive of overall downstaging (OR 2.28, p<0.001) and cN+->ypN0 (OR 3.09, p<0.001). Downstaging by either modality was associated with improved 5-year OS (Figure 1, p≤0.001). Downstaging with NAC was associated with an 8mo increase in median OS (33.7 vs. 25.7 months, p=0.005) and NAC+XRT a 5mo increase in median OS (30.0 vs. 25.0 months, p=0.008). cN+->ypN0 by NAC+XRT was associated with improved OS (p=0.012), but cN+->ypN0 by NAC was not (p=0.227). On Cox regression, downstaging following NAC was associated with a greater reduction in risk of death (NAC: HR 0.70, p=0.004; NAC+XRT: HR 0.83, p=0.0097). Conclusion: Downstaging after neoadjuvant therapies improves survival in non-metastatic PAC. Downstaging following NAC alone may result in a greater reduction in risk of death, but NAC+XRT led to downstaging more commonly, and was also associated with a survival advantage. Prospective randomized studies are needed to identify the optimal neoadjuvant modality/regimen in PAC.

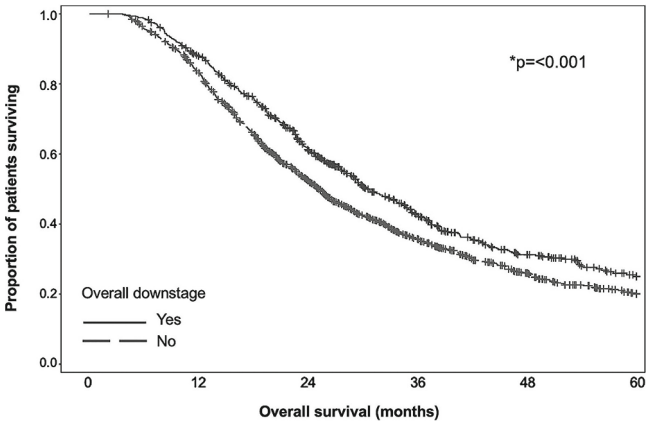


Figure 1: 5-year OS in patients who experienced overall downstaging vs. patients that did not experience overall downstaging.

P144

Influence of Tumor Location on Receipt of Chemotherapy in Patients with Operable Pancreatic Cancer J.A. Drake,* Z.E. Stiles, S.W. Behrman, E.S. Glazer, J.L. Deneve, D. Yakoub, P.V. Dickson. *Surgery, UTHSC, Memphis, TN.*

Introduction Chemotherapy (CTX) is associated with improved survival and recommended for patients undergoing resection for pancreatic ductal adenocarcinoma (PDAC). The current study evaluates how tumor location influences receipt of CTX for these patients. Methods The NCDB (2006-2017) was queried to identify patients who underwent curative intent resection of clinical stage I-III PDAC. Predictors of receipt of CTX, sequencing of CTX, and overall survival (OS) were analyzed. Results Among 14,557 patients who underwent resection for PDAC, 3,543 (24%) did not receive CTX. On multivariable analysis of sociodemographic and clinicopathologic factors, those with tail tumors were 18% less likely to receive CTX (OR 0.82, 95% CI 0.684-0.982) and 60% less likely to receive neoadjuvant CTX (OR 0.40, 95% CI 0.312-0.518) relative to patients with head/neck tumors. For patients with pancreatic body tumors there was no significant difference in rates of administration or sequence of CTX. For patients with tail tumors, median OS was 29.9 vs 18.9 mos (p<0.001) for those who received resection + CTX vs resection alone. In patients with tail tumors, independent predictors of failure to receive CTX, regardless of sequence, were increasing age (OR 0.95, 95% CI 0.930-0.960), 30-day post-op readmission (OR 0.42, 95% CI 0.289-0.622), and increasing post-op length of stay (OR 0.95, 95% CI 0.933-0.969) while Black race (OR 0.44, 95% CI 0.200-0.949) and treatment at a non-academic facility (OR 0.54, 95% CI 0.355-0.832) were predictors of not receiving neoadjuvant CTX. Notably, for patients with tail tumors median post-op length of stay was longer (7 vs 6 days, p<0.001) and 30-day readmission rates higher (16.1% vs 5.8%, p<0.001) for patients who received no CTX vs those treated with neoadjuvant CTX. Conclusion In patients with clinical stage I-III PDAC, primary tumor location within the tail was an independent predictor of failure to receive CTX. Given the marked improvement in OS when CTX is administered, strategies aimed at increasing the number of these patients who receive CTX are necessary. Consideration of neoadjuvant therapy, even for early stage tail tumors, is warranted.

P145

MEK Inhibition Synergizes with STING Activation by Increasing Type I Interferon in Pancreatic Cancer R. Ghukasyan,[1]* J. Cui,[2] E. Abt,[1] K. Chau,[1] L. Li,[1] N. Wu,[1] A. Moore,[1] C. Chan,[1] K. Liang,[3] T.M. Le,[1] C. Radu,[1] T. Donahue.[1] *1. Surgery, University of California, Los Angeles, Studio City, CA; 2. Wuhan University School of Medicine, Wuhan, China; 3. Xinjieng Medical University, Xinjieng, China.*

Introduction: Combination therapies that target tumor-specific changes are a promising strategy to effectively treat pancreatic ductal adenocarcinoma (PDAC). More than 95% of PDACs harbor KRAS mutations and exhibit hyperactivation of the MAPK signaling pathway. Stimulator of interferon genes (STING) is highly overexpressed in PDAC and leads to the expression of Type

I Interferon (IFNα/β) and NFκB-linked cytokines. Systemically administered STING agonists are an emerging class of cancer therapeutics. Methods: Trametinib or Cobimetinib were used for MEK inhibition (MEKi). STING was activated with a small molecule STING agonist amidobenzimidazole (diABZI) in vitro and using a doxycycline via a TetR STING^{R284M} genetic model in CFPAC1 cells in vivo. Cell viability was quantified by 2D-CellTiterGlo assay. Cytokine levels were measured by RT-PCR. Proteomic analyses were performed by western blots with targets for MAPK, STING, and cytokine signaling pathways. Results: STING activation with diABZI had a variable effect on the cytotoxicity of MEKi across PDAC cell lines, most notably in CFPAC1 cells where Trametinib IC50 was decreased by 1x10^9 (Fig 1a). Genetic STING activation in combination Cobimetinib led to universal CFPAC1 tumor regression in vivo (Fig 1b). Mechanistically, MEKi amplified both type I IFN and NFκB signaling induced by diABZI, as measured by pIRF3 and pP65 respectively. This was confirmed by a 40-fold increase in IFNβ transcript levels 24 hrs post diABZI and MEKi combination; with a lower magnitude increase in IL6 and TNFα levels (Fig 1d). Similarly, the downstream IFNα/β signaling markers pSTAT1 and MX1 were also increased by the combination of diABZI and MEKi as compared to diABZl alone, and this was not observed for the downstream IL6 marker pSTAT3 (Fig 1e). Conclusion: MEKi synergizes with the STING agonist diABZI by amplifying acute expression of Type I IFN and represents a novel promising treatment combination in pancreatic cancer.

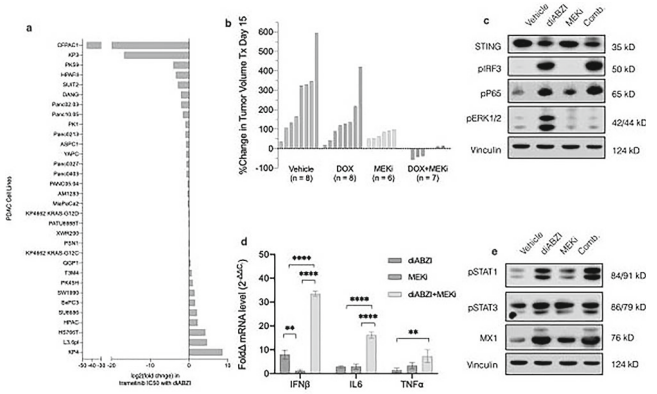
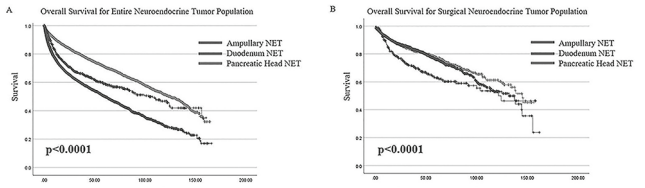


Fig1 I MEKi synergizes with the STING agonist diABZI by amplifying acute expression of Type I IFN (a) The effect of small molecule STING agonist diABZI at1 μM on Trametinib sensitivity across 32 PDAC lines. The cells were treated with 10-dose titration of trametinib, and viability was measured 72h post treatment with 2D-CellTiterGlo; x-axis plots log_2 fold change in trametinib IC50 with diABZI. (b) Tumor size progression in each NCG mouse with a single subcutaneously implanted doxycycline (DOX) inducible STING modified CFPAC1 TetR STING^{R284M} tumors after 15 days of treatment with vehicle, DOX diet, Cobimetinib (5 mg/kg dose qDay), or their combination. (c) Western blot analysis of STING pathway in CFPAC1 after 24h therapy with ±1 μM diABZI ± 100 nM Trametinib (MEKi). Targets included downstream effectors of STING in their active forms: phospho-IRF3 (pIRF3) responsible for Type I IFN production, and phospho-P65 (pP65), part of the activated NFκB pathway, responsible for IL6 and TNFα production. Phospho-ERK1 and ERK2 are downstream effectors of MEK. (d) RT-PCR analysis for IFNβ, IL6, and TNFα levels after 24h treatment ±1 μM diABZI ± 100 nM Trametinib (MEKi) in CFPAC-1; actin was used as the housekeeping gene. The results are reported as fold change calculated by ΔΔCT method. ****p-value << 0.00001, ***p-values≤0.0001, **p-values≤0.001. (e) Western blot analysis of cytokine signaling pathways in CFPAC-1. IFNα/β: Phospho-STAT1 and MX1; and IL6: Phospho-STAT3.

P146

Ampullary Neuroendocrine Tumors: A Window into a Rare Tumor S. Ruff,* A. Levy, J. Herman, S. Anantha, G. Deutsch, M. Weiss, D. Deperalta. *Northwell Health, New Hyde Park, NY.*

Background: Ampullary neuroendocrine tumors (NETs) make up <1% of all gastroenteropancreatic NETs and information about their behavior and prognosis relies on case series. This study describes the population of patients diagnosed with ampullary NETs and compares them to patients with duodenal and pancreatic head NETs. Methods: The National Cancer Database (2004 – 2016) was queried for patients with ampullary, duodenal and pancreatic head NETs. Clinicopathologic and treatment characteristics were compared. Kaplan Meier analysis and Cox regression were used to analyze survival. Results: Overall, 872, 9692, and 6561 patients were identified with ampullary, duodenal, and pancreatic head NETs, respectively. Patients with ampullary NETs had more poorly/undifferentiated tumors (N=149, 17%) than patients with duodenal (N=197, 2%) or pancreatic head (N=740, 11%) NETs. Patients with ampullary NETs had more positive lymph nodes (N=297, 34%) than patients with duodenal (N=950, 10%) or pancreatic head (N=1513, 23%) NETs. On multivariable analysis for patients with ampullary NETs, age (HR 1.03, p<0.0001), Charlson-Deyo (CD) score of 2 (HR 2.3, p=0.001) or ≥3 (HR 2.9, p=0.013), moderately (HR 1.9, p=0.007) or poorly/undifferentiated tumors (HR 4.0, p<0.0001), and metastatic disease (HR 2.0, p=0.001) were associated with decreased survival. At five years, the overall survival (OS) for patients with ampullary, duodenal, and pancreatic head NETs was 59%, 71%, and 50%, respectively (p<0.0001). Among patients that underwent resection for ampullary NETs (N=366), multivariable analysis showed that age (HR 1.04, p=0.002), CD score of 2 (OR 5.8, p<0.0001) or ≥3 (OR 17.4, p=0.026), and poorly/undifferentiated tumors (HR 4.6, p<0.0001) were associated with decreased survival. The five-year OS for patients with ampullary, duodenal, and pancreatic head NETs who underwent surgery was 62%, 78%, and 76% respectively (p<0.0001). Conclusions: Comparing the three populations, pancreatic head NETs had worse overall survival, whereas in the surgical population, ampullary NETs had worse overall survival. Identifying prognostic factors allows us to create more concrete guidelines and provide patients with improved prognostic information.



	Ampullary NET	Duodenal NET	Pancreatic Head NET
Median Overall Survival	103.4 months	124.8 months	60.1 months
Percent Survival at 5 years	58.7%	70.8%	50%
Percent Survival at 10 years	45.7%	51.1%	28.7%

	Ampullary NET	Duodenal NET	Pancreatic Head NET
Median Overall Survival	121.6 months	145.1 months	131. 8 months
Percent Survival at 5 years	62.1%	77.5%	75.8%
Percent Survival at 10 years	50%	69.3%	51.7%

Figure 1: Kaplan Meier analysis comparing overall survival of ampullary, duodenal, and pancreatic head neuroendocrine tumors for A) the entire population and B) the surgical population

P147

Does Routine Adjuvant Radiotherapy After Resection of Gallbladder Cancer Improve Long-term Survival? A Population-Based Cohort Study S.K. Kamarajah,[2]* S.A. White,[2] G.I. Salti,[1] F.S. Dahdaleh.[1] *1. General Surgery/Surgical Oncology, Edward-Elmhurst Health, Elmhurst, IL; 2. Department of HPB and Transplant Surgery, The Freeman Hospital, Tyne and Wear, United Kingdom.*

Introduction: Data supporting routine use of adjuvant radiotherapy (RT) compared to no RT (noRT) for gallbladder cancer (GBC) is unclear. This study aimed to determine whether RT improves long-term survival following resection for GBC. Methods: Patients receiving resection for GBC following curative resection from 2004 - 2016 were identified from the National Cancer Data Base (NCDB). Patients with survival <6 months were excluded to account for immortal time bias. Propensity score matching (PSM) and Cox regression was performed to account for selection bias and analyze impact of RT on overall survival. Results: Of 7,514 (77%) noRT and 2,261 (23%) RT, 2,104 noRT and 2,104 RT patients remained after PSM. After matching, RT was associated with improved survival (median: 26.7 vs 21.1 months, p<0.001), which remained after multivariable adjustment (HR: 0.78, $CI_{95\%}$: 0.72 - 0.84, p<0.001). On multivariable interaction analyses, this benefit persisted irrespective of nodal status: N0 (HR: 0.78, $CI_{95\%}$: 0.70 - 0.85, p<0.001), N1(HR: 0.76, $CI_{95\%}$: 0.67 - 0.86, p<0.001), N2/N3 (HR: 0.56, $CI_{95\%}$: 0.35 - 0.91, p=0.018), margin status: R0(HR: 0.77, $CI_{95\%}$: 0.71 - 0.85, p<0.001), R1 (HR: 0.78, $CI_{95\%}$: 0.68 - 0.88, p<0.001) and use of adjuvant chemotherapy (AC) (HR: 0.68, $CI_{95\%}$: 0.62 - 0.74, p<0.001). Stratified analysis by nodal, margin and AC status demonstrated consistent results. Conclusion : Contrary to current guidelines, RT following resection was associated with improved survival in this study, even in margin-negative and node-negative disease. These findings suggest that RT may play a role in the adjuvant setting.

P148

The Role of Adjuvant Chemotherapy and Radiation in Resected Intrahepatic Cholangiocarcinoma J.S. Ankeny, S. Marmor, M.J. Akers,* C.J. LaRocca, J.Y. Hui, T.M. Tuttle, E.H. Jensen. *University of Minnesota, Minneapolis, MN.*

Background: Limited data on the exact benefit and use of adjuvant therapy in intrahepatic cholangiocarcinoma (ICCA) exist. As such, significant controversy has occurred and clinical use guidelines are inconsistent. We sought to examine the role of adjuvant therapy in resected ICCA with a focus on the potential added benefit of radiation in patients with positive resection margins. Methods: We included patients with resected, non-metastatic ICCA from the National Cancer Database between 2004 and 2016. Patients were stratified by lymph node and margin status, and type of adjuvant therapy received (none,

chemotherapy (CT), or chemotherapy and radiation (CRT)). The association between treatment (surgery, CT, or CRT) and hazard of death was evaluated using Kaplan Meier Cox proportional hazards modeling. Results: We observed 6,229 patients who underwent resection for ICCA. Patients that had no lymph node evaluation or missing lymph node status (n = 2,759) were excluded to allow stratification based on known nodal status. Of the analyzed patients (n = 3,470), 35.4% were lymph node positive and 38.6% were margin positive. After stratification, median overall survival (OS) in the lymph node positive, adjuvant CT group was 20 mos. compared to 11 mos. with no adjuvant therapy ($p < 0.0001$). Median OS in the margin positive, adjuvant CT group was 19 mos. compared to 17 mos. with no adjuvant therapy ($p = 0.01$). Additionally, adjuvant CRT improved OS (21 mos.) over adjuvant CT in patients with positive margins ($p = 0.04$). This trend was particularly apparent for those with positive margins and negative lymph nodes. Patients with negative margins and negative nodes did not benefit from any kind of adjuvant therapy ($p = 0.89$). Conclusion: Adjuvant CT is associated with improved OS in resected ICCA with positive lymph nodes or a positive resection margin. Administration of CRT showed potential added survival benefit in patients with positive margins, particularly those with negative lymph nodes. Patients with negative margins and negative lymph nodes did not benefit from adjuvant therapy.

P149

Surgical Eligibility Does Not Infer Surgical Equity: Treatment Recommendations by Age and Race Differ for Patients with Stage I/II Pancreatic Head Adenocarcinoma C.A. Hester,* A. Kothari, J. Maxwell, N. Ikoma, M.P. Kim, C.D. Tzeng, J. Lee, M.H. Katz, H.S. Tran-Cao. *MD Anderson Cancer Center, Houston, TX.*

Background: Pancreatectomy is not recommended in up to 45% of healthy patients with stage I/II pancreatic ductal adenocarcinoma (PDAC) in the US. We hypothesized that age- and race-related disparities exist with respect to recommendations for surgery. We sought to characterize differences in rates of pancreatectomy recommendation to surgically eligible patients across age and racial groups. Methods: We identified White (W) and Black (B) patients in the NCDB with stage I/II PDAC of the pancreatic head, Charlson 0-1, aged 40-89 (2006-2015). We created models to compare rate of surgery recommendation and Overall Survival (OS) by age and race. We defined a Pancreatectomy Recommendation Equivalence Point (PREP) as the age at which the rate of not recommending surgery matches the rate of recommending surgery. We used marginal standardization linear regression to identify associations between age, race, and recommendation. We evaluated OS with Kaplan-Meier and cox regression models. Results: We studied 48,847 patients: 43,283 (89%) W and 5,564 (11%) B. For the entire cohort, the PREP was 80. The PREP was 5 years younger in B patients than W patients (81 vs 76, Figure 1). In a marginal standardization model, adjusted rates of recommended and completed pancreatectomy was lower for B than W patients aged 50-89. (67% vs 72% for patients in 50s, 62% vs 71% for 60s, 51% vs 64% for 70s, and 27% vs 37% for 80s). Median OS of patients before the PREP was greater for W than B patients (16 vs 14 months, $p<0.001$). OS of patients after the PREP was also greater for W than B patients (9 vs 7 months, $p<0.001$). We found no difference in OS between W and B patients after adjusting for surgery recommendation and completion and other variables (HR 0.99 [95% CI 0.96-1.00]). Conclusions: The PREP of healthy Black patients was 5 years younger than that of White patients, and in every age group, Black patients were not recommended pancreatectomy at a higher rate than White patients. Age and race disparities in treatment recommendations may contribute to shorter longevity of Black patients with stage I/II PDAC.

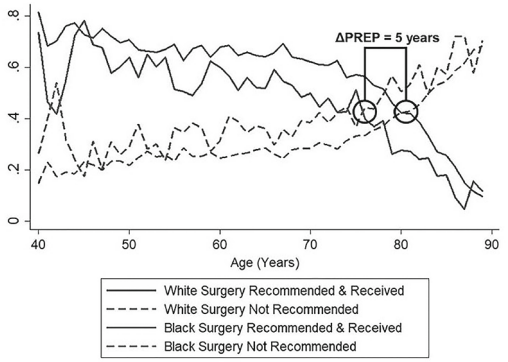


Figure: The distribution of pancreatoduodenectomy recommended and received and not recommended stratified by White and Black race. *PREP = Pancreatectomy Recommendation Equivalence Point.

P150

Low Intra-Tumoral Cancer-Associated Adipocyte Associated with Cell Proliferation and Worse Survival in Hepatocellular Carcinoma S. Mukhopadhyay,* Y. Tokumaru, K. Takabe. *Surgery, Roswell Park Cancer Institute, Buffalo, NY.*

Intra-tumoral cancer-associated adipocytes (CAA) induce inflammation and aggravate biology in many types of cancer. However, its role in hepatocellular carcinoma (HCC) progression is less known. We assessed the impact of intra-tumoral CAA amount on cancer biology and survival in HCC. We used a computational algorithm, xCell, to quantify intratumoral CAA across 350 HCC transcriptomes in The Cancer Genome Atlas (TCGA). HCC had the most intra-tumoral adipocytes among 37 types of cancer in TCGA. When the HCC-CAA cohort was divided into high and low by median there was no significant survival difference in disease-free (DFS), disease-specific (DSS), and overall (OS). CAA was higher in Stage I compared to II and III ($p=0.04$, $p=0.01$, respectively), and in pathological grade 1 and 2 compared to grade 3 and 4 ($p<0.01$), and in lower expression of mKi67 ($p<0.001$). MKi67 expression inversely correlated weakly with CAA levels ($r=-0.287$, $p<0.01$). CAA-low HCC enriched all 5 cell proliferation-related Hallmark gene sets by GSEA analysis. Cell proliferation score as well as homologous recombination defects were significantly higher in CAA-low HCC (both $p<0.001$). These results led us to hypothesize that CAA-extreme low HCC have worse biology and survival. When we defined extreme low-CAA as lowest 10% of the cohort, we found key cell proliferation gene sets enriched even more than our median cut-off (NES change; G2M -2.08 to -2.18, E2F -1.96 to -2.02), as well as DNA repair gene set (NES change -1.63 to -1.87). When extreme low CAA was compared with the other CAA, they were associated with significantly worse DFS, DSS and OS ($p=0.01$, p-0.011, $p<0.001$, respectively). We found that low amount of CAA in HCC is associated with advanced stage, high pathological grade, and high MKi67 expression. CAA-low HCC enriched all 5 cell proliferation-related gene sets. When extremely-low CAA (lowest 10% of the cohort) was compared with the other, enrichment G2M and E2F signaling as well as DNA repair gene set was stronger, and extremely-low CAA HCC was associated with worse DFS, DSS and OS. Our findings take initial steps into clarifying the role of adipocytes within HCC.

P152

Clinical and Imaging Characterization of Pathogenic High-risk Pancreatic Cancer Variants: Development of an Institutional Screening Protocol A.H. Choi,[1]* M. Roman,[2] W.F. Morano,[1] M.J. Selleck,[1] S. Lum,[1] N. Gomez.[1] *1. Surgery, Loma Linda University Health, Loma Linda, CA; 2. Loma Linda University School of Medicine, Loma Linda, CA.*

Background: While the International Cancer of the Pancreas Screening (CAPS) Consortium recommends screening patients with pathogenic high-risk pancreatic adenocarcinoma (HR-PDAC) variants and/or first-degree relatives (FDR) with PDAC, consensus on the population and timing of screening are lacking. We aimed to characterize clinical and imaging characteristics of a single institution's HR-PDAC population to develop a prospective screening protocol. Methods: Retrospective review of genetic testing records from

a tertiary institution was performed between 2004-2020. HR-PDAC genes included were ATM, BRCA1, BRCA2, CDKN2A, CHEK2, MLH1, MSH2, MSH6, MUTYH, STK11, PALB2, and PMS2. Records were reviewed for any previously performed imaging study involving the pancreas (abdominal ultrasound (US), computed tomography (CT) of the chest, abdomen/pelvis, magnetic resonance imaging (MRI) of the abdomen, and PET/CT). Results: Of 1877 genetic tests, 174 (9.3%) contained pathogenic variants in one HR-PDAC-associated gene, most commonly ATM (13/174, 7.5%), BRCA1 (51/174, 29.3%), and BRCA2 (60/174, 34.5%). In 174 patients, 378 imaging studies were performed. Median number of studies per patient was 2 (0-28), mainly CT abdomen/pelvis (65.9%). PDAC was diagnosed in 4/174 (2.3%) patients. One was screen-detected by MRI (known ATM variant); three had genetic testing performed after PDAC diagnosis. All were over age 50, none had FDRs with PDAC and thus did not meet CAPS screening criteria. Of patients without PDAC with at least two imaging studies (89/174), time between studies without HR pancreatic lesions was <12 months in 21/89 (23.6%), 12-24 months in 18/89 (20.2%), >24 months in 50/89 (56.2%). Conclusion: In our series, the rate of PDAC was 2.3%. In designing our protocol, we propose MRI screening at age 50 in the absence of FDR with PDAC. With >50% of HR patients without PDAC diagnosis having negative pancreatic imaging at an interval over two years, yearly MRI is likely not needed for many patients. However, prospective study with clinicopathologic/lifestyle risk factors is needed to further refine the screening interval.

P153

Nativity, Socioeconomic Status, and Enclave Residence on Survival in Latinx Patients with HCC N.M. Nevarez,* M.R. Porembka, S. Wang, J. Mansour, H. Zeh, N.E. Rich, A.G. Singal, A. Yopp. *University of Texas Southwestern Medical Center, Dallas, TX.*

INTRODUCTION: Hepatocellular carcinoma (HCC) disproportionately affects Latinx patients. Despite previous cancer studies demonstrating Latinx and Immigrant Paradoxes, survival advantages despite worse risk profiles, it is unclear if this advantage holds in HCC. The objective of this study was to characterize the effect of nativity, neighborhood socioeconomic status (nSES), and Latinx enclave residence between Latinx and non-Hispanic white (NHW) patients on HCC prognosis. METHODS: Latinx (foreign-born and US-born) and NHW patients diagnosed with HCC were identified in the Texas Cancer Registry from 2004 to 2017. Nativity for Latinx patients was imputed for missing birthplace data. Latinx enclave and nSES were measured using validated indices with tract-level 2000 US Census data. Fisher exact and Chi-square tests were used to compare characteristics. Multivariate Cox proportional hazard models were fit for all-cause survival adjusted for year of diagnosis, age, nativity, tumor stage, and clustering by census tract. RESULTS: Foreign-born Latinx (FL) HCC patients were significantly older (68 years vs. 62 vs. 63, median), female (35% vs. 24 vs. 23), live in high Latinx enclave area (86% vs. 72 vs 30), have lower nSES (49% vs 42 vs 11), and present with advanced stage disease (15% vs 14 vs 13, metastatic) compared to US-born Latinx (USL) and NHW patients (all $p<0.001$). In localized HCC, FL were less likely to get any treatment (49% vs. 40 vs. 33, $p<0.001$) compared to USL and NHW patients. In fully adjusted models, with enclave and nSES defined as a 4-category combination variable, FL patients had worse all-cause survival compared with USL patients (HR 1.1, 95% CI 1.1-1.2, $p<0.001$). High nSES (enclave or no enclave) and low nSES, high enclave had better all-cause survival compared to low nSES/low enclave. CONCLUSIONS: Compared with NHW and USL, FL HCC patients have worse survival. Although HCC patients with low nSES face worse survival, living in enclaves may offer a protective benefit.

P154

Association of Biliary Anaerobes with Response to Neoadjuvant Chemotherapy in Pancreatic Ductal Adenocarcinoma A. Nayyar,[1]* H. Shrader,[2] S.M. Williams-Perez,[1] M.O. Suraju,[1] A. Miller,[1] K. Coleman,[2] P. Ear,[2] C.H. Chan.[1] *1. Department of Surgery, University of Iowa Hospitals and Clinics, Iowa City, IA; 2. Holden Comprehensive Cancer Center, University of Iowa, Iowa City, IA.*

Introduction: A growing body of evidence demonstrates the substantial impact of gut microbiota in carcinogenesis and treatment response in gastrointestinal cancers, specifically hepatic and colorectal malignancies. However, limited data exists on the impact of biliary microbiota composition on therapeutic efficacy of neoadjuvant chemotherapy (NAC) in pancreatic ductal adenocarcinoma (PDAC). Methods: A single-institution, retrospective analysis was performed; all patients with PDAC who underwent pancreaticoduodenectomy after NAC, with intraoperative bile cultures between 2010 and September 2020 were included. Fisher's Exact Test was used to assess the association between bile flora composition and tumor regression score (TRS) on pathological specimen. Human pancreatic cancer cell line Panc1 was treated with 1 mM gemcitabine in the presence of patient-derived bile samples in a 1:50 dilution in vitro. Cellular activity was measured using Cell-Titer Blue assay after 24 hours of drug treatment. Relative cellular activities with or without gemcitabine were calculated for each bile sample. Results: A total of 23 patients were included. Overall, 10 patients had colonization with aerobes alone, 11 with aerobes and anaerobes, and 2 with no growth on bile cultures. Eight patients had a TRS of 0-1 and fifteen had a TRS of 2-3. Patients who had colonization with anaerobes were more likely to have a TRS of 0-1, than those without anaerobes (P=0.009). Pancreatic cancer cells were more sensitive to gemcitabine in the presence of bile colonized with anaerobes in comparing to the one without anaerobes in vitro (Fig.1). Discussion: This study provides preliminary data suggesting improved NAC response in the presence of anaerobes in the biliary tract, supported by improved sensitivity to gemcitabine in vitro. Further research is needed to identify specific anaerobic bacterial strains responsible for this phenomenon and to dissect the molecular mechanism of the observed enhanced chemosensitivity.

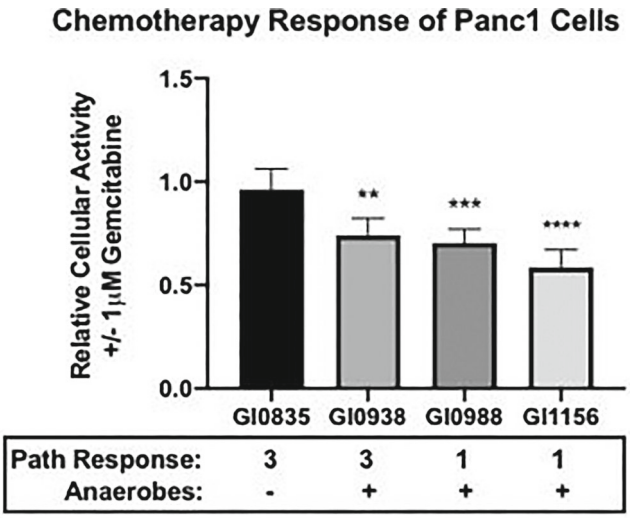


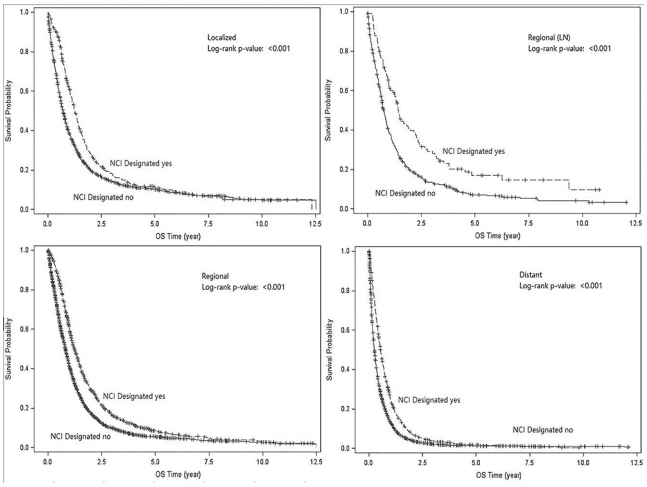
Figure 1: Panc1 human pancreatic cancer cells were treated with 1 mM Gemcitabine for 24 hours in the presence of 1:50 dilutions of 4 bile samples. GI0835/GI0938 and GI0988/GI1156 were obtained from patients with a TRS of 3 and 1, respectively. GI0835 was negative for anaerobes.

P155

Impact of Hospital Characteristics on Guideline Concordant Care and Survival in Pancreatic Cancer G.Z. Murimwa,* J. Yan, H. Zhu, M.R. Porembka, M. Augustine, S. Wang, J. Mansour, H. Zeh, A. Yopp, P. Polanco. *Surgery, University of Texas Southwestern, Dallas, TX.*

INTRODUCTION:Pancreatic ductal adenocarcinoma (PDAC) requires complex care and surgical intervention. Evidence suggests patients may benefit from regionalization of care however there isn't data characterizing the ideal hospital setting. Our study compares the significance of hospital characteristics on guideline concordant care (GCC)as well as survival in PDAC. METHODS: The Texas Cancer Registry was queried for all PDAC patients treated from 2005 to 2017. Clinical-pathological data, treatment characteristics, and survival data were correlated with independently abstracted hospital characteristics including: NIH designation (NIH-D), high-volume centers (HV-C), safety-net status (SNH), and American College of Surgeons Commission on Cancer Accreditation (ACS). Univariate and multivariate analysis (MVA) were used to define associations with GCC. RESULTS:17,070 patients were included. 19% were treated in NIH-D, 72% at ACS, 34% at HVC, and 34% at SNH.

Only 43% of patients received GCC. For all patients with PDAC, NCI-D had the strongest positive impact on survival in MVA (HR .71, p <.001), followed by HCV (HR .88, p< .001), and ACS (HR .87, P<.001). Similar pattern was found in surgically resected patients: NCI-D (HR .75,p<.001), HVC (HR .84, p< .001) and ACS (HR .85, p< .005). GCC conferred survival benefit in all patients (HR .75, CI .687 - .808, p<.001) and resected (HR .74,p<.001). SEER Staging (p<.001), NCI-D(OR 1.61, p< .001), HV-C (OR 1.14, p<.001), and SNS (OR .86,p< .001) were found to increase the likelihood of GCC. In resected patients only NCI-D correlated (OR 1.654,p<.001). Patients treated at hospital with combined designations: NCI-D+ACS, NCI-D+ACS+HVC and even SNH+NCI-D+ACS+HVC were associated with higher chances of GCC and improved survival (p<0.001). CONCLUSIONS: GCC is associated with improved survival. Patients treated at NCI-D, HV-C and ACS accredited hospitals more frequently receive GCC resulting in marked improvement on survival. NCI-D was the strongest characteristic for GCC and survival.



P156

Regression in Melanoma Predicts Lower Recurrence Rates and Better Recurrence-Free Survival S. Subramanian,[1]* G. Han,[2] N. Olson,[2] S. Leong,[3] M. Kashani-Sabet,[3] R. White,[4] J.S. Zager,[5] V.K. Sondak,[5] B. Pockaj,[6] J. Vetto,[1] S. Schneebaum,[7] D. Han.[1]
1. Division of Surgical Oncology, Oregon Health Science University, Portland, OR; 2. Department of Epidemiology and Biostatistics, School of Public Health, Texas A&M University, College Station, TX; 3. California Pacific Medical Center and Research Institute, San Fransico, CA; 4. Levine Cancer Institute, Carolinas Medical Center, Atrium Health, Charlotte, NC; 5. Department of Cutaneous Oncology, Moffitt Cancer Center, Tampa, FL; 6. Mayo Clinic, Phoenix, AZ; 7. Tel-Aviv Sourasky Medical Center, Tel Aviv, Israel.

Introduction: Several factors help to predict melanoma recurrences, but it is unknown if regression (REG) is prognostic of melanoma recurrence. We present a large multicenter study correlating regression with melanoma recurrence. Methods: The Sentinel Lymph Node Working Group database was queried from 1998 to 2018 for melanoma cases with known REG status. Clinicopathologic factors were correlated with recurrence-free survival (RFS) and type of recurrence. Results: There were 4790 patients, and median follow-up was 39.6 months. REG was seen in 1081 of 4790 (22.6%) cases. Overall, 764 of 4790 (15.9%) cases had a recurrence, with 170 (3.5%), 242 (5.1%) and 352 (7.3%) of 4790 patients having a first-site local, regional or distant recurrence, respectively. In cases with REG, recurrences were seen in 122 of 1081 (11.3%) cases, with 26 (2.4%), 33 (3.1%) and 63(5.8%) of 1081 cases having a first-site local, regional or distant recurrence, respectively. RFS was significantly better for cases with REG when compared to cases without REG (p<0.001). Significant predictors of worse RFS on multivariable analysis included increasing age and thickness, male gender, ulceration, lymphovascular invasion (LVI) and a positive sentinel lymph node biopsy (SLNB; all p<0.05). In contrast, REG significantly predicted a better RFS (HR: 0.66, 95% CI: 0.50-0.87, p=0.004). On multivariable analysis, increasing age and thickness, microsatellitosis and a positive SLNB correlated with a first-site local recurrence (all p<0.05). Factors associated with a first-site regional recurrence on multivariable analysis included increasing age and thickness, LVI, and a positive SLNB (all p<0.05), while REG significantly predicted fewer regional recurrences (p=0.017). Multivariable analysis also showed that increasing age and thickness, male gender, ulceration, LVI and a positive SLNB were prognostic of a first-site distant recurrence (all p<0.05). Conclusions: REG in melanoma significantly predicts a lower overall recurrence rate, better RFS and a lower regional recurrence rate. These results suggest that REG is a favorable prognostic marker and identifies patients who have a lower risk for a melanoma recurrence.

P157

Evolving Use of Opioid (OA) and Non-Opioid (NOA) Analgesics in Patients Undergoing Lymphadenectomy for Cutaneous Malignancy J. Robinson,* Y. Chiang, I. Chen, J. Gershenwald, A. Lucci, S. Fisher, J. Wargo, J. Lee, M. Ross, E. Keung. *Surgical Oncology, The University of Texas MD Anderson Cancer Center, Houston, TX.*

INTRODUCTION: OAs are often overprescribed in patients (pts) undergoing surgery and up to 10% of previously opioid-naïve pts develop new persistent OA use. We sought to examine prescribing practices after lymph node dissection (LND) for cutaneous malignancy in order to identify opportunities for practice improvement. METHOD: A single institution retrospective review of 331 pts with cutaneous malignancy who underwent LND between March 2016-March 2020 was performed. RESULTS: Median age at time of LND was 62 (range 18-89). Most pts were male (66%) and received Exparel intraoperatively (92%). The most common indication for LND was metastatic melanoma (84%) followed by squamous cell (10%), Merkel cell (5%), and basal cell (1%) carcinoma. Most pts underwent LND of 1 nodal basin (69%); 31% underwent concurrent wide excision(s) and/or LND at other site(s) at the time of surgery. Median quantity of OAs prescribed at discharge was 200 morphine equivalents (MEs). At discharge, non-opioid analgesics (NOAs) were increasingly utilized as adjuncts over each year of the study period (32%, 43%, 59%, and 77% of pts; p<0.001) while median ME prescribed decreased (250, 238, 150, and 100; p<0.001). Discharge with <200 ME was not associated with higher rate of narcotic refill requests after discharge (p=0.17). There were no differences between pts discharged with <200 vs ≥200 MEs with respect to age, BMI, gender, preoperative OAs or NOAs use, prior receipt of neoadjuvant therapy, or number of surgical sites excised at the time of surgery; however, those discharged with ≥200 MEs were more likely to have undergone a prior excision of a metachronous primary cutaneous malignancy (76% vs 60%, p=0.002) and less likely to be discharged with NOAs as adjuncts to OAs (40% vs 64%, p<0.001). CONCLUSIONS: Analgesic prescribing practices changed significantly at our institution over a recent 4 year period, with increasing use of NOAs and decreasing amounts of OAs following LND for cutaneous malignancy. Significant opportunity exists to further optimize use of NOAs and decrease reliance on OAs postoperatively following LND for cutaneous malignancy.

P158

Patterns of Recurrence in Patients with Sentinel Lymph Node (SLN) Positive Melanoma in the Post-Multicenter Selective Lymphadenectomy Trial II (MSLT-II) Era G.O. Ologun,* E. Keung, R. Goepfert, R. Amaria, M. Ross, J. Gershenwald, A. Lucci, S. Fisher, M. Davies, J. Lee, A. Bishop, J. Wargo, A. Guadagnolo, D. Mitra. *The University of Texas MD Anderson Cancer Center, Houston, TX.*

INTRODUCTION: In the post-MSLT-II era, fewer melanoma pts with a positive SLN undergo completion lymph node dissection (CLND). Many are treated with adjuvant immunotherapy (IO) or targeted therapy. Disease outcomes in this setting are not well characterized. This study evaluated patterns of recurrence for pts with SLN-positive melanoma in the contemporary clinical context. METHODS: A single institution retrospective review of 1,440 pts who underwent wide excision and positive SLN biopsy without CLND between March 2016 and December 2019 was performed. Of these, 215 pts (14.9%) were found to have ≥1 positive SLN and served as the basis for this analysis. RESULTS: Most pts were male (63%) and Caucasian (88%). Median age at diagnosis was 65 (interquartile range [IQR] range 51-74). The majority of primary tumors were located on the extremities (49%); the median Breslow thickness was 2.4 mm (IQR 1.3-4.4 mm). Axillary and cervical nodal basins were the most (50%) and least (18%). commonly involved regional nodal basins, respectively. The median number of SLNs removed was 2

(IQR 1-2). 47% of pts (n=102) received adjuvant systemic therapy (predominantly IO, 93%). 17 pts (8%) received adjuvant radiotherapy (primary site n=12, nodal basin n=9). 103 pts (48%) received no adjuvant therapy. At a median follow-up of 17 months (IQR 20-26 months), 52 pts (24%) had thus far recurred; of these, 37 recurred within the first year. Median time to recurrence was 8 months (range 1-35 months). Isolated locoregional recurrence was the first site of relapse for 37 pts (71%) with isolated nodal recurrence in 20 pts (38%). Distant metastasis at first recurrence was observed in 15 pts (29%). In this retrospective cohort, receipt of adjuvant systemic therapy was thus far not associated with reduced recurrence risk. CONCLUSIONS: Recurrence within the first year after definitive surgical treatment of SLN positive melanoma was common despite prevalent use of adjuvant systemic therapy. Opportunities exist for development of risk-adjusted follow-up, restaging, and adjuvant therapy strategies.

Patient, primary tumor, and lymph node characteristics

Demographics			
Median age (yrs, IQR)		65 (51-74)	
		n	%
Sex	Female	79	37%
	Male	136	63%
Race	White	190	88%
	Hispanic	20	9%
	Other	5	3%
Primary tumor characteristics			
Median Breslow depth (mm, IQR)		2.4 (1.3-4.4)	
		n	%
Primary site	Head & neck	35	16%
	Trunk	75	35%
	Upper extremity	50	23%
	Lower extremity	55	26%
Histology	Lentigo maligna	8	4%
	Nodular	47	22%
	Superficial	125	58%
	Acral	25	12%
	Not specified	10	5%
Pathologic features	Satellitosis	29	13%
	PNI	36	17%
	LVI	75	35%
	Ulceration	86	40%
Mutational Status	BRAF	79	37%
	NRAS	29	13%
	cKit	6	3%
Lymph node characteristics			
		n	%
Nodal basin involved	Head & neck	38	18%
	Axilla	108	50
	Inguinal	69	32
Median number of SLN removed (IQR)		2 (1.5-3)	
Median number of SLN positive (IQR)		1 (1-2)	
Median largest nodal deposit (mm, IQR)		1.05 (<0.1-3)	

Abbreviations: IQR, interquartile range; LVI, lymphovascular invasion; PNI, perineural invasion; yrs, years; LN, lymph node; SLN, sentinel lymph node; SLNB, sentinel lymph node biopsy

P159

Guideline-Concordant Use of Sentinel Lymph Node Biopsy for Melanoma by Commission on Cancer Designated Facility Types J. Narang,[1]* J.J. Hue,[2] K. Bingmer,[2] J.M. Hardacre,[2] J.M. Winter,[2] L.M. Ocuin,[3] J.B. Ammori,[2] A. Mangla,[2] J. Bordeaux,[2] L.D. Rothermel.[2] *1. Cleveland Clinic Lerner College of Medicine of Case Western Reserve University, Cleveland, OH; 2. University Hospitals Cleveland Medical Center, Cleveland, OH; 3. Atrium Health, Charlotte, NC.*

Introduction: Concordance with national guidelines for the surgical management of clinically node-negative melanomas requires judgment for the use of sentinel lymph node biopsy (SLNB). SLNB should be avoided in T1a melanomas without high risk features, while it should be routinely pursued in T2 or T3 melanomas. We investigated how cancer facility type affects adherence to these guidelines. Methods: The National Cancer Database (NCDB) years 2012-2016 was interrogated. The primary outcome was the appropriate use of SLNB for T1a and T2/T3 melanomas by facility type: community, comprehensive community, academic, or integrated network cancer centers. Results: 109,432 patients met inclusion criteria. For T1a melanomas, ~85% of patients appropriately did not receive a SLNB at community and academic centers; this rate was lowest at integrated facilities (75%; p<0.001). Over 83% of patients with T2/T3 disease treated at an academic center appropriately received a SLNB versus 77% treated at a community center (p<0.001). Adjusting for demographic and clinical factors, integrated (OR 0.53, p<0.001) and comprehensive community (OR 0.74, p<0.001) centers were less likely to appropriately defer SLNB in T1a melanoma compared to academic centers. Community (OR 0.71, p<0.001) and comprehensive community (OR 0.92, p=0.012) centers were less likely to adhere to SLNB guidelines in T2/T3 melanoma compared to academic centers. Patients treated at academic facilities were more likely to have private insurance, have travelled a further distance for care, and live in areas with a higher median income and education level compared to patients treated at all other facility types (p<0.001 for all comparisons). Conclusion: Disparities exist in the guideline-concordant utilization of SLNB for melanoma among Commission on Cancer-accredited facilities. Academic centers have the highest proportion of clinically node-negative patients with appropriately managed lymph nodes. Community programs are more likely to underutilize SLNB in T2/T3 disease, while integrated and comprehensive community facilities are more likely to over-utilize SLNB for patients with T1a melanoma.

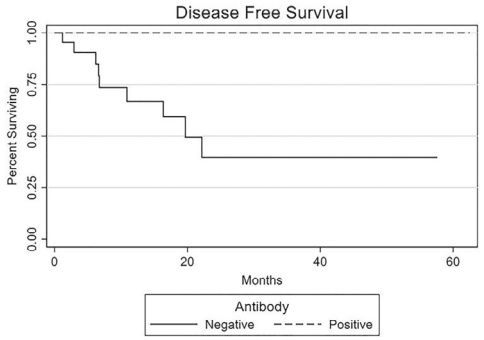
P160

Merkel Cell Polyomavirus Antibody Titer Predicts Recurrence Free Survival A.J. Arroyave,[1]* J. Lewis,[1] M. Landry,[2] J.M. McLoughlin,[1] L. Enomoto.[1] *1. General Surgery, UTMCK, Knoxville, TN; 2. Cleveland Clinic, Port St. Lucie, FL.*

Introduction: Merkel cell carcinoma (MCC) is a rare and aggressive cutaneous neuroendocrine malignancy with a propensity for local recurrence and regional metastasis. Merkel Cell Polyomavirus (MCPyV) is associated with development of MCC. Antibody titers may have prognostic implications. This study evaluated the impact of presence or absence of MCPyV antibody on 5-year overall survival (OS) and disease-free survival (DFS) of patients with MCC. Methods: This single center, IRB approved, retrospective cohort study evaluated 42 adult patients with MCC from 2014 to 2020 using a prospectively maintained database. Patients were compared based on MCPyV antibody status. 5-yr OS and DFS were estimated by Kaplan-Meier analysis. Results: Of 42 patients, 12 (28.6%) were MCPyV antibody positive, 33 (78.6%) underwent wide local excision, 31 (73.8%) received radiotherapy, and 30 (71.4%) received multimodal therapy. Median follow-up time was 12 months (range 1-63 months). Median 5-yr OS of the 42 patient cohort was 44.2 months. Median 5-yr OS of MCPyV antibody negative patients was 44.2 months. Median 5-yr OS of the antibody positive group was not reached. The difference in 5-yr OS between antibody-positive and antibody-negative patients was not statistically significant (p=0.22). Five patients, all MCPyV antibody negative, were never rendered disease free, and were removed from recurrence analysis. There were no recurrences among antibody positive patients. Seven of 25 MCPyV antibody negative patients (28.0%) had a recurrence. Median 5-yr DFS of the entire cohort was not reached. Median 5-yr DFS of the MCPyV antibody negative group was 19.7 months. 5-yr DFS was not reached for the antibody positive cohort (Figure). The MCPyV antibody positive cohort had a significantly improved 5-yr DFS compared to antibody negative patients (p=0.02). Conclusion: MCPyV antibody positive patients demonstrated improved 5-yr DFS compared to MCPyV antibody negative patients. Though not statistically significant, there was a strong trend toward improved 5-yr OS for MCPyV positive compared to MCPyV negative patients. This study substantiates the current understanding and value of MCPyV assessment for patients with MCC.

FIGURE

5-year disease-free survival (DFS) of Merkel Cell Carcinoma patients stratified by Merkel Cell Polyomavirus (MCPyV) antibody status.



P161

Ultrasound Examination of the Lymphatic Drainage Area and Regional Lymph Nodes in Melanoma Patients with In-Transit Metastases O.E. Nieweg,[1]* A.A. Nijhuis,[1] D. Chung,[2] K. London,[2] R.F. Uren,[2] J.F. Thompson.[1] *1. Surgery, Melanoma Institute Australia, North Sydney, NSW, Australia; 2. Alfred Nuclear Medicine and Ultrasound, Sydney, NSW, Australia.*

Introduction In-transit metastases (ITMs) are cutaneous or subcutaneous regional metastases that may occur in patients with melanoma. ITMs are often multiple and new lesions tend to appear over time. Ultrasonography can detect impalpable subcutaneous tumors. The aim of this study was to assess the value of ultrasound examination in detecting additional, non-palpable ITMs and to determine their relevance. Methods Melanoma patients with ITMs who underwent regional ultrasound examination of the skin and subcutaneous tissue between the wide excision site of the primary melanoma and the regional lymph node field at our institution were identified. In most, ultrasound assessment also included the regional lymph node field. Relevant data were collected and analyzed. Results Twenty-eight patients presenting with a total of 40 ITMs were included. Ultrasound examination identified additional ITMs in 15 patients (54%). No nodal metastases were detected. Most additional lesions were found closer to the regional lymph nodes than the original ITM. Management was influenced by the ultrasound findings in nine patients (32%). Five of these patients had more extensive surgery, three received systemic drug therapy instead of surgery and in one surgery was delayed and follow-up intensified. In one patient, only subcutaneous fat was found in the excised specimen and the ultrasound was classified as false positive. Conclusion In melanoma patients with ITMs, ultrasonography of the lymphatic drainage area provided valuable information, as additional ITMs were identified in more than half of them and management was influenced in a third.

P162

Performance of Gene Expression Profiling for Sentinel Lymph Node Sampling in Low Risk Thin Cutaneous Melanoma Patients K.S. Cools,* M. Tsao, B. Deschner, K. Fowler, J.B. Hammond, M. Fleming. *University of Tennessee Health Science Center, Memphis, TN.*

INTRODUCTION: Melanoma gene expression profiling (GEP) has the potential to further stratify patients with thin melanoma into low (Class 1A), intermediate (Class 1B/2A), and high (Class 2B) probabilities of a positive sentinel lymph node (SLN) biopsy. Despite these classifications, a positive sentinel lymph node is still identified in a number of Class IA patients, which can have implications on patient prognosis, treatment, and surveillance. We therefore aimed to identify risk factors for a positive SLN in Class IA patients. METHODS: Retrospective single center review of patients with thin invasive cutaneous melanoma was conducted. Patients with Breslow depth <=1.0mm (T1) and low risk GEP score (Class 1A) who underwent a SLN biopsy were included and separated into SLN positive and negative cohorts. Bivariate and multivariate analysis was used to compare patient demographics and primary tumor characteristics (T1 subclass, ulceration, and mitotic rate). RESULTS: We identified 116 patients with T1 cutaneous melanoma lesions and a low risk GEP score (Class 1A). Ten (8.6%) of these patients had a SLN positive for malignancy. Patients with positive SLNs were younger (47.7 vs. 64.7, p<.001), and had a higher mitotic rate (0 vs 1.5, p<.001). There was no difference in ulceration status or T1 subclass between the two groups. On multivariate analysis, patients were more likely to have a positive SLN if they were <55 years old (OR 4.2, 95% CI 1.1 – 16.9, p=.046), or had >=2 mitoses (OR 6.5, 95% CI 1.6 – 26.8, p=.010) on initial pathologic evaluation. CONCLUSION: Patients with thin cutaneous melanoma who are younger and have a higher mitotic rate may not benefit from GEP testing for SLN positivity risk stratification. GEP testing in the setting of thin melanoma should not replace surgical evaluation in determining the benefits of SLN biopsy.

Table 1: Thin cutaneous melanoma (Breslow thickness <=1.00 mm) patients with Class 1A gene expression profiling (GEP) stratified by sentinel lymph node positivity

		Sentinel Lymph Node Biopsy		
	N=	Positive	Negative	p value
Total	116	10 (8.6%)	106 (91.4%)	
Age, median (IQR)	63.4 (53.6 - 72.6)	47.7 (32.9 - 58.4)	64.7 (55.3 - 73.7)	<0.001
<55 yo	32	6 (18.8%)	26 (81.3%)	0.016
≥55 yo	84	4 (4.8%)	80 (95.2%)	
Ulceration				
Yes	19	1 (5.3%)	18 (94.7%)	0.569
No	97	9 (9.3%)	88 (90.7%)	
Mitoses per mm^2, median (IQR)	0 (0 - 1)	1.5 (1 - 2)	0 (0 - 1)	<0.001
Mitotic Rate				
0-1	98	5 (5.1%)	93 (94.9%)	0.002
≥2	18	5 (27.8%)	13 (72.2%)	
T stage				
T1a	37	3 (8.1%)	34 (91.9%)	0.893
T1b	79	7 (8.9%)	72 (91.1%)	

GEP – Gene expression profiling based on a 31-gene assay; IQR – interquartile range; T stage – based on the AJCC v 8 Cancer Staging Manual

P163

Transcriptomic-Driven Imputation of Stromal-Tumor Interactions in Metastatic Skin Cutaneous Melanoma S. Batchu,[1]* A.A. Hakim,[1] U. Atabek,[2] F. Spitz,[2] Y. Hong.[2] *1. Surgery, Cooper Medical School of Rowan University, Pine Brook, NJ; 2. Cooper University Hospital, Department of Surgery, Division of Surgical Oncology, Camden, NJ.*

Introduction Metastatic skin cutaneous melanomas (SCM) are aggressive tumors that have poor prognoses and novel systemic therapies are needed. To evaluate potential molecular targets in MSCM, publicly available RNA-seq data (The Cancer Genome Atlas) was deconvolved into stromal/tumor compartmental expression profiles to predict ligand-receptor interactions. Methods Tumor purities, the proportion of non-immune cells in the tissue sample, of 308 metastatic and 94 primary samples were estimated using known mRNA expression signatures of stromal/immune cells and DNA methylation patterns. Using the purity estimates and bulk tumor expression values, non-negative linear regression was used to estimate the average expression of each gene in the stromal/tumor compartments. The inferred expression profiles were annotated with a curated database of ligand-receptor interactions and assumed as reasonable proxies for molar concentrations in the law of mass action, allowing for quantification of directional ligand-receptor complex concentrations under equilibrium. Overall survival was estimated with Kaplan-Meier and compared with log-rank test stratified by median expression. Results Predicted tumor-to-tumor signaling enriched for multiple interactions with CD44, including ligands VIM, SPP1, and FN1. Stroma-to-tumor signaling exhibited increased interactions related to integrin beta 1 (ITGB1) signaling. Within the predicted stromal compartment, interactions with L-selectin (SELL) were enriched compared to other evaluated interactions. Compared to primary melanoma tumors, metastatic SCM exhibited increased stroma-to-tumor interactions corresponding to fibroblast growth factor signaling with receptors FGFR1, FGFR2, and FGFR4 in addition to Ephrin A2 (EFNA2) – EphA7 (ephrin type A receptor 7) interactions. Prolonged overall survival was associated with lower FGFR4 and higher SELL expression (log-rank p<0.05 and p<0.01 respectively) (Figure). Conclusions The predicted stromal and tumor compartment deconvolution yielded previously unrecognized interactions in metastatic SCM. In vivo evaluation of these targets will be important for confirming clinical utility.

P164

Melanoma Margins Trial (MelMarT-II): A Framework for Global Recruitment to a Large Multicentre Multinational Randomised Controlled Trial D. Gyorki,[1]* M.D. Moncrieff,[2] R.P. Saw,[3] A.J. Spillane,[3] R. Olofsson Bagge,[4] F. Wright,[5] J. Dancey,[6] J.M. Mammen,[7] E. Paton,[8] N. Williams,[8] D. Seminara,[8] J. Eguchi,[8] M.A. Henderson.[1] *1. Peter MacCallum Cancer Centre, Melbourne, VIC, Australia; 2. Norfolk and Norwich University Hospital, Norwich, United Kingdom; 3. Melanoma Institute Australia, University of Sydney, Sydney, NSW, Australia; 4. Sahlgrenska University Hospital, Göteborg, Sweden; 5. Sunnybrook Health Sciences Centre, Toronto, ON, Canada; 6. Queens University, Toronto, ON, Canada; 7. University of Kansas, Kansas City, KS; 8. Melanoma and Skin Cancer Trials (MASC Trials), Melbourne, VIC, Australia.*

Introduction: In surgery, well conducted randomized controlled trials provide the best evidence to advance clinical practice. Such trials frequently require large cohorts necessitating international collaboration. We describe the currently accruing MelMarT-II trial, which is successfully building an international team following publication of the MelMarT pilot study. Methods: The MelMarT-II study is a phase III multicentre, multinational randomised control trial comparing 1cm versus 2cm wide excision margins for T2b -T4b primary cutaneous melanoma. The primary endpoint is disease-free survival, secondary endpoints include quality of life and health economic evaluations. The collaborative framework to facilitate international participation aiming to recruit 2,998 patients over 5 years are described. Results: The MelMarT-II Study is being co-ordinated through MASC Trials (Australia) which supports central infrastructure and Research Electronic Data Capture (REDCap) online database. MASC Trials has assisted Australian investigators achieve major funding and supported funding applications internationally, with funding now secured in Canada and in progress in the UK, USA and Ireland, with $US 3.76M secured to date. Colleague to colleague promotion of the trial occurs and engagement with clinical trial groups (CTGs) facilitated by the MASC Trials network. 35 sites in 14 countries have commenced start-up activities, 8 sites are open with 56 patients recruited to date internationally (Australia 2 sites, Sweden 1 site, USA 4 sites, UK 1 site). Site activation has been impacted by COVID-19. Current and projecte d recruitment is shown in Figure 1. Conclusions: The MelMarT-II trial framework uses pilot study, investigator and collaborative CTG networks for successful site engagement. MASC Trials provides central infrastructure, administrative leadership as well as practical funding application support. Achieving multinational participation allows investigators to conduct a high-quality evidence-based trial to guide optimal management for patients with primary cutaneous melanoma.

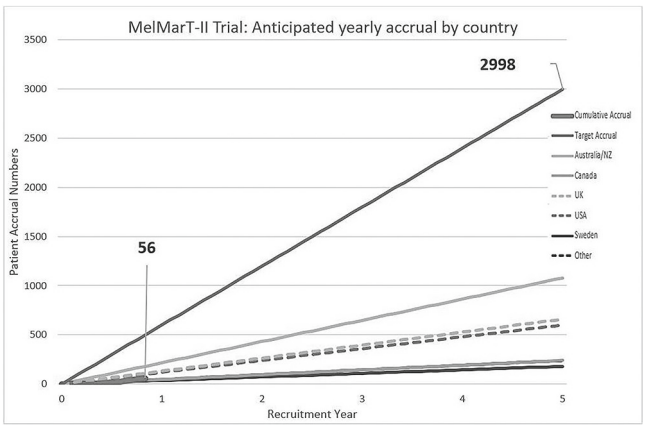


Figure 1. MelMarT-II Trial: Anticipated yearly accrual by country. Solid lines represent countries with secured funding. Dotted lines represent countries without secured funding.

P165

A Surgeon Assessment Tool to Evaluate Baseline and Post-Neoadjuvant Operability in a Melanoma Clinical Trial T.J. Hieken,* D.L. Price, M.S. Block. *Surgery, Mayo Clinic, Rochester, MN.*

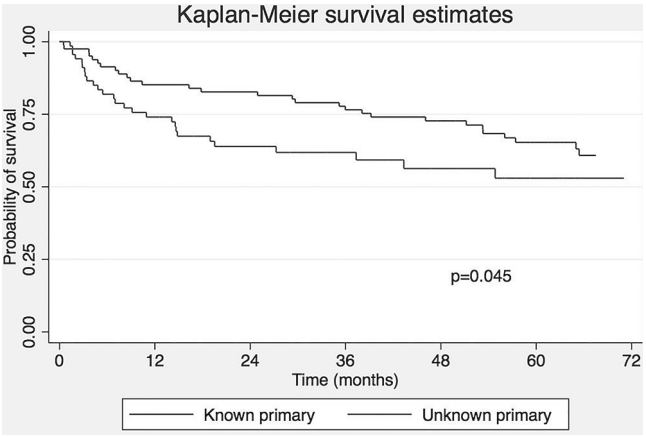
Introduction: The effect of neoadjuvant systemic therapies (NST) on the technical ease of operation in patients with stage III operable melanoma is unknown. As NST is increasingly explored, prospective capture of information on the degree of difficulty of operation after NST is important for informing the relative merits of NST vs surgery followed by adjuvant therapy. Methods: We designed a surgeon survey tool to capture key impressions at baseline prior to NST and at operation and conducted a sub-study for patients treated at our institution within a multi-institutional clinical trial of combinatorial NST for high-risk stage III melanoma (NeoACTIVATE, NCT03554083). This study enrolls patients with clinically node (LN)+ melanoma to 12 weeks of NST with cobimetinib + atezolizumab or vemurafenib, cobimetinib + atezolizumab, determined by BRAF status. Assessment tool forms completed by surgeons at initial consultation and day of operation were analyzed. Results: Among the first 22 patients enrolled from our institution, 21 surveys were completed (95%). Median patient age was 58 yrs, BMI 29 (19-43) and affected LN basin cervical in 3 (14%), axillary in 8 (38%), inguinal in 11 (52%) with ≥2 basins in 2 (10%). Prior to NST, median estimated affected LN size was 4 (1.5-11) cm, involved # of LNs was 3 (1-10) and fixation to adjacent structures present in 10 (48%). At operation, assessment of degree of difficulty decreased from baseline estimate in 5 (24%), increased in 2 (10%) and was <, average or >average vs usual operation in 3, 8 and 10 cases (14%, 38%, 48%). Operative minutes did not correlate significantly with this perception (mean 91, 113 and 109 minutes, respectively). Evaluation of relevant intraoperative factors indicated tumor extent was difficult to identify in 5 (24%) and tissue fixation was present in 13 (62%). Conclusions: These data support use of a surgeon assessment tool to improve understanding of the effect of NST on the technical conduct of operation for stage III melanoma. Validation of these findings across other prospective trials and further study to investigate associations with morbidity and patient-reported outcomes are warranted.

P166

Immune Checkpoint Inhibitors in Melanoma of Unknown Primary F. Ho,[1]* R.J. Torphy,[1] R.P. Tobin,[1] J.S. Borgers,[2] V.M. Vorwald,[1] C.A. Amato,[3] R. Van Gulick,[3] D.T. Cogswell,[1] R. Gonzalez,[3] K.D. Lewis,[3] T.M. Medina,[3] M.J. Rioth,[3] A.L. Gleisner,[1] W.A. Robinson,[3] M. McCarter.[1] *1. Department of Surgery, University of Colorado, Aurora, CO; 2. Department of Medical Oncology, The Netherlands Cancer Institute, Amsterdam, Netherlands; 3. Department of Medical Oncology, University of Colorado, Aurora, CO.*

Background: Metastatic melanoma of unknown primary (MUP) is uncommon, representing less than 5% of melanoma cases, and clinically understudied. Hypotheses regarding its origin include spontaneous regression of the primary tumor due to heightened immune surveillance in the host. The purpose of our study was to compare overall survival and response rates to immune checkpoint inhibitors (ICI) between patients with MUP and those with melanoma of known primary sites (MKP). Methods: Our institution's prospective melanoma database was searched for MUP patients treated with anti-CTLA4 (ipilimumab), anti-PD-1 (nivolumab, pembrolizumab), or both for advanced unresectable disease between 2008 and 2020. Overall survival (OS) and disease control rate (DCR, defined as partial response, complete response, or stable disease per RECIST criteria) in MUP patients were compared with patients with MKP treated with ICI at our institution over the same time period. Patients with poor follow-up or ocular primary were excluded. Analysis was based on intention to treat. Log-rank test and Cox proportional hazards were used to compare OS and logistic regression was used to compare DCR. Results: 150 patients with advanced melanoma treated with ICI were included in the study, 69 (54%) MUP and 81 (66%) MKP. Average patient age was 58.9 years, and 67.3% were male. In the MUP group, 24.6% received ipilimumab, 26.1% PD-1, 27.5% ipilimumab and PD-1 combined, and 21.7% ipilimumab and PD-1 sequentially, while in the MKP group, 19.8% received ipilimumab, 16.0% PD-1, 14.8% combined, and 49.4% sequentially (p=0.005). 3-year OS was 61.9% in MUP and 76.5% in MKP (p=0.045). After controlling for age, sex, and treatment, MUP was associated with a trend towards increased risk of death (HR 1.64, p=0.071). DCR was 56.5% in MUP and 79.0% in MKP patients. After controlling for age, sex, and treatment, patients with

MUP were 61% less likely to be associated with disease control (OR 0.39, p=0.019). Conclusions: In this retrospective cohort study of patients treated with ICI, patients with melanoma of unknown primary had diminished treatment response and trended towards higher risk of death compared with patients with melanoma of known primary.



Kaplan-Meier survival plot comparing overall survival in patients with melanoma of unknown primary vs. known primary treated with immune checkpoint inhibitors

P167

COVID-19 is Affecting the Presentation and Treatment of Melanoma Patients in the Northeastern United States (US)

C.H. Davis,[1]* S.H. Greco,[2] J. Ho,[1] V.P. Koshenkov,[1] J.M. Farma,[2] A.C. Berger.[1] *1. Rutgers Cancer Institute of New Jersey, New Brunswick, NJ; 2. Fox Chase Cancer Center, Philadelphia, PA.*

Background: The Covid-19 pandemic significantly affected healthcare delivery over the past year, with a shift in focus away from non-urgent care. There is data emerging showing that screening for breast and colon cancer has dramatically decreased. It is unknown whether the same trend has affected patients with melanoma. Methods: This is a retrospective cohort study of melanoma patients at two large volume NCI-designated comprehensive cancer centers in the Northeastern US, an area significantly affected by the current Covid-19 pandemic and subject to widespread lockdowns. Patients were compared for 5 months prior to the lockdown (10/19-3/20) and after the lockdown (5/20-9/20). Outcomes focused on delay in treatment and possible resultant upstaging of melanoma. Results: 237 patients were treated prior to the lockdown and 179 patients were treated after the lockdown (a 14% decrease). The primary site of melanoma included: 25% head/neck, 40% truncal, and 35% extremity. There was no delay in care after biopsy seen comparing the two groups(Table). However, fewer patients presented with in situ disease post-lockdown (18.1% vs 11.2%, p=0.054), and a higher proportion presented with stage III-IV melanoma (12.3% vs 11.0%). Finally, in Stage IIIB-IIID patients, there was a dramatic decrease in patients receiving adjuvant therapy in the post lockdown period (50% pre vs 23% post). Conclusion: The recent pandemic has shifted focus away from non-urgent medical care. As a result for melanoma patients, it appears there has been a shift away from melanoma in situ and towards more advanced disease, which may have significant downstream effects on prognosis. Significantly fewer melanoma patients have presented to Surgical Oncology after the lockdown and fewer patients are undergoing the recommended adjuvant therapies. Though there does not appear to be a delay from time of biopsy to surgery, there may be delay in routine dermatology visits and obtaining biopsies of skin lesions. We also may see more disparity as the pandemic progresses. Patient outreach efforts are essential to ensure that patients continue to receive preventative medical care as the pandemic continues.

Characteristics of Melanoma Patients Before and After Lockdown

	Pre-Covid Group (n=237)	Post-Covid Group (n=179)
Age, years (mean)	65.7	67.0
Sex, male (%)	62.9	58.1
Site of melanoma (%)		
Head/neck	26.7	23.6
Trunk	39.4	41.0
Extremity	33.9	35.4
Time from biopsy to surgical consultation, days (median)	17	16
Time from surgical consultation to surgery, days (median)	18	16
Pathologic Staging, %		
0	18.1	11.2
1a	44.7	46.9
1b	9.3	12.8
2a	8.0	8.9
2b	5.9	2.8
2c	3.0	5.0
3a	2.1	3.9
3b	2.5	2.2
3c	4.6	5.0
3d	1.3	0.0
4	0.4	1.1

P168

The Role of Sentinel Lymph Node Status Performed in Melanoma Patients with Local Recurrence or in Transit Metastasis

I. Mattavelli,* A. Maurichi, G. Gallino, A. Leva, C. Barbieri, E. Tolomio, R. Patuzzo, M. Santinami. *Fondazione IRCCS Istituto Nazionale dei Tumori di Milano, Milano, Italy.*

Background: Sentinel Node Biopsy (SNB) is routinely performed for primary melanoma, but its role in the treatment of Local Recurrence (LR) and In-Transit metastasis (IT) is controversial. This study aims to assess the role of SNB in melanoma patients who developed first loco-regional recurrence. Methods: A series of consecutive melanoma patients who received SNB for a first IT or LR at the National Cancer Institute of Milan, Italy, from 2000 to 2015 were selected from a prospective database. Clinicopathological characteristics were analyzed. Results: Seventy-two patients met selection criteria. Forty-three patients (59.7%) received SNB for LR and 29 (40.3%) for IT. The average interval between treatment of primitive melanoma and first recurrence diagnosis was 19 months (interquartile range: 6.9-49.0). SN identification rate was 97.2%. SN positivity was detected in 26 (37.1%) patients. The SN-positive rate in melanoma patients who had LR or IT was significantly higher than reported for primary tumours. Of patients with nodal involvement 17 had LR and 9 IT lesions. Disease Free Survival (DFS) was slightly higher in SN negative patients, in the absence of statistically significant differences. Overall Survival (OS) analysis showed similar values in the two groups. Conclusion: SNB is not routinely performed in cases of first LR or IT. Since DFS and OS do not show significant differences between SN negative and positive patients, our data do not give clear indications about performing SNB. However, we suggest submitting patients with LR to this procedure to obtain a more accurate staging and eventually candidate these patients to adjuvant treatment.

P169

Delay in Surgery Associated with Risk of Nodal Disease and Increased T-stage in Cutaneous Melanoma

N. Lee,[1]* S. Chang,[2] P. Lorimer,[1] J. Ramiscal,[1] A. Wilson,[1] M. Goldfarb,[1] R. Essner,[1] L. Foshag,[1] T. Fischer.[1] *1. John Wayne Cancer Institute, Santa Monica, CA; 2. Medical Data Research Center, Providence Health and Services Oregon and Southwest Washington, Portland, OR.*

INTRO: Delays in treatment have been correlated with worse outcomes in many cancers, but the risk of delays has not been well defined in cutaneous melanoma. Our aim is to characterize the risk conveyed by delays between biopsy and definitive surgery on T-stage, nodal status, and overall survival (OS). METHODS: Adult patients diagnosed between 2005-2014 with no evidence of clinical nodal or metastatic disease who subsequently underwent a nodal staging procedure were identified using the NCDB. Patients were stratified into groups based on time from diagnosis to definitive surgery as follows: <30 days, 30 to 59 days, 60 to 89 days, 90 to 119 days, and greater than 120 days. Outcomes analyzed included increase in t-stage between clinical and pathologic staging, positive node status, and OS. RESULTS: We identified 80,115 patients among the previously described time to surgery cohorts: 40,933 (51.1%) in <30 days, 31,064 (38.8%) in 30-59 days, 5824 (7.3%) in 60-90 days, 1347 (1.7%) in 90 to 119 days, and 947 (1.2%) in >120 days.

Increase in T stage between clinical and pathologic staging was significantly different between cohorts; 5.5%, 6.6%, 7.8%, 7.9%, 7.8% (p<0.001). Percentage of patients with nodal disease was significantly different between cohorts; 13.2%, 14.2%, 16.7%, 18.7%, and 19.5% respectively (p<0.001). Odds of increased T-stage between clinical and pathologic staging were found to be significantly more likely on multivariable analysis compared to <30 days (ref) in the 30-59 days (OR 1.12, 1.05-1.2) and 60-89 days (OR 1.25, 1.12-1.39) cohorts. On multivariable logistic regression analysis odds of nodal disease increased compared to <30 days (ref) in the 60-89 days (OR 1.2, CI 1.11-1.3), 90-119 days (OR 1.37, CI 1.17-1.59), and >120 days (OR 1.42, CI 1.19-1.7) cohorts. Overall survival was significantly different between <30 days (ref) and >120 days (1.26, 1.1-1.43) cohorts on multivariable Cox proportional-hazards regression analysis. CONCLUSION: Delay in definitive surgery is associated with increased risk of nodal disease and increased T stage in patients with cutaneous melanoma.

Univariate and Multivariable Analysis for OS

	Univariate Analysis		Multivariable Analysis	
	HR (CI)	p-value	HR (CI)	p-value
Time to Surgery				
< 30 days	(ref)			
30 - 59 days	1.12 (1.08-1.16)	<0.001	1.03 (0.99-1.06)	ns
60 - 89 days	1.33 (1.25-1.42)	<0.001	1.04 (0.98-1.11)	ns
90 - 119 days	1.55 (1.39-1.73)	<0.001	1.11 (0.99-1.25)	ns
>= 120 days	1.60 (1.41-1.83)	<0.001	1.26 (1.10-1.43)	<0.001
Age (years)	1.05 (1.05-1.05)	<0.001	1.04 (1.04-1.04)	<0.001
Sex				
Male	(ref)			
Female	0.57 (0.55-0.59)	<0.001	0.75 (0.72-0.78)	<0.001
Charlson/Deyo Score				
0	(ref)			
1	1.72 (1.64-1.79)	<0.001	1.23 (1.18-1.29)	<0.001
≥2	3.15 (2.92-3.41)	<0.001	1.96 (1.81-2.13)	<0.001
Clinical T Stage				
T1	(ref)			
T2	1.70 (1.61-1.81)	<0.001	1.42 (1.33-1.52)	<0.001
T3	3.41 (3.21-3.61)	<0.001	2.13 (1.99-2.29)	<0.001
T4	5.76 (5.43-6.12)	<0.001	3.06 (2.84-3.30)	<0.001
Increased T Stage				
No	(ref)			
Yes, T1	1.25 (1.12-1.39)	<0.001	1.99 (1.76-2.25)	<0.001
Yes, T2	2.45 (2.26-2.66)	<0.001	1.96 (1.80-2.14)	<0.001
Yes, T3	3.4 (3.07-3.78)	<0.001	1.53 (1.37-1.71)	<0.001
AJCC Pathologic N Stage				
N0	(ref)			
N1	2.26 (2.15-2.37)	<0.001	1.75 (1.64-1.87)	<0.001
N2	3.20 (3.01-3.41)	<0.001	2.20 (2.04-2.38)	<0.001
N3	6.49 (5.99-7.03)	<0.001	3.23 (2.92-3.57)	<0.001

HR = hazard ratio, CI = 95% confidence interval, ns = not statistically significant

P170

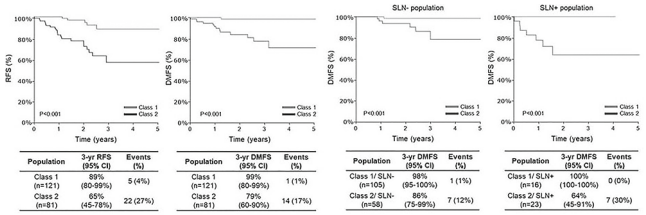
Contemporary Immunotherapy in Pediatric, Adolescent and Young Adult Melanoma: A National Cancer Database Analysis L. Cao,* K. Sugumar, S.S. Khan, A. Sarode, A. Mangla, M.E. Miller, L.D. Rothermel. *University Hospitals Cleveland Medical Center, Cleveland, OH.*

Introduction: Immune checkpoint inhibitors (ICI) have shown progress for patients with advanced melanoma in clinical trials. However, efficacy in pediatric (Peds), adolescent (Adol) and young adult (YA) populations is less clear. We investigated the outcomes of immunotherapy use among these populations. Method: Peds (1-11 years), Adol (12-18), YA (19-39), and older adult (OA; >39) patients with melanoma were identified in the National Cancer Database (NCDB) from 2012-2017. Chi-square analyses compared characteristics among different age groups. Kaplan-Meier survival estimates were performed for advanced melanoma patients by immunotherapy status. Results: 65 (0.2%) Peds patients, 142 (0.4%) Adol, 3,524 (10.1%) YA and 31,118 (89.3%) OA were included for stage III/IV melanoma cohorts. Female sex was seen in 51% Peds, 49% Adol, and 52% YA versus 35% OA (P<0.001). 9% Peds and Adol are non-white vs. 2-3% among other cohorts (P<0.001). 46% Peds are T3 or T4 vs. 24%, 13%, and 18% in Adol, YA, and OA groups, respectively (P<0.001). 32% Peds and 25% Adol are stage III/IV vs 17% and 13% in YA and OA groups, respectively (P<0.001). Immunotherapies were used for Peds patients in 42% stage III and 60% stage IV cases. Adol patients received immunotherapy in 45% of stage III and 30% of stage IV. Immunotherapy did not confer a statistically significant survival difference among stage III/IV Peds (P=0.93/0.48) and Adol (P=0.52/0.65), although observations are limited in these groups. YA received immunotherapies in 42% stage III and 51% stage IV patients. A survival benefit for stage III YAs was only seen on subgroup analysis for stage IIIB/C patients (p=0.02). YA with stage IV disease had improved OS (p<0.001). OA patients used immunotherapies in 26% stage III and 38% stage IV patients; OS was improved for both groups (p<0.001). Conclusion: Young and older adults benefit from immunotherapy use in select cases. More observations are needed to elicit whether immunotherapy benefits Peds and Adol melanomas. Prospective studies are needed to investigate whether ICI benefits Peds and Adol melanomas.

P171

31-Gene Expression Profiling for Cutaneous Melanoma Management: A Single-Center Study L.D. Dillon,* K. Dillon. *Larry D. Dillon, MD, PC, Colorado Springs, CO.*

Introduction: Cutaneous melanoma staging is based on primary tumor characteristics, sentinel lymph node (SLN) status, and metastasis. The 31-gene expression profile (31-GEP) test uses primary tumor biology to stratify patient risk of metastasis into low (Class 1) or high (Class 2) and may improve risk stratification in both SLN negative and positive populations. Objective: To demonstrate the prognostic value and clinical impact of the 31-GEP in a single high-volume melanoma surgery center. Methods: Two hundred and two patients with stage I-III melanoma from a single surgical oncology practice were enrolled in an IRB-approved retrospective study, and outcomes were assessed to determine 3-year recurrence-free (RFS) and distant metastasis-free survival (DMFS) using Kaplan-Meier and Cox regression analysis. Results: Of the 202 patients, 121 (60%) received a Class 1 result, and 81 (40%) a Class 2 result. The Class 1 population had significantly higher 3-year RFS (89% [95% CI: 80-99%] vs. 65% [95% CI: 53-80%], p<.001) and DMFS (99% [95% CI: 96-100%] vs. 79% [95% CI: 69-91%], p<.001) compared with Class 2. In addition, DMFS remained significantly higher for patients with a Class 1 result in both the SLN(-) and SLN(+) population compared to patients with a Class 2 result (see Figure). A 31-GEP Class 2 result was the most significant predictor for RFS (HR: 6.16 [95% CI: 2.32-16.34], p<.001) and DMFS (HR: 18.49 [95% CI: 2.24-141.34], p=.005) in a univariate analysis that included AJCC staging, and remained significant in a multivariable analysis for RFS (HR: 4.59 [95% CI: 1.60-13.18], p=.005) and DMFS (HR: 11.27 [95% CI: 1.37-92.88], p=.024). Conclusions: The 31-GEP accurately and significantly differentiated metastasis risk for patients managed at a single surgical oncology center between 2013 and 2019. The test was observed to be an independent, significant predictor of 3-year RFS and DMFS. The 31-GEP provides improved prognostic accuracy over SLN status alone, which may lead to improved healthcare resource allocation.



Population	3-yr RFS (95% CI)	Events (%)
Class 1 (n=121)	89% (80-99%)	5 (4%)
Class 2 (n=81)	65% (45-78%)	22 (27%)

Population	3-yr DMFS (95% CI)	Events (%)
Class 1 (n=121)	99% (80-99%)	1 (1%)
Class 2 (n=81)	79% (60-90%)	14 (17%)

Population	3-yr DMFS (95% CI)	Events (%)
Class 1/ SLN- (n=105)	98% (95-100%)	1 (1%)
Class 2/ SLN- (n=58)	86% (75-99%)	7 (12%)

Population	3-yr DMFS (95% CI)	Events (%)
Class 1/ SLN+ (n=16)	100% (100-100%)	0 (0%)
Class 2/ SLN+ (n=23)	64% (45-91%)	7 (30%)

Figure. **The 31-GEP stratifies patient risk for recurrence and distant metastasis into low (Class 1) and high (Class 2) and further stratifies risk for patients with negative (SLN-) or positive (SLN+) SLN status.**

P172

Safety of Talimogene Laherparepvec in the Geriatric Melanoma Patient: A Multi-Institutional Experience J. Johnson,[1]* R.J. Louie,[2] M.J. Carr,[3] K. Baecher,[4] F. Collichio,[1] M.C. Lowe,[4] A.A. Sarnaik,[3] K.A. Delman,[4] J.S. Zager,[3] D.W. Ollila.[1] *1. Surgery, University of North Carolina, Chapel Hill, NC; 2. Virginia Commonwealth University, Richmond, VA; 3. Moffitt Cancer Center, Tampa, FL; 4. Emory University, Atlanta, GA.*

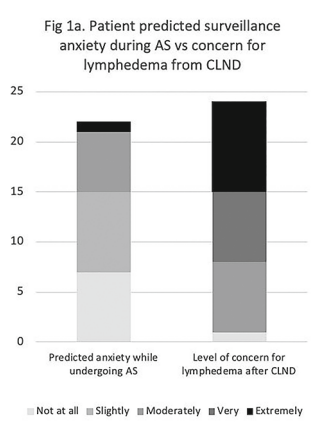
INTRODUCTION Talimogene laherparepvec (TVEC) is an FDA-approved oncolytic virus used to treat stage IIIB-IV metastatic melanoma via intralesional injection. As the US population ages, treatment options must weigh efficacy with safety in treating older patients. We aim to describe the real-world use of TVEC in geriatric metastatic melanoma patients. METHODS We performed a multi-institutional, IRB-approved review of patients age 65 who completed TVEC therapy at 3 centers from 10/2015–3/2020. Clinicopathologic characteristics, treatment data and outcomes were assessed. RESULTS We identified 126 patients with a median age of 75 (IQR 70, 81). 55% patients had 3 or more comorbidities at the time of treatment. Stage at treatment was I-II (2%), IIIB (39%), IIIC (43%), IIID (1%) and IV (14%). Treatment sites

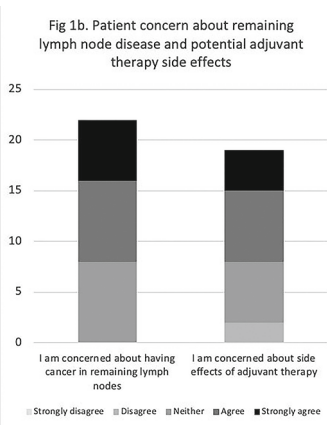
included lower extremity (37%), head and neck (36%), upper extremity (15%) and torso (13%). TVEC was first-line therapy for 57% of patients and 35% of patients had received prior immunotherapy. 16% of patients received concurrent immunotherapy. Patients completed a median of 6 cycles (IQR 4, 8). Clinical status when TVEC was stopped was progressive/persistent disease (49%), complete response (46%), and unknown (2%). 37% of patients had a reported adverse event (AE), with constitutional symptoms (fevers, chills, fatigue; 20%) and injection site complications (pain, bleeding, and infection; 10%) being most common. 8% of patients stopped TVEC due to an AE. Patients discontinued TVEC due to injection site complications, n=6; fever, n=1; nausea, n=1; MI/Death, n=1; and unspecified toxicity, n=1. Patients were hospitalized for MI (n=1) and cellulitis/sepsis (n=1). With a median follow-up of 9.1 months (IQR 3.3, 21.1), 84% of patients were alive and 43% had no evidence of disease. CONCLUSIONS TVEC is well-tolerated in the geriatric population. The adverse events seen in this geriatric cohort are consistent with those reported in the literature, with few patients hospitalized or discontinuing therapy due to AE. This study provides evidence for surgeons to guide in shared-decision making when implementing TVEC therapy for metastatic melanoma in the geriatric patient.

P173

Patient Preferences and Satisfaction with Treatment Decisions in Stage III Melanoma B. Bredbeck,* N. Mott, L. Dossett. *University of Michigan, Ann Arbor, MI.*

Introduction: Recent trials demonstrating a benefit for adjuvant therapy and equivalent survival for completion lymph node dissection (CLND) versus active surveillance (AS) for sentinel lymph node positive disease have increased the complexity of treatment decision making for patients with stage III melanoma. It is unknown how patients perceive medical-decision making discussions with providers or the preferences they consider when weighing their treatment options. Methods. We conducted an explanatory mixed methods study of subjects >18 years old who had recently been diagnosed with stage III melanoma at an academic medical center. The survey included the validated 30-point satisfaction with decision (SWD) scale. The explanatory semi-structured interview was developed using a shared decision-making framework. Results: 24 subjects completed the survey, and 14 subjects completed the explanatory interview. Average distance from home to the hospital was 126 miles. Providers were most likely to discuss (n=19) and recommend (n=16) AS of the lymph node basin and were least likely to discuss (n=14) or recommend (n=4) adjuvant therapy. SWD for treatment of the lymph node basin (mean 27.3, CI 25.5-29) and adjuvant therapy (mean 26, CI 23.7-28.3) were high overall despite some concerns for side effects and screening anxiety (Figure 1). In interviews, subjects expressed some values that signaled preference sensitivity to treatment decisions but overall followed strong recommendations of the treating physician. Despite high travel burden, patients undergoing active nodal surveillance described high motivation to adhere to frequent ultrasounds. Overall decisional conflict was low regardless of treatment decision. Conclusion: Subjects with recently diagnosed stage III melanoma did not always receive treatment counseling based on shared decision making, with most patients describing provider preference rather than a values-based discussion of treatment options. Despite this, satisfaction with treatment decisions was high. As emerging evidence better informs treatment guidelines, disseminating best practices to providers will likely have the greatest impact on treatment decisions.

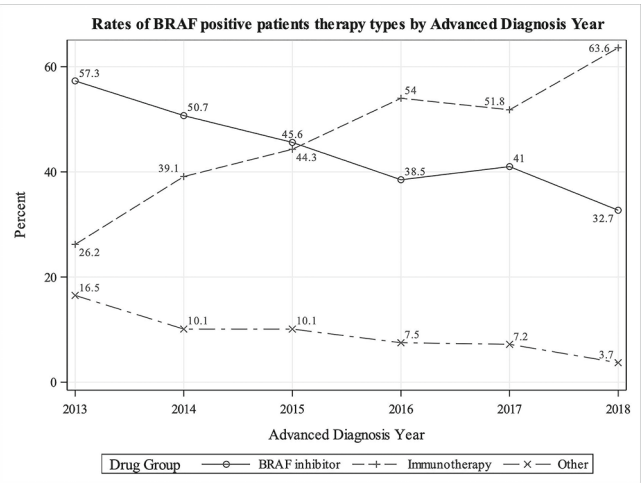




P174

Real-world Frequency of BRAF Testing and Utilization of Therapies in Patients with Advanced Melanoma M.V. Hill,* M. Deng, E. Handorf, A.J. Olszanski, J.M. Farma. *General Surgery, Fox Chase Cancer Center, Bala Cynwyd, PA.*

Introduction: With the approval of both BRAF targeted agents and immunotherapy for the treatment of Stage III, recurrent and metastatic melanoma, patients have effective treatment options. BRAF testing is recommended at the time of advanced melanoma diagnosis, but the widespread use of immunotherapy has potentially decreased its frequency. In addition, little is known regarding the treatment trends for patients with BRAF mutated tumors. This investigation aims to assess the real-world prevalence of BRAF testing at the time of advanced melanoma diagnosis and treatment trends for patients with BRAF mutated tumors. Methods: Using the nationwide Flatiron Health electronic health record-derived de-identified database, patients age ≥ 18 years with a histologically confirmed diagnosis of advanced melanoma from 2013-2018 were examined. Molecular testing performed within 3 months of advanced diagnosis was considered to have the test performed at the time of advanced diagnosis. Test prevalence was calculated and compared in groups stratified by patient, tumor, and treatment factors. Results: 4459 patients were included, and the average age was 63 years. 1936 (43.4%) patients had Stage III, 1191 (26.7%) Stage IV and 1332 (29.9%) had recurrent disease. 50.4% of patients received medical treatment, ranging from 76.4% in Stage IV, 71% in recurrent patients, and 26.7% in Stage III patients. Of those who received treatment, 73% received immunotherapy first line. 73.8% of patients had molecular testing and 58.3% had testing at the time of advanced diagnosis. Of those tested 43% had a BRAF mutated tumor. 48% of these patients received first line immunotherapy while 43% received a BRAF inhibitor. The prevalence of immunotherapy in patients with BRAF mutated tumors increased by year of advanced diagnosis (Figure 1). Conclusion: The majority of patients with advanced melanoma undergo molecular testing at the time of advanced diagnosis. Immunotherapy is the most commonly prescribed treatment among BRAF mutated and wild-type melanoma subgroups. These results provide real-world data on the frequency and timing of molecular testing and treatment trends for patients with advanced melanoma.

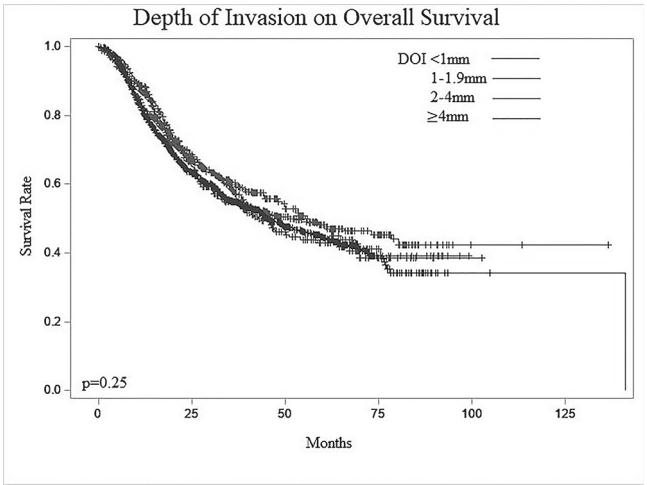


P175

What is the Effect of Depth of Invasion on Metastatic Potential in Merkel Cell Carcinoma M.J. Minarich,* E. Handorf, A. Porpiglia. *Surgical Oncology, Fox Chase Cancer Center, Philadelphia, PA.*

Introduction: Merkel cell carcinoma (MCC) is a rare cutaneous malignancy with a propensity for lymph node and distant metastasis. Current tumor staging relies on tumor diameter, but the association between depth of invasion (DOI) and the development of metastatic disease is unclear. Methods: We identified all patients diagnosed with MCC who had complete clinical staging and recorded DOI in the National Cancer Database from 2004-2016. DOI was categorized as <1mm, 1-1.9mm, 2-3.9mm and greater than 4mm. Chi-square test was utilized to determine the correlation between DOI and lymph node metastasis (LNM)and distant metastasis (DM). Kaplan Meyer curves with log

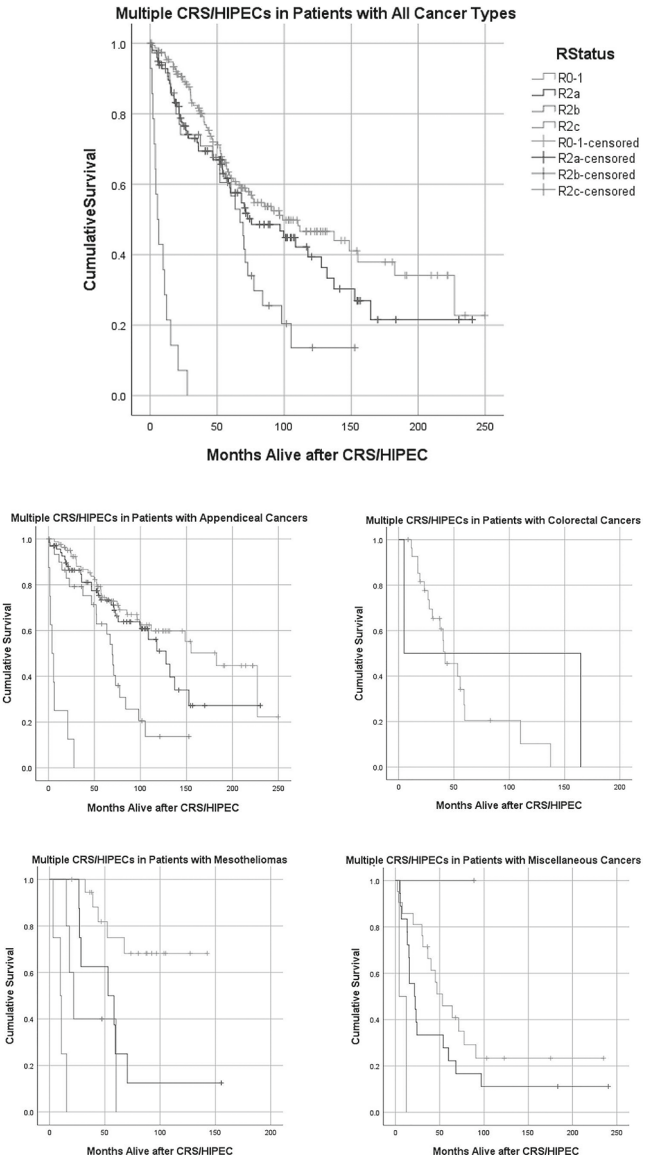
rank tests were created to analyze the effect of DOI on overall survival (OS). Results: Out of a cohort of 16974 patients diagnosed with MCC, 2938 patients (17.3%) underwent complete clinical staging with recorded DOI. Overall LNM rate was 36.9% for the cohort, and DM rate was 4.9%. DOI was <1mm in 687 patients (23.4%), 1-1.9mm in 422 (13.4%), 2-3.9mm in 449 (15.3%), and ≥4mm in 1380 (47.0%). Rates of LNM were 41.9%, 38.4%, 32.1% and 25.31% respectively. Rates of DM were 6.3%, 5.2%, 2.0% and 5% respectively. DOI was not found to be correlated with OS (p=0.25) Conclusion: Increasing DOI is not associated with increased rate of LNM, DM or OS and should not be used as a prognostic factor for MCC.



P176

Repeat Cytoreductive Surgery with Hyperthermic Intraperitoneal Chemotherapy for Cancers with Peritoneal Metastasis: A 30-year Institutional Experience C.D. Valenzuela,* E.A. Levine, R. Gawdi, C.W. Mangieri, O. Moaven, M.E. Lundy, K.I. Votanopoulos, P. Shen. *Surgical Oncology, Wake Forest Baptist Medical Center, Winston-Salem, NC.*

Introduction: For patients with metastatic cancers limited to the peritoneal cavity, cytoreductive surgery (CRS) with hyperthermic intraperitoneal chemotherapy (HIPEC) is an option known to increase survival. Increasingly, some patients are being offered repeat CRS/HIPEC procedures when disease recurrence remains limited to the peritoneum. The benefit of repeat CRS/HIPEC is promising, but to date has been reported only in small numbers of patients. Here, we describe our longitudinal experience and outcomes over approximately thirty years in our patients who received multiple CRS/HIPECs. Methods: From our prospectively-maintained database of CRS/HIPECs (1476 patients) performed between December 1991 and April 2020, patients who underwent more than one CRS/HIPEC procedure were analyzed. Review included demographics, primary tumor type, survival, completeness of cytoreduction, and complication rate. Results: 157 repeat CRS/HIPECs were performed in a set of 144 patients. Of these patients, 12 received a third CRS/HIPEC. One patient received a fourth CRS/HIPEC. Average age at first and second operations were 48.6 and 51.7 years, respectively. Cancer types were appendix (92 patients), colorectal (15), mesothelioma (17), ovarian and primary peritoneal (9), small bowel (3), sarcoma (4), gastric (2), gallbladder (1), and urachal (1). Overall, average Peritoneal Cancer Index was 14. The complication rate (Clavien-Dindo III or higher) after second CRS/HIPEC was 28.6%. Kaplan-Meier analysis showed for those who underwent R2a or better cytoreduction: appendix cancers had the most favorable survival outcomes, 10- and 20-year estimated survival for all tumor types combined was approximately 45% and 22%. Conclusions: Selected patients with peritoneal surface disease can experience long-term survival over decades, controlled with serial CRS/HIPEC procedures. Previous data from our institution suggests an interval greater than 2 years between the initial and repeat operation results in the best clinical outcomes. Patients with appendiceal primaries derive the greatest benefit from this approach.

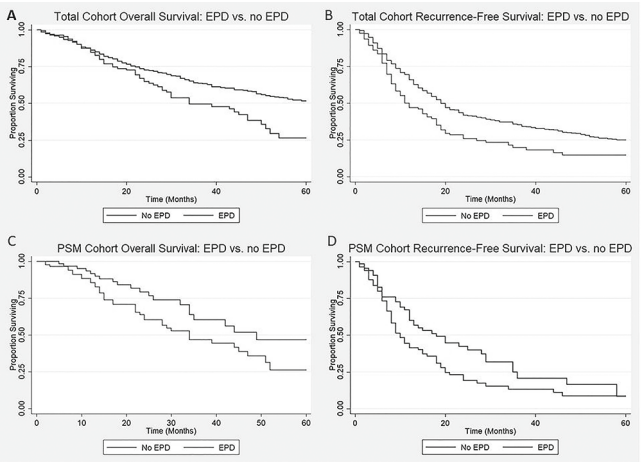


P177

Is CRS-HIPEC Still Indicated in Patients with Extraperitoneal Disease? A Multi-Institutional Analysis from the US HIPEC Collaborative E.W. Beal,[1]* J. Chen,[1] A. Kim,[1] J. Hays,[1] F.M. Johnston,[2] D.E. Abbott,[3] M. Raoof,[4] T.E. Grotz,[5] K. Fournier,[6] S. Dineen,[7] B.D. Powers,[7] J. Veerapong,[8] C.N. Clarke,[8] C. Staley,[9] S. Patel,[10] G.C. Wilson,[10] L. Lambert,[11] J. Cloyd.[1] *1. Surgery - Surgical Oncology, The Ohio State University Wexner Medical Center and James Comprehensive Cancer Center, Columbus, OH; 2. Johns Hopkins, Baltimore, MD; 3. University of Wisconsin, Madison, WI; 4. City of Hope, Duarte, CA; 5. Mayo Clinic, Rochester, MN; 6. MD Anderson Cancer Center, Houston, TX; 7. Moffitt Cancer Center, Tampa, FL; 8. University of California San Diego, San Diego, CA; 9. Emory University, Atlanta, GA; 10. University of Cincinnati, Cincinnati, OH; 11. University of Massachusetts, Worcester, MA.*

Background: Cytoreductive surgery (CRS) and hyperthermic intraperitoneal chemotherapy (HIPEC) is an increasingly utilized strategy for patients with peritoneal surface malignancies. However, the role of CRS-HIPEC in patients with coexisting extraperitoneal disease (EPD) is controversial. Methods: Among patients with peritoneal metastases from appendiceal (AC)

or colorectal cancer (CRC) who underwent CRS-HIPEC from 12 academic institutions, those with EPD (liver, lung, or retroperitoneal lymph nodes [RP LN]) were retrospectively compared to those without EPD. Overall (OS) and recurrence-free survival (RFS) analysis was performed using the Kaplan-Meier method and multivariable Cox-proportional hazards regression models before and after propensity score matching (PSM) for age, ASA class, peritoneal carcinomatosis index (PCI), tumor differentiation, and completeness of cytoreduction (CCR). Results: Among 1,341 patients with AC (64%) or CRC (36%) who underwent CRS +/- HIPEC, 134 (10%) had EPD while 1,207 (90%) did not. EPD was most commonly located in the lung (N=63, 47%) or RP LN (N=38, 28%). Patients with EPD experienced worse median OS (34 vs. 63 months; p=0.003; Fig. 1A) and RFS (12 vs. 19 months; p<0.001, Fig. 1B) compared to those without EPD. After PSM, patients with EPD experienced worse OS (34 vs. 49 months, p=0.072, Fig. 1C) and RFS (10 vs. 20 months, p=0.022, Fig. 1D). After controlling for body mass index, gender, ASA class, ECOG performance status (PS), neoadjuvant and adjuvant chemotherapy, CCR, HIPEC, and post-operative complications, EPD was independently associated with worse OS (HR 1.92, 95% CI 1.02-3.60, p=0.043) and RFS (HR 1.47, 95% 1.00-2.19, p=0.056). Conclusions: While the presence of EPD was independently associated with worse oncologic outcomes among patients undergoing CRS-HIPEC for AC/CRC, these results suggest that EPD alone should not be considered an absolute contraindication to surgery for otherwise well selected patients.



P178

Aerosolization of Thermosensitive Hydrogels Using Pressurized Intraperitoneal Aerosol Chemotherapy (PIPAC) M. Rahimi Gorji,[1]* H. Braet,[2] C. Debbaut,[3] G. Ghorbaniasl,[4] S. Cosyns,[1] W. Willaert,[1] K. Remaut,[2] W. Ceelen.[1] *1. Department of Human Structure and Repair, Ghent University, Ghent, Belgium; 2. Ghent Research group on Nanomedicines, Ghent University, Ghent, Belgium; 3. IBiTech–bioMMeda, Ghent University, Ghent, Belgium; 4. Department of Mechanical Engineering, Vrije Universiteit Brussel, Brussels, Belgium.*

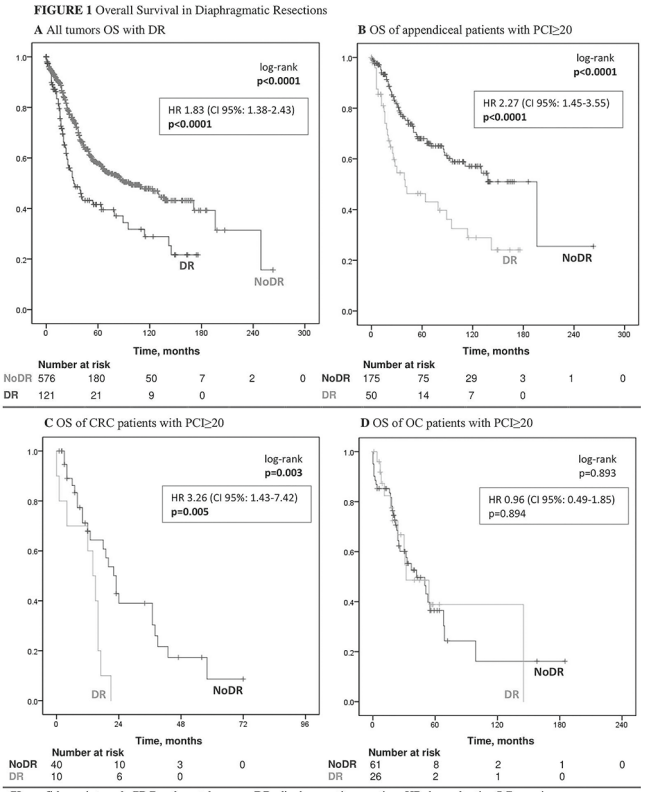
INTRODUCTION Pressurized intraperitoneal aerosol chemotherapy (PIPAC) holds promise in the treatment of extensive or irresectable peritoneal metastases (PM). In current clinical practice, aqueous solutions of chemotherapy are nebulized using a high-pressure injector and dedicated nozzle (CapnoPen®). There is growing interest in intraperitoneal (IP) delivery of prolonged release formulations such as thermosensitive hydrogels. We used numerical simulations and in vitro experiments to test whether high viscosity hydrogels can be nebulized using the current technology. METHODS The triblock thermosensitive copolymer Pluronic® F127 was prepared at different concentrations (5, 10, 15, 20 and 25%) and nebulized in an in vitro box in the presence of CO_2. We measured the viscosity, resulting median droplet diameter, and cone angle (in degrees) of the resulting jet spray. In addition, a computational model of box was generated using the COMSOL Multiphysics (Burlington, VT) and simulate the nebulization of solutions using appreciate initial (zero pressure) and boundary conditions (inlet flow at 12 mmHg), consisting of the flow rate and the properties of the solutions. RESULTS For increasing concentrations, the viscosity of the saline and Pluronic solutions was 1.002, 3.43, 15.7, 27.97, 43.35 and 50.51 mPa.s, and the resulting droplet diameters using a volume of 20 ml and flow rate of 0.5 ml/s were 59, 74, 138, 214, 346 and 371 μm, respectively. With increasing viscosity, the cone angle exponentially decreased. At the highest viscosity, a downward liquid stream was obtained without any nebulization. A comparison between experimental and simulated results of the aerosol distribution and cone angles showed an overall good agreement. CONCLUSIONS With the currently available technology, PIPAC is not suitable for nebulizing the thermosensitive hydrogel Pluronic F127 when the concentration is higher than 10% (viscosity > 15.7 mPa.s). Alternative technological solutions should be sought in order to allow IP aerosolization of high viscosity solutions.

P179

Outcomes Following Cytoreductive Surgery with Hyperthermic Intraperitoneal Chemotherapy with and without Diaphragmatic Resection in Patients with Peritoneal Carcinomatosis

A. Nikiforchin,* V. Gushchin, E. Baron, M. Sittig, C. Nieroda, A. Sardi. *Surgical Oncology, Mercy Medical Center, Baltimore, MD.*

INTRODUCTION Diaphragmatic resection (DR) may be required during cytoreductive surgery with hyperthermic intraperitoneal chemotherapy (CRS/HIPEC) to achieve complete cytoreduction (CC). While CC provides the best survival outcomes, the necessity of DR may indicate unfavorable tumor biology and worse prognosis. We aimed to determine how DR during CRS/HIPEC affects patient outcomes. METHODS We conducted a retrospective cohort study using a prospective single center database from October 1994 to May 2020. Patients with peritoneal carcinomatosis from any origin who underwent CRS/HIPEC with CC-0/1/2 were assigned to DR and NoDR groups. Subgroup analysis was performed when peritoneal cancer index (PCI) ≥20 to eliminate confounding of more extensive disease in DR. Survival was analyzed with Kaplan-Meier method. RESULTS Of 826 CRS/HIPECs, 774 were included: 134 DR and 640 NoDR. Primary tumor sites included appendiceal (n=407, DR=61, NoDR=346), colorectal (n=108, DR=17, NoDR=91), ovarian (n=160, DR=44, NoDR=116), other (n=99, DR=12, NoDR=87). Groups were balanced by age (55 [IQR: 48-64] vs 56 [IQR: 47-65] years], p=0.773) and sex (75% vs 70% female, p=0.254). Median PCI was significantly higher in DR: 29 (IQR: 18-35) vs 21 (IQR: 8-31), p<0.001. CC-0/1 rate was 89% in DR and 95% in NoDR, p=0.003. Neither major complications nor 100-day mortality differed between the groups (p=0.355 and p=1.000, respectively). Median follow-up was 64 months. Median overall survival (OS) was significantly lower in DR: 32 vs 96 months, p<0.0001. Subgroup analysis by tumor type in patients with PCI≥20 showed significantly shorter OS in DR than NoDR in appendiceal (40 vs 196 months, p<0.0001) and colorectal (14 vs 23 months, p=0.003), but not in ovarian tumors (32 vs 42 months, p=0.893), while median PCI did not differ significantly among these subgroups. CONCLUSIONS Diaphragmatic resection during CRS/HIPEC does not increase morbidity and mortality. It is associated with worse survival in appendiceal and colorectal tumors, even after adjusting for tumor burden but does not appear to impact ovarian cancer survival.



CI, confidence interval; CRC, colorectal cancer; DR, diaphragmatic resection; HR, hazard ratio; OC, ovarian cancer; OS, overall survival

P180

Rates and Factors Associated with Preventable Adverse Events After Cytoreductive Surgery and Hyperthermic Intraperitoneal Chemotherapy A.M. Patel,[1]* R. Alterio,[1] K. Li,[2] M.R. Porembka,[1] M. Augustine,[1] J. Mansour,[1] A. Yopp,[1] H. Zeh,[1] S. Wang,[1] P. Polanco.[1] *1. Surgical Oncology, University of Texas Southwestern Medical Center, Dallas, TX; 2. University of California, San Diego, San Diego, CA.*

Introduction: Previous reports have shown that preventable adverse events (AEs) occur in approximately 13% of complex oncologic surgeries. Cytoreductive surgery with hyperthermic intraperitoneal chemotherapy (CRS/HIPEC) is an invasive procedure associated with postoperative morbidity, yet, there is lack of data regarding hospital-level AEs. Our study aims to assess the rates and patient/hospital-factors associated with preventable AEs in patients undergoing CRS/HIPEC. Methods: We queried the HCUP-National Inpatient Sample to identify patients undergoing CRS/HIPEC (2004-2013). Patient safety indicators (PSIs) were used to identify preventable AEs. PSIs are standardized indicators that identify unintended hospital-acquired AEs (AHRQ). Uni- and multi-variable analysis (MVA) using generalized linear mixed models were used to describe associations of PSIs with patient and hospital characteristics. Results: We identified 993 patients that underwent CRS/HIPEC. Of these, 319 (32.1%) reported one or more PSIs. Large and medium bed-size hospitals were associated with higher PSI rates than small (31.3% and 44.5%, respectively, vs. 22.2%, p<0.001). Medicare patients had a higher PSI rate than Medicaid, private insurance, or self-pay (41% vs. 28.2%, 30.4%, and 21.1%, respectively, p=0.003). Patients ≥65yo had a higher likelihood of having PSIs (39.7% vs. 29.9%, p=0.006). Higher Charlson comorbidity index (CCI) ≥3 (36.3%) or CCI 1-2 (32.3%) had higher PSI rate when compared to CCI 0 (21.9%, p<0.001). Sex, race, hospital teaching status, and hospital procedure volume were not significant predictors of ≥1PSI. In MVA adjusting for hospital clustering, age, CCI, bed-size, and location, CCI≥3 remained associated with a higher likelihood of having PSI (OR: 1.763, 95%CI:1.19-2.62, p=0.005, see Figure 1). Conclusion: This is the first study reporting national rates of preventable AEs for CRS/HIPEC using PSIs. CRS/HIPEC have more than twice the likelihood of having AEs when compared to previously reported rates for major oncological surgeries. Preventable AEs were strongly associated with patient comorbidities but not with specific hospital factors.

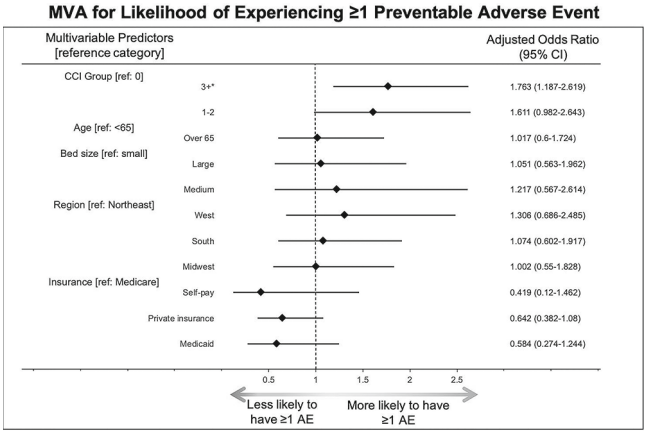


Figure 1: Forest plot illustrating multivariable generalized mixed linear model of the effect of patient and hospital characteristics on having 1 or more preventable adverse events, as measured by AHRQ's patient safety indicators (PSIs). *Denotes statistical significance, p <0.05.

P181

Cytoreductive Surgery with Hyperthermic Intrathoracic Chemotherapy for Patients with Intrapleural Dissemination of Peritoneal Surface Malignancies A. Nikiforchin,* V. Gushchin, E. Baron, M. King, C. Nieroda, A. Sardi. *Surgical Oncology, Mercy Medical Center, Baltimore, MD.*

INTRODUCTION Various peritoneal surface malignancies (PSM) can invade through the diaphragm and lead to intrapleural tumor dissemination. While cytoreductive surgery with hyperthermic intraperitoneal chemotherapy (CRS/HIPEC) improves outcomes for PSM with intraabdominal spread, its safety and efficacy in patients with intrapleural dissemination of PSM remains unclear. We present a case series of patients with intrapleural lesions treated with CRS and hyperthermic intrathoracic chemotherapy (HITHOC). METHODS We conducted a descriptive study to evaluate outcomes of PSM patients who underwent HITHOC for intrapleural lesions. CRS/HITHOC was performed either via diaphragmatic window during CRS/HIPEC or thoracotomy as a separate procedure. A prospective, high-volume PSM center's database was reviewed from October 1994 to May 2020. RESULTS Of 852 CRSs, 16 HITHOCs in 14 patients were identified: 10 CRS/HIPEC+HITHOCs and 6 CRS/HITHOCs via thoracotomy. Median age was 58 (IQR: 49-65). Primary tumor sites included: 10 (63%) appendix, 4 (25%) ovarian, 1 (6%) colon, and 1 (6%) unknown. There were 10 (63%) patients with recurrent disease. For CRS/HIPEC+HITHOCs, median peritoneal cancer index (PCI) was 24 (IQR: 17-35). Complete cytoreduction was achieved in 90% of CRS/HIPEC+HITHOCs and 67% of CRS/HITHOCs. The major complication (grade III-V) rate was 20% (n=2) in CRS/HIPEC+HITHOCs and 17% (n=1) in CRS/HITHOCs with a single 100-day mortality after CRS/HIPEC+HITHOC due to myocardial infarction. Median follow-up was 21 months. For all patients, overall survival at 1, 3, and 5 years was 93.8%, 68.4% and 68.4%, whereas 1-, 3-, and 5-year progression-free survival was 68.9%, 15.3%, and not reached. Intrapleural recurrence occurred in 0% and 33% (n=2) in CRS/HIPEC+HITHOC and CRS/HITHOC groups, respectively. CONCLUSIONS CRS/HITHOC performed with HIPEC via diaphragmatic window or via thoracotomy as a separate procedure is a safe and effective option for intrapleural dissemination of PSM. Further studies with longer follow-up and pooled data are needed to evaluate survival for different PSM histopathologies.

Table 1 Patient Characteristics

Variable	CRS/HIPEC+HITHOC (n=10)	CRS/HITHOC (n=6)
Age at surgery, years, median (IQR)	61 (50-70)	57 (42-59)
Female sex, n (%)	7 (70)	3 (50)
Primary tumor origin, n (%)		
Low-grade appendiceal	1 (10)	4 (67)
High-grade appendiceal	3 (30)	2 (33)
Ovarian	4 (40)	0 (0)
Colorectal	1 (10)	0 (0)
Unknown	1 (10)	0 (0)
Previous CRS/HIPEC, n (%)	1 (10)	6 (100)
PCI at exploration, median (IQR)	24 (17-35)	NA
EBL, mL, median (IQR)	725 (350-1,000)	475 (250-750)
Length of surgery, min, median (IQR)	570 (481-820)	367 (264-432)
CC-0/1, n (%)	9 (90)	4 (67)
Chemoperfusion agents, n (%)		
Mitomycin-C	5 (50)	5 (83)
Carboplatin	2 (20)	0 (0)
Melphalan	3 (30)	1 (17)
Major complications (grade III-V), n (%)	2 (20)	1 (17)
LOS, days, median (IQR)	12 (10-14)	7 (5-8)
Recurrence, n (%)	3 (30)	3 (50)
Intrapleural recurrence, n (%)	0 (0)	2 (33)

CC, completeness of cytoreduction; CRS, cytoreductive surgery; EBL, estimated blood loss; HIPEC, hyperthermic intraperitoneal chemotherapy; HITHOC, hyperthermic intrathoracic chemotherapy; IQR, interquartile range; LOS, length of hospital stay; NA, not applicable; PCI, peritoneal cancer index; PSS, previous surgical score

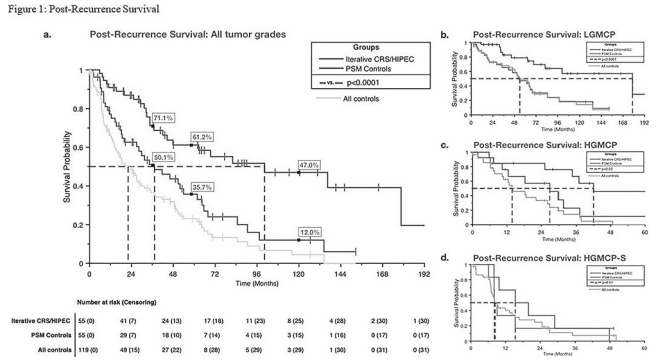


Figure 1. Post-Recurrence Survival measured from the time of disease recurrence after the first CRS/HIPEC to time of death or time of last contact for the iterative CRS/HIPEC cohort, matched controls by propensity score matching (PSM) and the entire pool of controls. Survival probability was calculated using the Kaplan-Meier estimator and compared using the log-rank test (Iterative CRS/HIPEC vs PSM controls). (a). Post-Recurrence Survival (16 years) in all tumor grades, survival rates marked (■) at 3, 5 and 10 years. (b) Post-Recurrence Survival (16 years) in low-grade MCP. (c) Post-Recurrence Survival (5 years) in high-grade MCP. (d) Post-Recurrence Survival (5 years) in high-grade MCP with signet ring cells.

P182

Iterative Cytoreduction and Hyperthermic Intraperitoneal Chemotherapy for Recurrent Mucinous Tumors of the Appendix

F. Lopez-Ramirez,* V. Gushchin, M. Sittig, E. Baron, C. Nieroda, A. Sardi. *Surgical Oncology, Mercy Medical Center, Baltimore, MD.*

Introduction: Cytoreductive surgery with hyperthermic intraperitoneal chemotherapy (CRS/HIPEC) is the standard for appendiceal tumors (AT) with mucinous carcinomatosis peritonei (MCP); however, recurrence is common with limited evidence of outcomes after repeated CRS/HIPEC. We evaluated feasibility and outcomes of iterative CRS/HIPEC (iCRS/HIPEC) in recurrent MCP from AT. Methods: A retrospective cohort study from 1999-2019 was conducted to examine the association between iCRS/HIPEC and survival in recurrent MCP from AT with history of CRS/HIPEC. Post-recurrence survival (PRS) was measured from date of recurrence after 1st CRS/HIPEC to death or last contact. Outcomes were compared within tumor grades between >1 CRS/HIPEC and matched controls without iCRS/HIPEC after relapse, using propensity score matching (1:1). Propensity scores were estimated using 1st CRS/HIPEC completeness of cytoreduction (CC), lymph node status, time to recurrence, age at recurrence and tumor grade. Results: Overall, 55 iCRS/HIPEC patients were identified: 36 low-grade MCP (LGMCP), 13 high-grade MCP (HGMCP), and 6 high-grade signet-ring cell (HGMCP-S). Ten had a 3rd CRS/HIPEC. Median PCI scores were 33, 19 and 10, median lengths of surgery were 695, 570, and 540 minutes, and median lengths of stay were 12, 9 and 8 days for 1st, 2nd and 3rd CRS/HIPEC respectively. CC-0/1 was achieved in 94.4%, 78.2% and 88.9% in the 1st, 2nd and 3rd CRS/HIPEC respectively. No 90-day postoperative mortality occurred in the iCRS/HIPEC group. Median disease-free survival for iCRS/HIPEC was 20.3, 37.5 and 9.2 months after 1st, 2nd and 3rd CRS/HIPEC respectively. Median PRS was 100.3 months for the iCRS/HIPEC vs 37.2 months for matched controls (p<0.001). Median PRS by tumor grade was 178.6 vs 53.9 (p<0.001), 42.0 vs 26.9 (p=0.02) and 15.4 vs 8.1 months (p=0.61) for repeated vs matched controls in LGMCP, HGMCP and HGMCP-S, respectively. Conclusions: Iterative CRS/HIPEC appeared to have a positive impact on survival and should be considered in selected low- and high-grade AT with MCP recurrence. This survival benefit was not evidenced for iCRS/HIPEC in recurrent MCP with signet-ring morphology.

P183

Characteristics of Exceptional Versus Poor Survivors in Colorectal Cancer Patients Undergoing Cytoreductive Surgery and Hyperthermic Intraperitoneal Chemotherapy.

G. SenthilKumar,[1]* T.C. Gamblin,[1] C.N. Clarke,[1] C. Kimbrough,[2] K. Fournier,[3] A. Lee,[3] C. Pokrzywa,[4] D.E. Abbott,[4] G. Wilson,[5] S. Patel,[5] J. Greer,[6] F.M. Johnston,[6] S. Dineen,[7] S. Dessureault,[7] J.M. Baumgartner,[8] J. Veerapong,[8] J. Leiting,[9] T.E. Grotz,[9] S. Maithel,[10] C. Staley,[10] M. Zaidi,[10] B. Lee,[11] M. Raoof,[11] L. Lambert,[13] R. Hendrix,[12] J. Cloyd,[2] H. Mogal.[1] *1. Medical College of Wisconsin, Milwaukee, WI; 2. The Ohio State University Wexner Medical Center, Columbus, OH; 3. University of Texas MD Anderson Cancer Center, Houston, TX; 4. University of Wisconsin, Madison, Madison, WI; 5. University of Cincinnati College of Medicine, Cincinnati, OH; 6. Johns Hopkins University, Baltimore, MD; 7. Moffitt Cancer Center, Morsani College of Medicine, Tampa, FL; 8. University of California, San Diego, San Diego, CA; 9. Mayo Clinic, Rochester, MN; 10. Winship Cancer Institute, Emory University, Atlanta, GA; 11. City of Hope National Medical Center, Duarte, CA; 12. University of Massachusetts Medical School, Worcester, MA; 13. University of Utah Huntsman Cancer Institute, Salt Lake City, UT.*

Introduction: Cytoreductive surgery and hyperthermic intraperitoneal chemotherapy (CRS/HIPEC) confers survival benefit in select patients with peritoneal metastases from colorectal cancer (CRC-PM). Identifying and characterizing exceptional (ES) and poor survivors (PS) may help improve prognostication and patient selection for surgery. Methods: Data from a 12-institution cohort of CRC-PM patients treated with CRS/HIPEC that had CC0/1 resection was retrospectively analyzed. ES, PS, and intermediate survivors (IS) were defined as ≥75th, ≤ 25th, 25th - 75th percentile of overall survival (OS) respectively. OS and recurrence-free survival (RFS) were analyzed using Kaplan-Meier method. Perioperative variables were compared, and logistic regression was used to identify factors associated with survival. Results: Of the 402 CRC-PM patients with CC0/1, 100 each were identified as ES and PS. OS and RFS was significantly different between ES, IS, and PS subgroups (p<0.0001 for all); median OS 70 vs 21.7 vs 6.2 months, RFS 19.1 vs 10 vs 6 months. In comparison to PS, ES had significantly higher median BMI (27.8 vs 26.0, p=0.017), adjuvant chemotherapy rate (41.5% vs. 13.8%, p<0.0001), lower post-operative complications (51.0% vs 67.7%, p=0.017) and lower CA-125 (>25 U/ml 6.7% vs 46.7%, p=0.013). For ES patients, hindgut embryonic origin was independently associated with improved OS. For PS patients, higher CEA levels, Clavien-Dindo grade and CRS without HIPEC were associated with worse OS, while higher CEA levels and CRS without HIPEC were associated with worse RFS (Table 1). Conclusion: In this large cohort of

CRC-PM patients undergoing CC0/1 resection, low CA-125 levels, adjuvant systemic chemotherapy and lower postoperative complications were associated with exceptional survival. Lower CEA levels and addition of HIPEC to CRS were associated with improved outcomes in patients with the worst survival. Stratification of outliers by survival category may provide insight into tumor biology and patient selection for CRS/HIPEC.

Table 1: Univariate and multivariate analysis of perioperative variables associated with overall and recurrence free survival.

OS ES	Univariate Analysis (HR, 95% CI)	p<0.15	Multivariate Analysis (HR, 95% CI)	p<0.05
Age	1.035, 1.001-1.070	0.045		
BMI	1.034, .994-1.076	0.094		
Hind Gut Embryonic Origin	0.456, .201-1.033	0.060	0.284, 0.086-0.943	0.040
Adjuvant Chemotherapy	1.758, .848-3.648	0.129		
CEA	1.006, .999-1.013	0.109		
RFS ES				
PCI	1.041, 1.007-1.077	0.019		
Age	1.018, 0.996-1.041	0.102		
Hindgut Embryonic Origin	0.580, 0.327-1.029	0.063		
Perioperative Chemotherapy	0.529, 0.302-0.927	0.026		
CEA>37U/ml	2.463, 1.362-4.453	0.003		
CA19-9	1.029, 0.992- 1.067	0.127		
CA125	1.115, 1.001-1.241	0.047		
CRS with HIPEC	0.111, 0.038-0.322	0.0001		
OS PS				
PCI	1.060, 1.010-1.113	0.018		
BMI	1.034, .994-1.076	0.094		
CEA	1.002, 0.999-1.005	0.134	1.004, 1.000-1.0007	0.05
CRS with HIPEC	0.147, 0.032-0.668	0.013	0.085, 0.012-0.593	0.013
Highest Clavien-Dino Grade	1.552, 1.278-1.883	0.0001	1.547, 1.176-2.035	0.002
RFS PS				
Hindgut Embryonic Origin	0.384, 0.123-1.193	0.098		
CEA	1.003, .999-1.006	0.112	1.006, 1.001-1.010	0.021
CRS with HIPEC	0.076, 0.016-0.360	0.001	0.110, 0.015-0.785	0.028

P184

Rectal Anastomosis and Hyperthermic Intraperitoneal Chemotherapy: Should We Avoid Diverting Loop Ileostomy?
A. Brind'Amour,* V. Pravong, L. Sidéris, P. Dubé, L. De Guerke, S. Fortin, M. Auclair, B. Trilling, J. Tremblay. *Maisonneuve-Rosemont Hospital, Montréal, QC, Canada.*

Introduction : Literature on rectal anastomosis and diverting ileostomy in patients treated with hyperthermic intraperitoneal chemotherapy (HIPEC) is limited. This study assesses the safety of rectal anastomoses during cytoreductive surgery (CRS) and HIPEC, with and without fecal diversion, and its morbidity when performed. Methods: From January 2012 to January 2020, patients with peritoneal metastases who underwent complete CRS and HIPEC that required a rectal anastomosis were included in this single-hospital retrospective chart review. Perioperative and postoperative outcomes were evaluated for both the index surgery and stoma reversal surgery, when performed. Results : 84 patients were included, of which 29 had a diverting loop ileostomy. The rectal anastomotic leak (AL) rate for the series was 8.3%. Factors associated with AL were male gender ($p = 0.031$) and increased BMI ($p < 0.0005$). A trend for AL was observed for patients with diabetes ($p = 0.109$) and more than one colorectal anastomosis ($p = 0.108$). Diverting loop ileostomy was associated with a significant decrease of clinically significant rectal AL (0% vs 12.7%, $p = 0.045$). However, the 90-day readmission rate was higher in this group (37.9% vs 10.9%, $p = 0.003$). Stoma reversal surgery was performed for all patients, but 3 patients experienced AL (10.7%). Conclusions : This study suggests that creation of a diverting loop ileostomy may be an effective strategy to prevent symptomatic rectal AL following CRS with HIPEC and may be considered in patients with high risk features. However, it is also associated with an increased readmission rate and increased risk of AL following reversal surgery.

P185

Barriers to Cytoreduction and Chemoperfusion for Appendiceal Cancer with Peritoneal Metastases C. Rieser,* P. Herman, L. Hall, A. Zureikat, J. Pingpank, M. Ongchin, A. Lee, M. Holtzman, M. Choudry, R. Hoehn. *UPMC, Pittsburgh, PA.*

Introduction: Appendiceal cancer with peritoneal metastases is a complex disease requiring multidisciplinary care. Cytoreductive surgery and hyperthermic intraperitoneal chemoperfusion (CRS HIPEC) can improve survival for appropriately selected patients, but this requires early evaluation by experienced surgical oncologists. Barriers to specialist referral and CRS HIPEC likely exist but are poorly understood. Methods: We conducted a retrospective cohort study examining all patients diagnosed with synchronous appendiceal peritoneal metastases from 2010-2018 in a large regional hospital network that includes a high-volume CRS HIPEC center. Baseline characteristics, oncologic features, presentation details, treatment strategies, and survival were evaluated. Predictors of surgical oncology referral and CRS HIPEC receipt were assessed by logistic regression. Results: 186 patients were identified: 90.7% white, 78.1% married, and 55% diagnosed in an inpatient setting. Among patients with high grade (G2/G3) tumors (n=141), 97.9% of patients were evaluated by medical oncology and 90.8% received systemic chemotherapy. Among all patients, 179 (96.2%) were evaluated by surgical oncology and 142 (76.3%) underwent CRS HIPEC. Age was the only significant predictor of surgical oncology referral (OR 0.24 for every decade, $p=0.001$). On multivariate analysis, CRS HIPEC was less likely among patients who were older (OR 0.67 for every decade), minority race (OR 0.26), unmarried (OR 0.35), lower socioeconomic status (OR 0.43), and had high grade tumors (OR 0.05) (all $p<0.05$). Receipt of chemotherapy was associated with increased likelihood of CRS HIPEC (OR 3.90, $p=0.03$). After adjusting for age, tumor histology, and treatment receipt, low socioeconomic status remained a predictor of worse overall survival (HR 1.59, 95% CI 1.03-2.47, $p=0.04$). Conclusions: This analysis is the first to evaluate barriers to CRS HIPEC. While a majority of patients in this study were evaluated by a multidisciplinary team, multivariate analysis suggests social factors may play a role in the treatment received. Addressing these disparities is crucial for ensuring equitable outcomes and improving patient care.

P186

Survival Outcomes for Primary Peritoneal Mesothelioma at Academic Versus Community Hospitals V.M. Welten,* A.C. Fields, R.A. Malizia, J. Yoo, J.E. Goldberg, J.L. Irani, R. Bleday, N. Melnitchouk. *Brigham and Women's Hospital, Boston, MA.*

Introduction: Primary peritoneal mesothelioma is a rare disease with poor outcomes, few studies existing in the literature, and no established National Comprehensive Cancer Network guidelines. Cytoreductive surgery with heated intraperitoneal chemotherapy (HIPEC) is the cornerstone of therapy, which may require an experienced center. We aim to compare survival outcomes of primary peritoneal mesothelioma treated at academic versus community hospitals. Methods: The National Cancer Database was used to retrospectively identify patients with primary peritoneal mesothelioma from 2004 to 2016. Patients were divided according to treating facility type: academic or community. Outcomes were assessed using log-rank tests, Cox proportional hazard modeling, and Kaplan-Meier survival statistics. Results: 2682 patients were identified with primary peritoneal mesothelioma, 1272 (47.4%) of which were treated at an academic facility, and 1410 (52.6%) of which were treated at a community facility. 872 (61.8%) of patients at community centers did not undergo surgery as part of their disease treatment, compared to 478 (37.6%) at academic centers. 546 (42.9%) of patients underwent debulking or radical surgery and 905 (71.2%) received chemotherapy at academic facilities, compared to only 286 (20.2%) and 811 (57.5%) at community facilities, respectively. Unadjusted survival was significantly better for patients at academic facilities ($p<0.0001$) (Figure). 1- and 5-year survival rates were 66.2% (95%CI 63.3 – 68.9) and 29.7% (95%CI 26.7 – 32.7) for academic centers and 48.9% (95%CI 46.1 – 51.7) and 18.3% (95%CI 16.0 – 20.7) for community centers, respectively. In multivariable analysis, community facility was an independent risk factor for death (HR1.23, $p<0.0001$) compared to academic facility. Surgery and chemotherapy were both independently associated with improved survival. Conclusions: We found better survival outcomes for primary peritoneal mesothelioma treated at academic compared

to community facilities. Patients at academic centers underwent surgery and received chemotherapy more frequently than those at community centers, and may be better served at experienced academic centers.

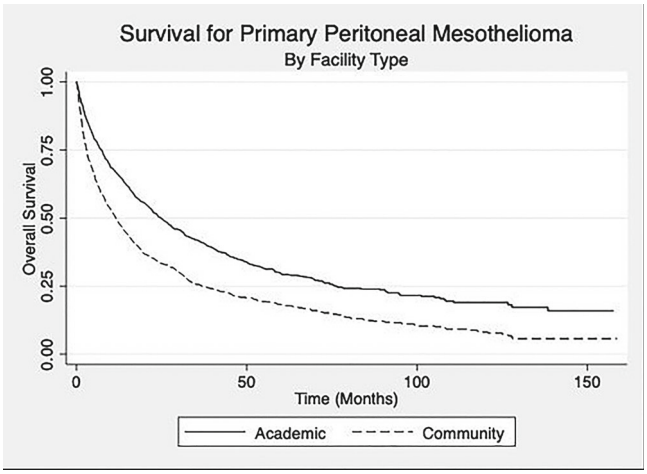


Figure. Overall survival by facility type for primary peritoneal mesothelioma.

P187

Assessment of Fertility Following CRS/HIPEC for the Management of Peritoneal Carcinomatosis: A Single Institution Experience

C. Schlegel,[1]* M.R. Liebdzinski,[1] L. Hall,[1] J. Pingpank,[1] M. Holtzman,[1] A. Lee,[1] D. Bartlett,[2] M. Choudry,[1] M. Ongchin.[1] *1. University of Pittsburgh Medical Center, PIttsburgh, PA; 2. Alleghany Health Network, Pittsburgh, PA.*

Background Recent studies have shown GI malignancies on the rise in young adults; cytoreductive surgery and hyperthermic intraperitoneal chemoperfusion (CRS/HIPEC) is increasingly utilized in patients with peritoneal carcinomatosis (PC). As these young cancer patients live longer, important quality of life questions arise and require further study, including the question of fertility in young women with PC. We aim to examine our high-volume, single institution experience with fertility following CRS/HIPEC. Methods A retrospective review of a prospectively collected data was performed. Women <40 years old who underwent CRS/HIPEC at the University of Pittsburgh Medical Center from 1/2010-2020, are currently alive and whom a complete TAH/BSO was not necessary were were offered study enrollment, and participated in a survey of pre and post treatment fertility experiences. Results Nine women met study criteria; 8 agreed to participate. The average age at diagnosis was 34yrs (23-40); the majority of women had appendiceal primary (5), followed by colorectal (2) and sarcoma. Four received neoadjuvant chemotherapy. Most received Mitomycin C intraoperatively (7) with an average PCI of 10 (1-28). Of the women who had not undergone previous tubal ligation, the majority (71%) desired fertility to be part of their preoperative conversation, though only 3 patients had the topic discussed, often prompted by the patient. A lack in counseling over surgically induced menopause was also noted as an area in need of further support. One patient became pregnant post HIPEC and delivered full term without complication, with a second patient currently undergoing IVF. Conclusions For many young women struggling with a new metastatic cancer diagnosis, fertility and surgical induced menopause are significant factors in their overall quality of life, and often overlooked as we counsel our patients. We are actively expanding this study based upon these initial results; more work is needed to identify women for whom fertility specific counseling may be of benefit.

P188

Management of Malignant Bowel Obstructions: Survey of National Practice Patterns

J.M. Bleicher,[1]* L. Lambert,[2] C.L. Scaife,[2] A.L. Colonna.[1] *1. General Surgery, University of Utah, Salt Lake City, UT; 2. Huntsman Cancer Institute at the University of Utah, Salt Lake City, UT.*

Introduction: Malignant bowel obstructions (MBO) are one of the most challenging problems surgeons encounter and little high-quality evidence exists to guide treatment. We hypothesized that practice patterns differ among surgical specialists. Methods: We developed 3 case scenarios of patients with previously treated cancer who subsequently developed an MBO. Each case had 5-6 alternate scenarios, with changes to the type of malignancy, extent of metastases, disease-free interval, and/or the presence of ascites. We surveyed the Eastern Association for the Surgery of Trauma (EAST) and the Society of Surgical Oncology (SSO) memberships on the likelihood they would offer an operation in each scenario. We analyzed responses for factors associated with the likelihood surgeons would offer surgical management in each situation. Results: 316/3,006 (11%) surgeons completed the survey. 119 (37.7%) were surgical oncologists (SO) and 197 (62.3%) acute care surgeons (ACS). On multivariable analysis, SO were 1.6 times more likely to offer surgical management than ACS (Table 1). The largest differences were seen in patients with extraperitoneal or multiple intraperitoneal sites of metastases. For patients with MBO from a single metastasis, 95.8% of SO were likely or very likely to offer an operation compared to 94.4% of ACS ($p = 0.587$). In the setting of multiple hepatic metastases, 91.6% of SO and 77.7% of ACS ($p = 0.001$) would offer surgery, 84.9% vs 64.0% ($p < 0.001$) with pulmonary metastases and 78.2% vs 55.3% ($p < 0.001$) with omental metastases. 74.1% of SO compared to 46.6% of ACS ($p < 0.001$) were likely to operate on patients with ascites. Surgeons with over 25 years of clinical experience and surgeons practicing in rural settings were also more likely to offer surgical interventions. All surgeons were less likely to offer operations to patients with multiple sites of obstruction, recurrent MBO, and shorter disease-free intervals. Conclusions: Surgical management of MBO varies significantly by surgical specialty and surgeon experience. SO appear to be more comfortable operating in the setting of metastatic cancer; however, optimal treatment remains unknown.

Univariable and multivariable analysis of factors predictive of participants selecting “likely” or “very likely” to offer an operation. Participant selections averaged across all scenarios in all cases.

		Univariable		Multivariable [a]	
		(n, %)	p-value	Incidence Rate Ratio (95% CI)	p-value
Gender	Female	30 (45.5)	0.241		
	Male	114 (55.3)			
Fellowship Training	Surgical Oncology	73 (73.0)	< 0.001	Excluded [b]	
	Acute Care Surgery	55 (39.0)			
Current Practice	Surgical Oncology	78 (70.3)	< 0.001	Reference	-
	Acute Care Surgery	67 (41.4)		0.61 (0.49 – 0.76)	< 0.001
Years in Practice	< 5	27 (41.5)	0.001	0.66 (0.47 – 0.91)	0.011
	5 - 10	32 (44.4)		0.65 (0.48 – 0.89)	0.008
	11 - 15	25 (71.4)		0.90 (0.68 – 1.19)	0.462
	16 - 20	17 (44.7)		0.61 (0.42 – 0.88)	0.009
	21 - 25	17 (58.6)		0.78 (0.56 – 1.09)	0.150
	> 25	27 (79.4)		Reference	-
Type of Practice	Academic	87 (52.7)	0.452		
	Private	26 (59.1)			
Location	Northeast	38 (65.5)	0.101	Reference	-
	Southeast	39 (53.4)		0.93 (0.70 – 1.22)	0.586
	Midwest	39 (55.7)		1.02 (0.79 – 1.32)	0.880
	Southern	7 (33.3)		0.59 (0.32 – 1.08)	0.087
	Mountain West	10 (45.5)		1.06 (0.66 – 1.71)	0.818
	Pacific	12 (41.4)		0.79 (0.51 – 1.23)	0.301
Rurality	Urban	77 (47.0)	0.017	Reference	-
	Suburban	49 (63.6)		1.34 (1.06 – 1.70)	0.014
	Rural	17 (68.0)		1.56 (1.14 – 2.13)	0.006

Abbreviations: CI – Confidence interval.

[a] All variables with $p < 0.20$ on univariable analysis included in multivariable analysis.

[b] Fellowship training excluded from multivariable analysis as this variable is confounding with the variable describing current practice.

P189

Intravital Mroscopy in the Study of the Tumor Vasculature of Patients with Peritoneal Carcinomatosis C. Mangum,[1]* M. Kim,[2] D. Fisher,[2] K. Attwood,[2] W. Ji,[2] D. Mukhopadhyay,[1] S. Bagaria,[1] M. Robertson,[1] T. Dinh,[1] K. Knutson,[1] J. Skitzki,[2] M. Wallace,[1] E. Gabriel.[1] *1. Surgery, Mayo Clinic, Jacksonville, FL; 2. Roswell Park, Buffalo, NY.*

Introduction: Our preclinical models have shown that aberrancies in tumor vasculature limit the delivery of anticancer agents, which impedes tumor response. Using human intravital microscopy (HIVM), which permits the in vivo, real-time investigation of blood vessels, we hypothesized that HIVM would be feasible in patients with peritoneal carcinomatosis (PC) and function as a vascular biomarker for tumor response. Methods: During cytoreductive surgery with hyperthermic intraperitoneal chemotherapy (CRS-HIPEC) for PC, HIVM was performed in both tumor and non-tumor areas. The primary outcome was HIVM feasibility to measure vessel characteristics. We secondarily evaluated the clinical utility of the associations between HIVM vessel characteristics and oncologic outcomes (RECIST response to neoadjuvant therapy and disease-specific survival). Results: Thirty patients with PC (including appendiceal cancer, colorectal, gastric, ovarian, mesothelioma, and sarcoma) were enrolled. Nineteen patients (63.3%) received neoadjuvant therapy. HIVM was feasible in all patients. Compared to non-tumor (control) areas, PC areas had a lower density of functional vessels, a higher proportion of non-functional vessels, smaller lumenal diameters, and lower blood flow velocity. Qualitative differences in these vessel characteristics were observed among patients who had partial response (PR), stable disease (SD), or progressive disease (PD) after receiving neoadjuvant therapy (see Figure). Patients who had achieved PD had the highest density of functional vessels, lowest density of non-functional vessels, and the lowest proportion of non-function vessels when compared to patients who had SD or PD. However, no statistically significant relationships were found between HIVM vessel characteristics and oncologic outcomes. Conclusions: These novel findings comprise the first real-time evidence of the microscopic differences between normal and tumor-associated vessels in human subjects. Although vessel characteristics were not associated with outcomes, our early results form the basis for our larger clinical trial appropriately powered to determine the utility of HIVM as a vascular biomarker.

P190

Incorporation of the 8th Edition AJCC/TNM Staging of Carcinoma of the Appendix into the Esquivel Peritoneal Surface Disease Severity Score (E-PSDSS) in 229 Patients with Mucinous Appendiceal Neoplasms with or without Peritoneal Dissemination J. Esquivel,[1] J. Qiu,[2] G. Esquivel.[2]* *1. Surgical Oncology, Frederick Memorial Hospital, Clarksville, MD; 2. University of Delaware, Newark, DE.*

Introduction An ideal staging classification has to be practical and reproducible, have prognostic significance, and be able to determine the sequence of therapeutic interventions at the time of diagnosis. A staging classification that meets these criteria in mucinous appendiceal neoplasms continues to represent an unmet need in oncology. Materials and Methods We retrospectively analyzed 229 patients with mucinous appendiceal neoplasms based on the AJCC/TNM 8th edition staging manual but incorporated G (grade) and E (extent of disease). The impact of these pathological variables is scored as stages 0 to IV and is reported as the Esquivel Peritoneal Surface Disease Severity Score (E-PSDSS). Results There were 135 females and 94 males. Median age was 52 years (range 21-79). One hundred and seventy three patients underwent cytoreductive surgery (CRS) and HIPEC (75.5%). Mean follow-up of all 229 patients was 34.6 months. There were 30 (13.1%), 56 (24.4%), 48(20.9%), 20(8.7%) and 75(32.7%) patients with E-PSDSS 0, I, II, III, and IV, respectively. When stratifying the 173 patients undergoing CRS and HIPEC by the severity of their peritoneal disease, 5-year overall survival was 100%, 100%, 84.46%, 52.29% and 12.92% for E-PSDSS 0, I, II, III and IV, respectively ($p<0.0001$). On multivariate analysis, sex (female vs male) p=0.0462) and E-PSDSS stage [0, I, II, III, IV] (HR 0 vs IV NR, HR 1 vs IV NR, HR II vs IV 0.072 [95% CI 0.028, 0.189], HR III vs IV 0.353 [95% CI 0.158, 0.791]; $p<0.0001$) were identified as independent predictors of survival. Conclusion The E-PSDSS is practical and reproducible as it combines specimen examination and reporting according to the protocol of the College of American Pathologists with the pTNM requirements from the AJCC staging manual. It represents an important prognostic indicator in patients with mucinous appendiceal neoplasms and may improve selection of therapies from the time of diagnosis.

P191

Actual 5-Year Survivors After Cytoreductive Surgery and HIPEC for Metastatic Colorectal Cancer: Who Beats the Odds? T. Tran,[1]* M. O'Leary,[1] M. Zaidi,[2] J. Greer,[3] F.M. Johnston,[3] S. Dineen,[4] B.D. Powers,[4] D.E. Abbott,[5] C. Pokrzywa,[5] T.E. Grotz,[6] J. Leiting,[6] S. Patel,[7] V. Dhar,[7] J. Veerapong,[8] J.M. Baumgartner,[8] C.N. Clarke,[9] K. Fournier,[10] L. Lambert,[11] R. Hendrix,[11] A. Kim,[12] J. Cloyd,[12] B. Lee,[13] M. Raoof.[13] *1. Surgery, City of Hope, Duarte, CA; 2. Emory University, Atlanta, GA; 3. John Hopkins Hospital, Baltimore, MD; 4. Moffitt Cancer Center, Tampa, FL; 5. University of Wisconsin, Madison, WI; 6. Mayo Clinic, Rochester, MN; 7. University of Cincinnati, Cincinnati, OH; 8. University of California, San Diego, La Jolla, CA; 9. Medical College of Wisconsin, Milwaukee, WI; 10. MD Anderson, Houston, TX; 11. University of Massachusetts, Worchester, MA; 12. The Ohio State University, Columbus, OH; 13. City of Hope, Duarte, CA.*

INTRODUCTION:Colorectal peritoneal carcinomatosis (CPC) has traditionally been viewed to be associated with a poor prognosis, with long-term survival essentially unheard of. Cytoreductive surgery with hyperthermic intra-peritoneal chemotherapy (CRS/HIPEC) has emerged as a promising treatment modality in the management of CPC. The prevalence and characteristics of actual 5-year survivors after surgical treatment of CPC have not been described previously. METHODS:A multi-center collaborative registry from 12 U.S academic centers who underwent CRS/HIPEC for colorectal cancer were analyzed. Clinicopathologic characteristics and long-term outcomes of actual 5-year survivors were compared with non-survivors (patients who died within 5 years of surgery). RESULTS: Of the 205 patients who underwent curative-intent CRS/HIPEC, 22 (10.7%) were 5-year survivors. Compared with non-survivors, the 5-year survivors had significantly lower PCI scores (median 5 vs. 13,$P<0.001$). The 5-year survivors had higher lymphocytes (30% vs. 23%,P=0.020) and lower neutrophil-to-lymphocyte ratio (2 vs. 2.7, P=0.033). Completeness of cytoreduction (CC0) was more common among 5-year survivors (89.5% vs 60.3%,P=0.035), while there were no 5-year survivors with CC2. Fewer 5-year survivors developed recurrence (45.5% vs 76.7%,P=0.004) and the majority of recurrences were solitary. Repeat CRS for recurrence was associated with improved median survival (47 vs 34 mo,P=0.022). The sole presence of a higher PCI did not exclude long-term survival, as 21% had intermediate PCI 10-19, and 5% had high PCI >20 (P=0.003). Among the 5-year survivors, 50% remained alive without recurrence. CONCLUSIONS: One in ten patients with CPC reaches the 5-year survival milestone after CRS/HIPEC. About 50% of patients who achieve the 5-year milestone are considered cured. A 5-year survival is rarely achieved with unfavorable clinicopathologic factors such as incompleteness of cytoreduction and high PCI score, therefore patients should be carefully selected for CRS/HIPEC. This data can guide preoperative counseling and set patient expectations of potential cure and long-term survival.

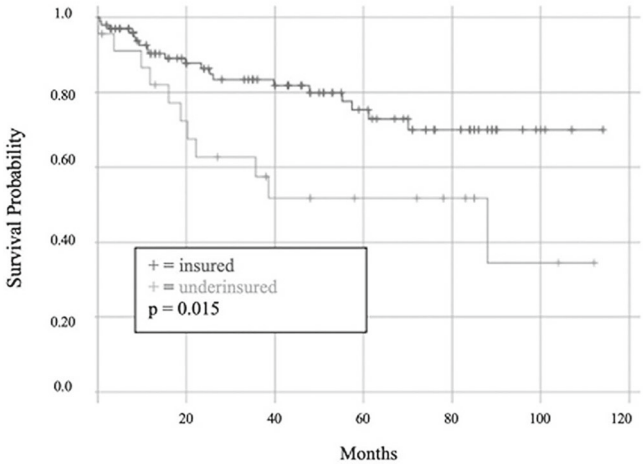
	Non-survivors (n=183)	Long-term survivors (n=22)	P value
Neutrophil-lymphocyte ratio (median, IQR)	2.72 (1.9-4.1)	2.03 (1.49-2.72)	0.033
Lymphocytes %	23.4 (15.2-28.2)	30.1 (23.2-36)	0.020
PCI (median, IQR)	13 (8-20)	5 (3-11)	<0.001
CCR (n, %)			
0	108 (60.3)	17 (89.5)	0.035
1	41 (23.5)	2 (10.5)	
2+	29 (16.2)	0 (0)	
Right sided tumors (n, %)	76 (51.4)	9 (45)	0.640
Primary T- stage (n,%)			
T1-2	6 (3.3)	1 (4.5)	0.160
T3	45 (24.6)	9 (40.9)	
T4	77 (42.1)	4 (18.2)	
Tx	55 (30.1)	8 (36.4)	
Primary N-stage (n,%)			
N0	31 (24.4)	7 (50)	0.154
N1	45 (35.4)	3 (21.4)	
N2	48 (37.8)	3 (21.4)	
N3	1 (0.8)	0 (0)	
Nx	2 (1.6)	1 (7.1)	
Synchronous Peritoneal Metastases (n,%)	81 (64.8)	8 (50)	0.278
Positive LN (median, IQR)	2 (0-5)	0 (0-2)	0.031
Primary tumor differentiation (n,%)			
Well	11 (9.3)	1 (8.3)	0.732
Moderate	65 (55.1)	8 (66.7)	
Poor	42 (35.6)	3 (25)	
Neoadjuvant Chemotherapy (n,%)	114 (62.3)	17 (77.3)	0.240
Adjuvant Chemotherapy (n,%)	50 (42)	3 (16.7)	0.067
Recurrence (n,%)	122 (76.7)	10 (45.5)	0.004

P192

Impact of Insurance Status on Oncologic and Perioperative Outcomes After Cytoreductive Surgery with Hyperthermic Intraperitoneal Chemotherapy D. Hanna,[1]* M. Ghani,[1] A. Hermina,[2] A. Mina,[1] C. Bailey,[1] K. Idrees,[1] D. Magge.[1] *1. Vanderbilt University Medical Center, Nashville, TN; 2. Meharry Medical College, Nashville, TN.*

Introduction: A growing body of research has shown that underinsured patients are at increased risk of impaired access to healthcare and delay in medical treatment compared to insured patients. Cytoreductive surgery with hyperthermic intraperitoneal chemotherapy (CRS-HIPEC), is performed largely at highly specialized cancer centers and may pose challenges for the underinsured. This study investigates surgical outcomes following CRS-HIPEC for insured and underinsured patients with peritoneal carcinomatosis. Methods: We performed a retrospective review of a prospectively maintained database of 125 patients undergoing CRS-HIPEC between 1/2013-12/2019. Patients were categorized into two groups based on their insurance status. The insured group was comprised of patients with commercial private insurance at the time of CRS-HIPEC or who obtained it during the follow-up period, while the underinsured group consisted of patients with Medicare, Medicaid, or self-pay throughout the follow-up period. Perioperative and oncologic outcomes were compared between the two groups. Results: A total of 102 (81.6%) patients were insured and 23 (18.4%) patients were underinsured. There were no significant differences in age, medical morbidities, primary tumor type or grade, peritoneal carcinomatosis index, or completion of cytoreduction score between the two groups. The mean overall survival (OS) for insured patients was 89.6 months (95% CI: 80.3-98.9 months) and was 62.8 months (95% CI: 42.8-82.7 months) for underinsured patients (p=0.015). Additionally, insured patients had a significantly longer follow-up time (35.1 months vs 11.5 months, p <0.001). Underinsurance status was also associated with increased hospital LOS (p=0.003), increased ICU LOS (p=0.035), and higher rate of Clavien-Dindo classification 3-4 complication (p=0.003). Conclusion: In this retrospective study conducted at large urban specialized cancer center in the southeastern United states, private insurance status was associated with increased overall survival and longer follow-up period. Furthermore, underinsurance status was associated with increased perioperative morbidity.

Figure 1: Overall Survival based on Insurance Status



P193

Impact of Age and Microsatellite Status on Overall Survival in Patients Undergoing Cytoreductive Surgery and Hyperthermic Intraperitoneal Chemotherapy for Colorectal and Appendiceal Cancers D. Hanna,[1]* M. Ghani,[1] A. Hermina,[2] A. Mina,[1] C. Bailey,[1] K. Idrees,[1] D. Magge.[1] *1. Section of Surgical Sciences, Vanderbilt University Medical Center, Nashville, TN; 2. Meharry Medical College, Nashville, TN.*

Introduction: The incidence of appendiceal cancer (AC) as well as colorectal cancer (CRC) are rising among patients younger than the age of 50, prior to initiation of recommended screening colonoscopy. It has been previously shown that younger patients with CRC peritoneal carcinomatosis (PC) undergoing CRS-HIPEC have improved OS when compared to their older cohort. Our study aims to identify whether a higher rate of microsatellite instability in younger patients potentially explains this survival advantage. Methods: We performed a retrospective review of a prospectively maintained database consisting of patients who underwent CRS-HIPEC between 1/2013-12/2019. Patients with PC from CRC and appendiceal neoplasms aged <50 years at the time of diagnosis who underwent CRS-HIPEC were compared to patients 50 years or older. Clinicopathologic data, including microsatellite status [microsatellite instability-high (MSI-H) vs. microsatellite stable (MSS)], and oncologic outcomes were compared between the two groups. Results: Of the 108 patients who underwent CRS-HIPEC for PC due to CRC or appendiceal cancer, 41 (38%) were <50 years old. Tumor grade, ECOG score, ASA status, peritoneal carcinomatosis index, and completion of cytoreduction score were similar between the two age groups. MSI status was available for 52 patients. 80% of patients with MSI-H were <50 years. MSI-H was observed in 37% of patients younger than 50 years and 7% (p=0.007) in patients older than 50. Neither age <50 years (p=0.5) nor MSI-H status (p=0.9) were associated with improved overall survival in our study population, and within the colorectal and appendiceal cancer cohorts. Conclusion: Despite otherwise similar baseline and perioperative characteristics, in our institutional review of CRC and AC patients undergoing CRS-HIPEC, microsatellite instability was more likely to be seen in the younger patient cohort but was not associated with longer overall survival. However, these patients with microsatellite instability may benefit from novel immunotherapies.

Microsatellite Status Stratified by AGe and Cancer Type

	Colorectal Cancer		Appendiceal Cancer		
	Age <50	Age • 50	Age <50	Age • 50	Total
MSS	10	13	4	15	42
MSI-H	5	1	3	1	10
Total	15	14	7	16	52

P194

Novel 3-D Modeling Process to Determine Treatment Surface Area and Volume for Chemotherapeutic Dosing in HIPEC J. Domitrovic,[5] M. Milosevic,[2] L. Hubbard,[3] B. Milisevic,[2] V. Simic,[2] A. Ziemys,[4] M. Kojic,[4] A.M. Holder.[1]* *1. Surgery, University of Alabama at Birmingham, Birmingham, AL; 2. Belgrade Metropolitan University, Belgrade, Serbia; 3. Houston Methodist Hospital, Houston, TX; 4. Houston Methodist Research Institute, Houston, TX; 5. Texas A&M University School of Medicine, Bryan, TX.*

Introduction: Chemotherapy dosing for HIPEC is based on body surface area (BSA), and under-dosing may contribute to the high local recurrence rate in patients with peritoneal malignancies s/p cytoreductive surgery and HIPEC (CRS/HIPEC). We analyzed abdominopelvic CTs as part of routine workup and surveillance of patients with peritoneal carcinomatosis who underwent CRS/HIPEC. Our aim was to develop a novel protocol to calculate optimal perfusate volume and chemotherapeutic concentration that could be easily integrated into the preoperative workflow to aid HIPEC surgeons in delivery of a precise dose of chemotherapy to the peritoneum. Methods: Using a new computational model, we calculated precisely each individual patient's functional peritoneal membrane surface area and peritoneal cavity volume from two patients with identical body surface area (BSA), currently used to calculate chemotherapy dosing for HIPEC. We also utilized 3-D modeling to simulate the temperature fields in the peritoneal cavity under standard conditions (Flow rate of 1500ml/min, Inflow temperature 45C), increased flow rate (2000ml/min), increased inflow temperature (46C) and the combination. Results: Although BSAs of both patients were identical, their calculated peritoneal surface area differed by >15%. Furthermore, the simulated HIPEC suggests that the inflow temperature and flow rate should be increased to ensure mild hyperthermia (41-42C) is achieved (Figure 1). Conclusion: Though time intensive, this novel 3-D modeling process from preoperative abdominopelvic CTs provides more precise estimates of peritoneal surface area compared to BSA. Furthermore, modeling offers insights into failure to achieve uniform mild hyperthermia as another potential cause of local recurrence. This study will contribute to the rational design of clinical trials for the standardization of personalized intraperitoneal chemotherapeutic drug delivery for peritoneal carcinomatosis.

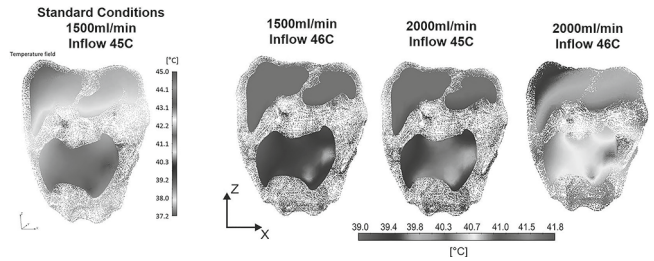


Figure 1

P195

Distress Symptom Score and Depression in Patients Treated with Cytoreductive Surgery and Hyperthermic Intraperitoneal Chemotherapy N.L. Krueger,* J. Knight, Y. Wang, A. Banerjee, H. Mogal. *Department of Surgery, Medical College of Wisconsin, Wauwatosa, WI.*

Introduction: Psychological distress and depressive symptoms frequently affect patients diagnosed with peritoneal surface malignancy (PSM). The pattern of distress and depression in patients with PSM treated with CRS-HIPEC is not well defined. This study aims to characterize trajectories of and factors affecting distress and depressive symptoms after CRS-HIPEC. Methods: Patient Health Questionnaire (PHQ) -2/9 and the NCCN distress thermometer and problem list for patients undergoing CRS-HIPEC at a single institution from 2010-2020 were retrospectively analyzed. Responses were tracked prior to surgery and postoperatively at various time points. Logistic Mixed models were used to assess factors associated with overall distress score and sub-components of the problem list. Results: Of 384 evaluable patients, median age was 56.7[48.4,65.7] with 53.3% being female. Majority had appendiceal (41.5%) and colorectal (30.1%) primaries. After adjusting for age, primary tumor site, tumor burden, completeness of cytoreduction score, perioperative chemotherapy and postoperative complications, males had lower levels of distress at baseline (OR 0.34, CI 0.31 – 0.37; p=0.01). However, this effect was reversed postoperatively with increase in distress scores over time (OR 1.04, CI 1.00 – 1.07; p = 0.04) (Figure). Male gender was associated with worsening nausea (OR 1.08, CI 1.00 – 1.16; p = 0.04) and ability to eat (OR 1.12, CI 1.01 – 1.25; p = 0.03) over time. Younger age was associated with decrease in preoperative sadness (OR 1.05, CI 1.01 – 1.08; p = 0.01) and pain (OR 0.97, CI 0.95 – 1.00; p = 0.04); however, this effect was not maintained postoperatively. No significant associations were noted between individual predictors and PHQ2/9 scores at baseline or over time. Conclusion: Behavioral health screening tools provide valuable insight into depressive symptoms post CRS-HIPEC. This may improve screening and develop interventional strategies to mitigate perioperative distress and improve quality of life. Further research is warranted to uncover biological mechanisms responsible for age- and gender-based differences in symptom trajectory.

P196

The Use of an Ex Vivo Tumor-Bearing Tissue Perfusion Model to Investigate the Effects of a Novel Immunotherapeutic Agent E.A. Verbus,* M. Teke, A. Rossi, T.M. Khan, A. Saif, S. Rehman, H. Hong, A. Luna, S. Sinha, K. Remmert, A. Blakely, J.L. Davis, J. Hodge, J. Hernandez. *Surgical Branch, National Institutes of Health, Bethesda, MD.*

INTRODUCTION: TGF-β is a well-studied cytokine that has immunosuppressive, pro-tumorigenic effects in the tumor microenvironment (TME) via several mechanisms including upregulation of regulator T-cells and inhibition of NK cells. Bitrafusp alfa is a novel immunotherapeutic agent (IO) consisting of the IgG_1 anti-PD-L1 checkpoint inhibitor Avelumab fused via peptide linkers to two TGF-β receptor molecules designed to bind and sequester TGF-β in the TME in an attempt to combat tumor progression. Here, we use a new system for sustaining tumor-bearing human tissue to study a novel IO agent ex vivo. METHODS: Tissue containing tumor procured from seven patients was affixed to platforms and placed in a perfusion circuit. This setup, termed the SMART (Surgically-resected tuMor with intAct microenviRonmenT) System, sustains human tissue by exposing it to continuously circulating perfusate made from the patient's own plasma. Bintrafusp alfa was introduced into the system and the perfusate was sampled at 1, 12, 24, and 48 hours. A control system was setup concurrently using the same patient's tissue and plasma. Tissue and perfusate samples from each time point were then analyzed. RESULTS: TGF-β levels measured via ELISA decreased in all patients to an average of 3.9-5.6% of baseline as early as 1 hour after addition of drug, whereas TGF-β levels in control systems did not show a comparable decrease in concentration. Additional cytokines evaluated from perfusate samples showed varying results, with some patients showing a decrease in several inflammatory markers, including IL-23, in drug treated samples. 1/7 patients had potential drug-induced apoptosis on histology that was correlated with an over 5000% increase in calreticulin from baseline measured by ELISA and a decrease in VEGF when compared to the control. CONCLUSION: Addition of Bintrafusp alfa yielded an immediate and sustained decrease in the circulating level of TGF-β; however, alterations in other cytokines and perceived drug effect varied among patients. This underscores the variability of tumor response to IO agents, and the need to interrogate patients individually to elucidate effect.

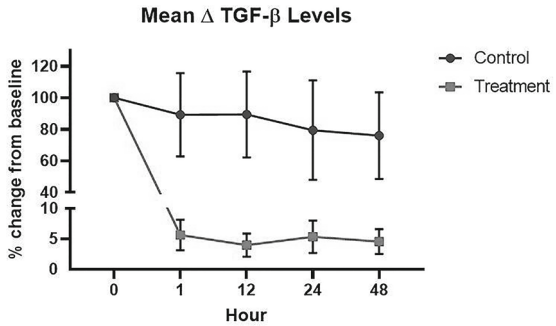


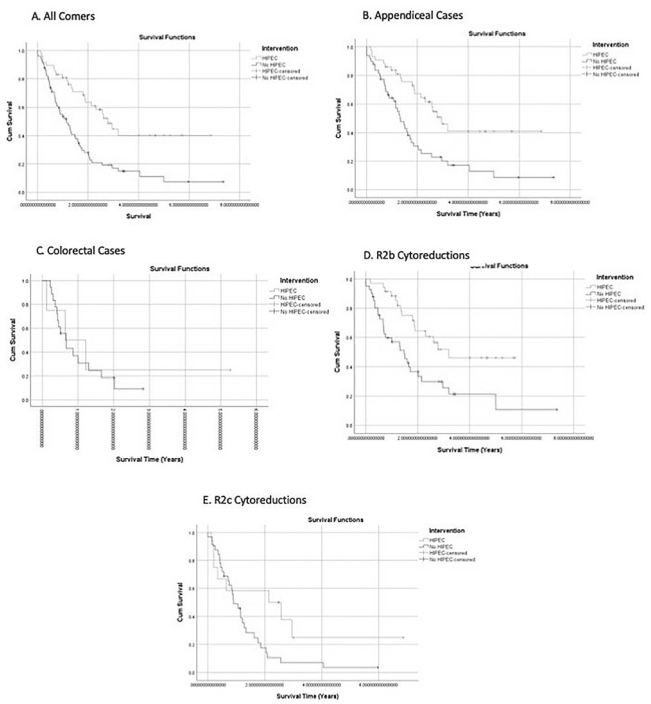
Figure 1: The average change in concentration of TGF-β in all patients represented as percent of baseline, showing a sustained decreased in TGF-β in drug treated samples

P197

Utility of Hyperthermic Intraperitoneal Chemotherapy in Cases of Incomplete Cytoreductive Surgery C.W. Mangieri,* O. Moaven, C.D. Valenzuela, K.I. Votanopoulos, P. Shen, E.A. Levine. *Surgical Oncology, Wake Forest Baptist Health, Winston-Salem, NC.*

Introduction: Performing hyperthermic intraperitoneal chemotherapy (HIPEC) during cytoreductive surgery (CRS) is typically reserved for a complete or "optimal" cytoreduction. There is the potential for therapeutic effect of HIPEC with an incomplete cytoreduction, particularly for near optimal cytoreductions. Methods: Retrospective review of our prospectively maintained CRS and HIPEC registries. Incomplete cytoreductions (R2b, R2c) for appendiceal and colorectal cancer. Analysis focused on overall survival (OS) and progression-free survival (PFS) stratified out by HIPEC performance. Subgroup analysis was performed for primary etiology and specific cytoreductive score. Results: 121 cases, 74 patients undergoing CRS alone and 47 patients undergoing CRS-HIPEC. Groups were statistically identical in regard to demographics, comorbidities, functional status, and post-operative complications. The only difference was the HIPEC group had a higher average PCI score at 31 vs 22 (P <0.001). For the entire study group there was a survival benefit with HIPEC. The mean OS and PFS were 2.3 vs 1.4 (P = 0.001) and 1.6 vs 0.7 (P <0.0001) respectively for cases with HIPEC vs without HIPEC. On subgroup analysis there were 93 cases with appendiceal primaries, 43 with HIPEC and 50 without HIPEC, and HIPEC was also found to have benefit in that subgroup. The mean OS and PFS for appendiceal cases were 2.4 vs 1.5 (P= 0.016) and 1.7 vs 0.8 (P <0.0001) respectively for cases with HIPEC vs without HIPEC. The survival benefit was most pronounced in low-grade appendiceal cases with doubling of the OS and PFS with HIPEC (P= 0.004). Subgroup analysis of colorectal primary cases, 10 with HIPEC and 18 without HIPEC, revealed no difference in OS and PFS. The mean OS and PFS for R2b cases were 2.28 vs 1.01 (P= 0.011) and 1.67 vs 0.75 (P= 0.001) respectively for cases with HIPEC vs without HIPEC. Conclusion: HIPEC can provide a survival benefit for incomplete cytoreductions for appendiceal, but not colorectal cancer, with the greatest effect found for low-grade appendiceal neoplasms. HIPEC with incomplete cytoreductions should be considered for near optimal cytoreductions (R2b) of appendiceal cancer.

Figure 1: Kaplan-Meier Overall Survival Curves



P198

Genomic and Immuno-Phenotypic Aerations in Colorectal Cancer Peritoneal Metastases Compared to Matched Hematogenous Metastases P.M. Smith,* K. Idrees. *Surger, Vanderbilt University Medical Center, Nashville, TN.*

Introduction – Most colorectal cancer (CRC) patients die from metastatic disease and the peritoneum is the second most common site of metastasis with peritoneal metastases (PMs) carrying a dismal prognosis. The majority of research on CRC metastasis has focused on hematogenous metastases (HMs) including liver and lung. Our aim was to characterize the genomic and immunophenotypic landscape of PMs along with matched primary tumors, HMs, and lymph node metastases (LNMs) from CRC. Methods – Two patients with matched primary tumor, HM (liver or lung), LNM, and PM were identified. All samples were treatment-naïve except for one liver metastasis. Whole Exome Sequencing (WES), RNA-sequencing (RNA-seq), and immunohistochemistry (IHC) analyses were performed. Results – WES demonstrated a significantly higher mutational burden, higher number of mutation-associated neoantigens (MANAs) (Table 1), and a unique COSMIC gene signature in PMs compared to matched primary tumors, HMs, and LNMs. CMS subtyping of all tumors from these patients demonstrated a mutational pattern consistent with Microsatellite Instability-high (MSI-H) CRCs (CMS subtypes 1 and 3) despite being microsatellite stable (MSS) by mismatch repair protein expression (including MLH1, MSH2, MSH3, MSH6, and PMS2 by IHC). CIBERSORT analysis of RNA-seq data also demonstrated markedly reduced immune cell diversity and a higher contribution of alternatively activated (M2) macrophages in PMs compared to other tumor types. Conclusions – In this study, we demonstrate in two patients with MSS CRC and matched primary tumor, PM, HM, and LNM samples, that in both cases the PM specimens had a marked increase in tumor mutational burden and MANAs, an altered mutational signature, and a unique landscape of immune cell infiltration. These early data suggests that PMs from CRC may be genomically and immunophenotypically distinct from other CRC metastases, and that patients with PMs may benefit from investigation into novel immuno-therapeutic strategies that leverage their high mutational burden and altered immune cell landscape. Multi-institutional cooperation is likely necessary to validate these findings.

Patient	Site	Mutational Burden	Mutations per Megabase	Mutation Associated Neoantigens	CMS Subtype
1	Primary Tumor	274	<1	44	3
	Lymph Node Metastasis	272	<1	45	3
	Lung Metastasis	272	<1	44	3
	Liver Metastasis*	282	<1	51	3
	Peritoneal Metastasis	6875	>10	614	1
2	Primary Tumor	232	<1	18	3
	Lymph Node Metastasis	220	<1	19	3
	Peritoneal Metastasis	1017	>10	59	3

*This sample was not treatment naive.

P199

Incidence, Risk Factors, and Outcomes from Conversion of Low-grade to High-grade Disease for Multiple CRS-HIPEC C.W. Mangieri,* C.D. Valenzuela, K.I. Votanopoulos, P. Shen, E.A. Levine. *Surgical Oncology, Wake Forest Baptist Health, Winston-Salem, NC.*

Introduction: Conversion from low-grade to high-grade disease is known to occur with multiple cytoreductive surgeries with hyperthermic intraperitoneal chemotherapy (CRS-HIPEC) for appendiceal neoplasms. However the rate, incidence, risk factors, and outcomes have not been studied. This analysis focused on elucidating those questions. Methods: Retrospective review of our appendiceal CRS-HIPEC registry with extraction of multiple CRS-HIPEC cases for patients who were originally diagnosed with low-grade disease. Primary outcomes were the incidence rate of conversion to high-grade disease and risk factors for conversion. Secondary outcomes were impact of conversion on the ability to achieve a complete cytoreduction, overall survival (OS), and disease-free survival (DFS). Results: 134 cases of multiple CRS-HIPEC were identified involving 65 patients. 11 patients converted to high-grade disease, incidence rate 17%. Risk factors identified elevated baseline CEA levels, splenectomy at index CRS-HIPEC, and chemotherapy utilization (Table 1). Conversion to high-grade disease had no impact on cytoreduction scores (P= 0.44). When evaluating impact on OS and DFS from the index CRS-HIPEC procedure, conversion was found to have no impact. Mean OS was 9.5 and

8.8 years (P= 0.67) while mean DFS was 4.1 and 3.6 years (P=0.67) for cases that remained low-grade compared to those that converted. However, when evaluating OS from the time of conversion at repeat CRS-HIPEC patients who progressed to high-grade disease had decreased survival at 4.4 vs 5.8 years (P= 0.032). Actual 5-year OS and DFS rates had a similar trend with no difference in rates from the index CRS-HIPEC, 88.1% vs 71.4% for OS (P=0.243) and 36.4% vs 20% for DFS (P=0.314) for non-converted compared to converted cases. While the 5-years OS were inferior for converted cases from the time of repeat CRS-HIPEC at 43% vs 69% (P=0.043). Conclusion: First study to identify the incidence rate and risk factors for conversion to high-grade disease for patients who undergo multiple CRS-HIPECs. Conversion had no impact in OS and DFS from the index CRS-HIPEC but resulted in inferior survival from repeat surgery.

Risk Factors for Conversion to High-Grade Disease

	Remained Low-Grade (N = 54 Patients)	Converted High-Grade (N = 11 Patients)	OR	95% CI	P Value
Age	51.78 (+/-12.15)	51.70 (+/-10.94)	0.964	0.251-3.711	0.417
Sex	Male, 49.1% Female, 50.9%	Male, 40% Female, 60%	0.691	0.175-2.724	0.810
Race	Caucasian, 70.9% Non-Caucasian, 29.1%	Caucasian, 60% Non-Caucasian, 40%	1.625	0.404-6.541	0.338
Time to Recurrence	4.22 years (+/-3.99)	3.56 years (+/-4.83)	0.375	0.073-1.935	0.497
Baseline CEA Level	29.75 (+/-57.57)	102.93 (+/-116.78)	5.565	1.080-28.675	0.023
Malignant Ascites	10.9%	9.1%	0.891	0.812-1.077	0.303
PCI at Index CRS-HIPEC	16 (+/-8)	15.50 (+/-7.34)	0.797	0.181-3.508	0.795
Cytoreduction Score at Index CRS-HIPEC	R0, 10.9% R1, 21.8% R2a, 47.3% R2b, 18.2% R2c, 1.8%	R0, 18.2% R1, 18.2% R2a, 54.5% R2b, 9.1% R2c, 0%	0.808	0.152-4.289	0.645
Splenectomy at Index CRS-HIPEC	20%	72.7%	10.67	2.030-56.056	0.004
Lymph Node Involvement	7.3%	9.1%	1.417	0.142-14.173	0.717
Chemotherapy Utilization	23.6%	45.5%	3.231	1.807-12.931	0.017

P200

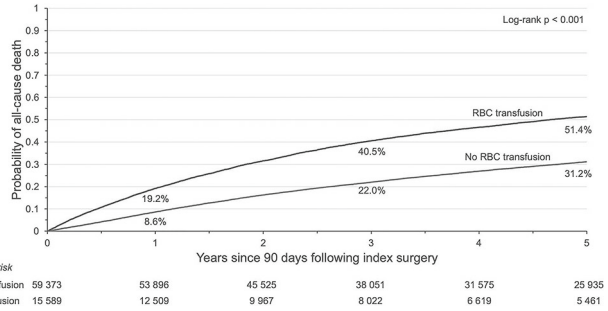
Does Cytoreductive Surgery and Hyperthermic Intraperitoneal Chemotherapy (CRS/HIPEC) Reduce Persistent Opioid Use in Patients with Peritoneal Carcinomatosis? T. Pu,[1]* M. Share,[2] G. Russell,[3] R.A. Erali,[4] I. Madeka,[5] P. Shen,[2] K.I. Votanopoulos,[2] E.A. Levine.[2] *1. Department of Surgery, Eastern Virginia Medical School, Norfolk, VA, VA; 2. Department of Surgical Oncology, Wake Forest Baptist Health, Winston-Salem, NC; 3. Department of Biostatistical Sciences, Wake Forest School of Medicine, Winston-Salem, NC; 4. Department of Surgery, Wake Forest Baptist Health, Winston-Salem, NC; 5. Wake Forest School of Medicine, Winston-Salem, NC.*

INTRODUCTION It is unclear if cytoreductive surgery (CRS) and Hyperthermic Intraperitoneal Chemotherapy (HIPEC) improves chronic pain in patients with peritoneal carcinomatosis. This study examines persistent opioid use in patients receiving CRS/HIPEC. METHODS A retrospective review was performed on a HIPEC prospective database from September 2013 to July 2018. Opioid prescription data was obtained from the North Carolina Controlled Substance Reporting System. Non-naïve patients were defined as patients who received narcotics between 12 months and 31 days pre-surgery. Persistent opioid use was defined as patients who continued filling opioid prescriptions 90 days to 1 year post-surgery. RESULTS Analysis included 136 naïve and 129 non-naïve patients. 45.7% of non-naïve patients became non-persistent opioid users after receiving CRS/HIPEC, while only 25% of naïve patients developed persistent opioid use (p<0.0001). Non-naïve patients have increased risk of persistent opioid use per each 100 units of median morphine milligram equivalents (MMEs) prescribed at discharge (OR 1.11, 95% CI: 1.01, 1.22; p=0.03). Naïve patients had less daily median morphine milligram equivalents (MME) (1.1 ± 3.8) than non-naïve patients (12.2 ± 37.3) during 90 days to 1-year post-HIPEC (p<0.0001). Persistent opioid use was more likely in colorectal than appendiceal primary cancers (OR 1.99, 95% CI: 1.07-3.70; p=0.024) and in patients receiving preoperative chemotherapy (OR 3.3, 95% CI: 1.57-6.94; p<0.01). Age, gender, ECOG, PCI score, LOS, and regional anesthesia did not affect persistent opioid use. CONCLUSION CRS/HIPEC may ultimately reduce incidence of chronic pain and opioid dependence in patients with peritoneal carcinomatosis. Nearly half of non-naïve patients were free of opioid use in the first year after CRS/HIPEC, while only a quarter of naïve patients developed persistent opioid use.

P201

Association of Perioperative Red Blood Cell Transfusions with All-Cause and Cancer-Specific Death in Patients Undergoing Surgery for Gastrointestinal Cancer J. Zuckerman,[1]* N. Coburn,[1] J. Callum,[1] A.L. Mahar,[2] S.A. Acuna,[1] M.P. Guttman,[1] V. Zuk,[3] Y. Lin,[1] A.F. Turgeon,[4] G. Martel,[5] J. Hallet.[1] *1. Surgery, University of Toronto, Toronto, ON, Canada; 2. University of Manitoba, Winnipeg, MB, Canada; 3. Sunnybrook Research Institute, Toronto, ON, Canada; 4. Universite Laval, Quebec, QC, Canada; 5. University of Ottawa, Ottawa, ON, Canada.*

Introduction: Red blood cell (RBC) transfusions are common in patients undergoing gastrointestinal cancer surgery. To adequately balance the risks and benefits of transfusion, clinicians must understand their potential effect on long-term outcomes. Our objective was to determine, among patients who have undergone gastrointestinal cancer resection, if perioperative RBC transfusions are associated with higher risk of all-cause and cancer-specific death. Methods: We performed a population-based retrospective cohort study between January 1, 2007 and March 31, 2019 in Ontario, Canada. Patients who underwent gastrointestinal cancer resection and survived at least 90 days postoperatively were eligible for inclusion. All-cause death from the ninetieth post-operative day was compared between groups using Kaplan-Meier methods and Cox proportional hazards models. Cancer-specific death was compared using competing risk methods. Sensitivity analyses evaluated the robustness of estimates. Results: We identified 74,962 patients (mean age, 67.7 years; 55.4% male; 79.7% colorectal cancer) who underwent resection for gastrointestinal cancer and survived at least 90 days after surgery. Over a median follow-up of 4.1 years (interquartile range 1.9-5.0 years), patients who received RBC transfusions demonstrated increased hazards of all-cause and cancer-specific death relative to patients who were not transfused (hazard ratio: 1.39, 95% confidence interval 1.34 to 1.44; cause-specific hazards ratio: 1.36, 1.30 to 1.43) (Figure). The adjusted risk of all-cause death was higher in early follow-up intervals (3-6 months post-operatively) but remained elevated in each subsequent interval over 5 years. Sensitivity analyses did not alter these results; the E-value was 1.82. Conclusions: RBC transfusion among patients with gastrointestinal cancer is associated with increased all-cause death; this persisted over time suggesting a long-term effect of perioperative transfusion. These findings should help clinicians balance the risks and benefits of transfusion before well-designed trials are conducted in this patient population.



P202

Deviations of Surgical Oncology Care as a Result of COVID-19 Pandemic: Impact at a Single Institution in New York City E. Gleeson,* D. Cha, D. Lee, A. Greenstein, R. Steinhagen, U. Sarpel, N. Gandhi, D. Magge, N. Cohen, P. Tabrizian, B. Golas. *Surgery, Icahn School of Medicine at Mount Sinai, New York, NY.*

INTRODUCTION: Due to delays in elective surgery during COVID-19, several organizations created guidelines for cancer treatment. How these guidelines have been implemented at various cancer centers during the COVID-19 pandemic is not well described. This study describes the experience of a division of surgical oncology from a single institution in New York City. METHODS: All patients presented at multidisciplinary tumor boards from March 16, 2020 to May 30, 2020, a timeframe that overlapped when elective cases were cancelled due to COVID-19 pandemic surge, were reviewed. Decision for surgery, delay of surgery, treatment modification, or change in treatment strategy was based on multidisciplinary tumor board review. Rates of COVID-19 positivity, delays to surgery, modification of treatment strategy

and changing of treatment strategies were collected. RESULTS: Of the 92 patients presented at tumor boards, 41 (45%) patients experienced deviations from their cancer care due to the pandemic (Table). The largest cohort had colon cancer (10 patients), followed by pancreatic (6 patients), rectal (5 patients), hepatocellular carcinoma (5 patients) and other cancers. Sixty-one percent (n=25) experienced delay of surgery with a median delay of 35 days. Twenty-seven percent (n=11) experienced interruption of chemotherapy and 14.7% of patients (n=6) received additional chemotherapy. Our study population developed COVID-19 at a higher rate (9.8%) than the New York City population. All of the COVID-positive patients experienced deviations from their treatment (5 experienced interruption in chemotherapy and 4 had delays to surgery). CONCLUSIONS: The sample of surgical oncology patients included in this study is likely one of the largest affected by COVID-19 at this time. These results can be used to guide management of other multidisciplinary teams as COVID-19 continues to surge in other parts of the country.

Type of Deviation from Care

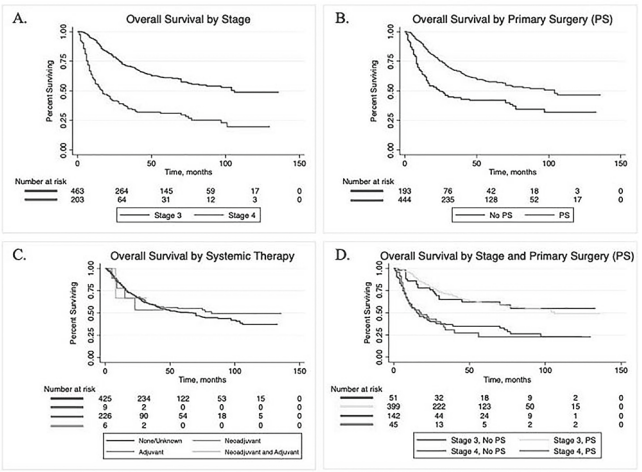
Type of Deviation from Care	n (%)
Surgery Delayed with No Ongoing Treatment	17 (41.4)
Delay in Surgery, Presentation or Workup	
Delay in Presentation	3 (7.3)
Delay in Workup	3 (7.3)
Patients Already Receiving Treatment	
Interruption in Chemotherapy	11 (26.8)
Additional Chemotherapy	6 (14.7)
Interruption in Radiotherapy	2 (4.9)
Additional Radiotherapy	1 (2.4)

P203

Patterns of Treatment in Advanced Melanoma M.A. Rose,[1]* J.T. Miura,[2] J. Ermer,[2] G.C. Karakousis,[2] H. Wachtel.[2] *1. University of Pennsylvania Perelman School of Medicine, Philadelphia, PA; 2. University of Pennsylvania Department of Surgery, Division of Endocrine and Oncologic Surgery, Philadelphia, PA.*

Introduction: Treatment of advanced melanoma has been transformed by novel therapies. The purpose of this study is to analyze patterns of treatment and survival outcomes in multimodality melanoma therapy. Methods: A retrospective cohort study was performed. Patients with initial Stage 3 or 4 melanoma upon first evaluation between January 2009 and May 2019 were included. Primary outcomes were overall survival (OS) and progression-free survival (PFS). Kaplan Meier survival analysis was performed. Covariates meeting nominal significance on univariate cox proportional hazards regression were incorporated into a multivariate model to evaluate associations between clinical characteristics and survival. Results: Of 668 patients, 69.3% were Stage 3 and 30.7% Stage 4. The median age was 61 yrs (IQR:48,71). 93.9% had a skin primary tumor. Median OS was 70 mo; median DFS was 11 mo. On multivariate Cox regression, age (HR=1.040, p<0.001), multi-racial race (HR=12.799, p=0.015), number of positive nodes (HR=1.116, p=0.001), residual tumor (HR=9.310, p<0.001), adjuvant radiation (HR=1.04e˜8, p<0.001), single and multiple agent targeted therapy (HR=3.392, p=0.046; HR=14.464, p=0.003 respectively), and tumor at last follow-up (HR=8.408, p<0.001) were associated with shorter OS. Most Stage 3 patients (86.2%) had surgery for a primary tumor compared to 22.4% from Stage 4. Primary tumor surgery was not significantly associated with OS. 1386 surgeries were performed (mean=2.1 per subject) including 606 on primary tumors (n=508, Stage 3) and 770 metastasectomies (n=657, Stage 3). Adjuvant therapy in Stage 3 included immunotherapy (n=105), targeted therapy (n=1), systemic therapy (n=149), and radiation (n=29). Median time to surgery from diagnosis was 21 days (IQR:0,45) for Stage 4. Adjuvant therapy in Stage 4 included immunotherapy (n=22), targeted therapy (n=1), systemic therapy (n=77), and radiation (n=49). Conclusions: Adjuvant therapy is increasingly used in Stage 3 melanoma; surgery is uncommonly used for Stage 4. Median survival is long suggesting durable long-term survival can be achieved with aggressive therapy. Further studies should identify optimal timing and patient selection in the current therapeutic landscape.

Figure 1. Survival outcomes for subjects with advanced melanoma. A.) Overall survival (OS) by stage (Stage 3 ref.; Stage 4 HR=2.985, p<0.001); B.) OS by primary surgery (PS) from a skin primary (no PS ref.; PS HR=0.505, p<0.001); C.) OS by systemic therapy administration (no systemic therapy ref; neoadjuvant HR=1.245, p=0.664; adjuvant HR=0.890, p=0.361; neoadjuvant and adjuvant HR=0.944, p=0.936); D.) OS by stage and PS.



P204

Completeness of Gastric Cancer Pathology Reports: The Case for Synoptic Reporting C. Seo,[1]* J. Beltrano,[2] K. Boulva,[2] S. Tadros,[2] D. Maziak,[2] C. Nessim,[2] S. Apte.[2] *1. Faculty of Medicine, University of Ottawa, Ottawa, ON, Canada; 2. The Ottawa Hospital, Ottawa, ON, Canada.*

Introduction: Risk stratification of resected gastric cancer (GC) is dependent on the completeness of pathologic reporting. To standardize reporting, the College of American Pathologists (CAP) publishes reporting protocols with "core" and "optional" elements. Inaccuracies in element reporting may impact prognosis or clinical decision-making for resected GC. The objective of this study was to evaluate the compliance of GC pathology reporting with CAP guidelines and its effect on peri-operative management for resected GC at a tertiary referral centre. Methods: A retrospective analysis of 185 GC pathology reports between 2007 and 2019 was performed. Palliative, prophylactic, or emergent resections, benign pathology, and in situ disease were excluded. To assess the completeness of reporting, data from pathology reports were tabulated into "core" or "optional" elements per the CAP guidelines. Changes in peri-operative treatment regimens were analyzed in association with the completeness of pathology reports. Results: 63.6% of patients were male, 60% were smokers, and the mean age at diagnosis was 66.4. Histologic grade, Lauren classification, and WHO classification were reported in 96.2%, 71.9%, and 17.1% respectively. Only 14.1% reported all three. Tumor site and distance to closest margin were reported in 78.2% and 79.2% respectively. Lymphovascular and perineural invasion were reported in 97.3% and 82.9% respectively. Tumor depth and the number of lymph nodes were reported in 97.8% and 98.9% respectively. Only 50.8% of reports contained all core elements. Treatment effect was reported in 64.9%. When treatment effect was reported, 41.8% changed to a different chemotherapy regimen postoperatively, but only 15.4% did when not reported (p=0.07). Margin status was missing in 25.7% of patients that underwent adjuvant radiotherapy. Conclusion: There is a high rate of incompletely reported data elements for resected GC at a designated referral centre. This poses a potential challenge for accurate postoperative risk stratification and treatment planning. Incomplete reporting of margins and treatment effect may change the decision for adjuvant chemotherapy.

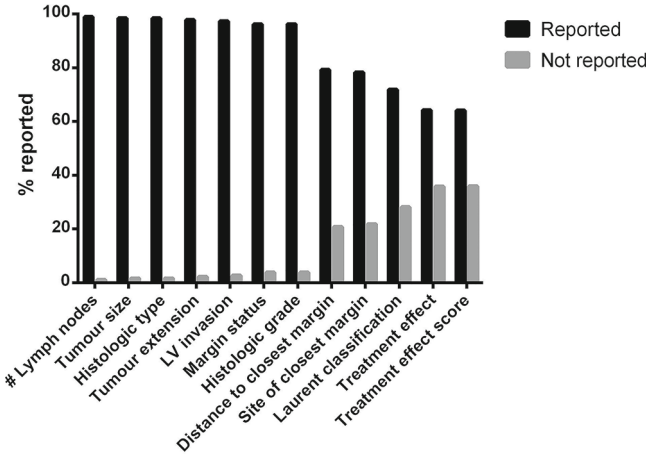


Figure 1. Completeness of core and optional pathology element reporting for resected gastric cancer.

P205

The Association Between Surgical Case Volume and a Textbook Outcome with Survival Following Pancreatic Cancer Surgery.
A.A. Norain,* L. Egbert, Y. Chang, C. Stucky, P. Cronin, S. Ahmad, N. Wasif. *Mayo Clinic, Phoenix, AZ.*

Introduction: Recent studies demonstrated textbook outcome (TO) as a viable metric in the assessment of oncology outcomes. We evaluated if Leapfrog volume standards for pancreatic cancer resection correlate with TO. Methods: The National Cancer Database was reviewed (NCDB 2010-2015) for patients who underwent surgical treatment for pancreatic adenocarcinoma. Patients were stratified by the volume of treating facility into three groups (low <6, medium 6-19, and high ≥20 cases/year). We defined TO as adequate lymph node count, negative margin, length of stay <75th percentile, appropriate systemic therapy, timely systemic therapy, and without a mortality event or readmission within 30 days. The independent effect of our TO and other potential prognostic factors was assessed using a multivariable adjusted cox proportional hazard survival model. Results: Our review yielded 7270 pancreatic resections, with 30.7%, 48.7%, and 20.6% performed at low, medium, and high-volume facilities, respectively. Patients treated at low-volume facilities were more likely to be African-American, uninsured or on Medicaid, and with higher Charlson co-morbidity scores; all p <0.001. Overall, only 28.7% of patients had TO. A greater number of patients achieved a TO at high (37.5%) compared with medium (28.4%) or low (23.4%) volume facilities (p < 0.001). Although hospital case volume was not an independent prognostic factor for long term survival on multivariable analysis, achieving a TO was significantly associated with improved survival OR 0.59 (95% CI 0.52-0.66) Conclusion: High volume hospitals show improved long-term survival following pancreatic resection. However, this is associated not with case volume, but with achieving a TO more frequently than at medium or low volume hospitals. Overall only 28.7% of patients achieved a TO, suggesting a focus of quality improvement efforts to improve outcomes.

Comparison of Textbook Outcome Parameters Between Hospital Volume Groups

	Low	Med	High	Total	Overall	Pairwise comparison		
	(N=2233)	(N=3542)	(N=1495)	(N=7270)	P-value	LV vs. MV P-value	LV vs. HV P-value	MV vs. HV P-value
Number of hospitals	113	60	9	182				
Textbook outcome, n (%)								
No	1711 (76.6%)	2535 (71.6%)	935 (62.5%)	5181 (71.3%)	<0.001	<0.001	<0.001	<0.001
Yes	522 (23.4%)	1007 (28.4%)	560 (37.5%)	2089 (28.7%)				
Adequate lymph node count, n (%)								
No	779 (34.9%)	823 (23.2%)	262 (17.5%)	1864 (25.6%)	<0.001	<0.001	<0.001	<0.001
Yes	1436 (64.3%)	2713 (76.6%)	1224 (81.9%)	5373 (73.9%)				
Unknown	18 (0.8%)	6 (0.2%)	9 (0.6%)	33 (0.5%)				
Margin Status, n (%)								
Negative	1738 (77.8%)	2795 (78.9%)	1219 (81.5%)	5752 (79.1%)	0.04	0.55	0.01	0.03
Positive	468 (21.0%)	701 (19.8%)	266 (17.8%)	1435 (19.7%)				
Unknown	27 (1.2%)	46 (1.3%)	10 (0.7%)	83 (1.1%)				
Normal LOS (< 75th percentile), n (%)								
Prolonged LOS	724 (33.2%)	856 (26.4%)	282 (19.3%)	1862 (27.0%)	<0.001	<0.001	<0.001	<0.001
Normal LOS	1459 (66.8%)	2387 (73.6%)	1182 (80.7%)	5028 (73.0%)				
Missing	50	299	31	380				
Appropriate systemic therapy, n (%)								
No	649 (29.1%)	907 (25.6%)	322 (21.5%)	1878 (25.8%)	<0.001	<0.001	<0.001	<0.001
Yes	1510 (67.6%)	2457 (69.4%)	1070 (71.6%)	5037 (69.3%)				
Unknown	74 (3.3%)	178 (5.0%)	103 (6.9%)	355 (4.9%)				
Timely systemic therapy, n (%)								
No	104 (4.7%)	154 (4.3%)	76 (5.1%)	334 (4.6%)				
Yes	1331 (59.6%)	2159 (61.0%)	981 (65.6%)	4471 (61.5%)	<0.001	0.00141	<0.001	<0.001
Missing treatment date(s)	75 (3.4%)	144 (4.1%)	13 (0.9%)	232 (3.2%)				
Therapy not administered	649 (29.1%)	907 (25.6%)	322 (21.5%)	1878 (25.8%)				
Unknown chemo status	74 (3.3%)	178 (5.0%)	103 (6.9%)	355 (4.9%)				
30 day readmission, n (%)								
No	2027 (90.8%)	3311 (93.5%)	1381 (92.4%)	6719 (92.4%)	<0.001	<0.001	0.02	0.08
Yes	193 (8.6%)	221 (6.2%)	113 (7.6%)	527 (7.2%)				
Unknown	13 (0.6%)	10 (0.3%)	1 (0.1%)	24 (0.3%)				
30d mortality, n (%)								
Alive	2141 (95.9%)	3453 (97.5%)	1466 (98.1%)	7060 (97.1%)	<0.001	<0.001	<0.001	0.21
Died	92 (4.1%)	89 (2.5%)	29 (1.9%)	210 (2.9%)				
Overall survival, n (%)								
Alive	632 (28.3%)	1128 (31.8%)	383 (25.6%)	2143 (29.5%)	<0.001	0.004	0.07	<0.001
Died	1601 (71.7%)	2414 (68.2%)	1112 (74.4%)	5127 (70.5%)				

P206

Evaluating Age as a Predictor of Postoperative Opioid Use and Prescribing Habits in Geriatric Cancer Patients A.D. Melucci,* O.F. Lynch, M.J. Wright, A. Baran, L. Temple, G.C. Poles, J. Moalem. *Surgery, University of Rochester, Rochester, NY.*

INTRODUCTION: We studied narcotic utilization and prescribing habits of geriatric patients (GP) undergoing surgical resection for cancer. METHODS: Medical records of 675 adult patients with cancer or neoplasms who underwent elective resection between 01/2019 and 12/2019 were reviewed. Open and minimally invasive (MIS) procedures of the pancreas, colon, rectum, lung, breast, and skin were included. Emergent procedures, chronic opioid users, and patients without malignancy were excluded with 445 patients (245 GP age >/= 65) in the analysis. RESULTS: GP were discharged with 33% less opioids than non-geriatric patients (NGP) with median discharge (DC) MEQ (IQR) 75(150)mg vs. 112.5(102.5)mg, (p=0.002). Stratifying patients by age groups revealed progressive decreases in median DC MEQ: 90, 50, and 0mg for ages 65-74, 75-84, and >85 (p<0.0001). GP were half as likely to request a refill (6.1% vs. 12.5%, p=0.02). GP compared to NGP had lower average final 48-hour pain scores (1(3.3) vs. 3.2(4.8) (p<0.0001)) and opioid use in the final 48-hours of admission (60(300)mg vs. 240(450)mg (p<0.0001)). While there was no association between overall LOS and DC MEQ, DC MEQ was significantly correlated with average pain score and opioid use in final 48-hours for GP (r2=0.85 and 0.54; p<0.0001 for both). DC provider type had no impact on GP DC MEQ. There was a significant difference in DC MEQ by cancer type (p<0.0001). GP had a lower DC MEQ than NGP for colorectal (0 vs. 112.5mg), hepatobiliary (131.3 vs. 150mg) and lung (112.5 vs. 150mg) cancers, but not for breast and melanoma. Higher DC MEQ was noted for all patients with cancer stage >2 (p=0.09). Analyzing by procedure, the lower narcotic use among GP vs. NGP was most notable following MIS 0(112.5) vs. 112.5(198.8)mg and open colon resections 22.5(112.5) vs. 101.3(150)mg. CONCLUSIONS: Geriatric cancer patients were discharged with significantly less opioids after surgery compared to non-geriatric patients and required refills less often. Increasing age was a predictor of lower DC MEQ, a finding driven by GP's lower prescriptions for intraabdominal and intrathoracic malignancies but not for skin and soft tissue cancers.

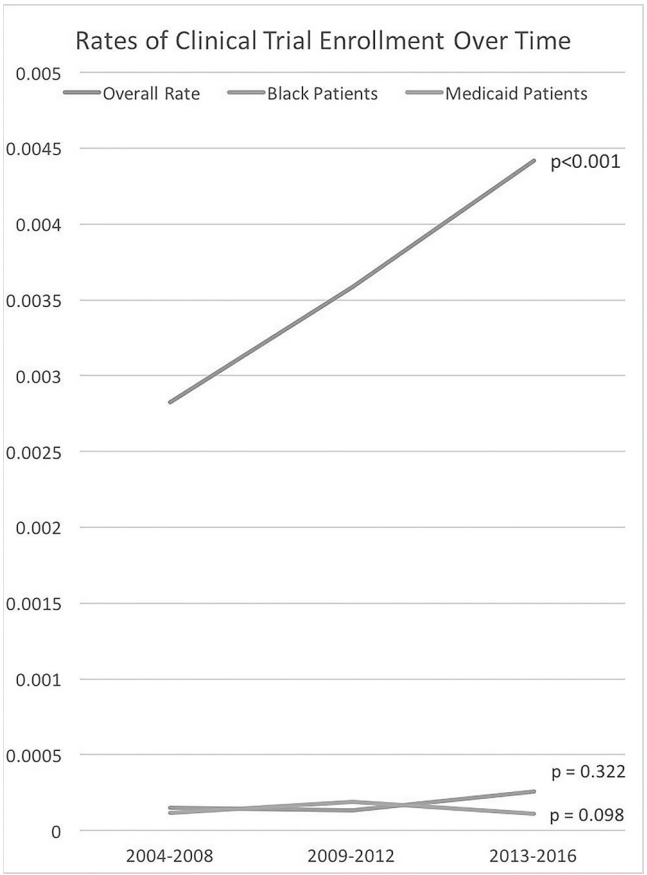
Discharge Prescription Median MEQ				
		Geriatric (n=245)	Non-Geriatric (n=200)	p-value
Age Group		75.0	112.5	0.002
	<65 (n=200)	N/A	112.5	
	65-74 (n=144)	90.0	N/A	
	75-84 (n=88)	50.0	N/A	
	85+ (n=13)	13.0	N/A	
Procedure	MIS Colorectal (n=89)	75.0	112.5	<0.0001
	MIS Hepatobiliary (n=10)	131.3	112.5	
	Open Colorectal (n=32)	75.0	101.3	
	Open Hepatobiliary (n=42)	150.0	150.0	
	Mastectomy +/- SLNB (n=63)	75.0	60.0	
	VATS lung (n=157)	112.5	112.5	
	Wide local excision +/- SLNB (n=52)	37.5	37.5	
Discharging Provider	Junior resident (n=89)	75.0	75.0	0.01
	Senior resident (n=10)	37.5	75.0	
	Advanced Practice Provider/Faculty (n=302)	75.0	112.5	
Cancer Type	Breast (n=63)	60.0	75.0	<0.0001
	Colorectal (n=129)	0.0	112.5	
	Lung (n=133)	112.5	150.0	
	Melanoma (n=53)	37.5	37.5	
	Pancreas Biliary (n=51)	131.3	150.0	
	Metastatic (n=16)	168.8	116.3	
Cancer Stage	0 (n=34)	75.0	75.0	0.09
	1 (n=184)	75.0	95.0	
	2 (n=96)	75.0	112.5	
	3 (n=88)	60.0	112.5	
	4 (n=39)	112.5	120.0	

MIS: minimally invasive surgery; SLNB: sentinel lymph node biopsy; VATS: video-assisted thorascopic surgery.

P207

Access Denied: Inequities in Clinical Trial Enrollment for Pancreatic Cancer M.F. Eskander,* L. Gil, E.W. Beal, Y. Li, B. Oppong, S. Obeng-Gyasi, A. Tsung. *Surgery, The Ohio State University, Columbus, OH.*

Introduction: The influence of social determinants of health (SDH) on participation in clinical trials for pancreatic cancer is not well-understood. In this study, we describe trends and identify disparities in pancreatic cancer clinical trial enrollment. Methods: Retrospective study of patients with Stage I-IV pancreatic cancer in the 2004-2016 National Cancer Database (NCDB.) Cohort stratified into those enrolled in clinical trials during first course of treatment vs. not enrolled. Bivariate analysis and logistic regression used to understand relationship between SDH and clinical trial participation. Results: 1,127 patients (0.4%) enrolled in clinical trials vs. 301,340 (99.6%) not enrolled. Enrollment increased over study period ($p<0.001$) but not for historically disadvantaged populations (Figure.) The majority enrolled had metastatic disease (65.8%.) On multivariate analysis, in addition to year of diagnosis ($p<0.001$), stage ($p<0.001$) and Charlson score ($p<0.001$), increasing age (OR 0.96, CI 0.96-0.97), non-white race (OR 0.54, CI 0.44-0.66 vs. white), living in the South (OR 0.42, 0.35-0.51 vs. Northeast), and Medicaid, lack of insurance, or unknown insurance (0.41, CI 0.31-0.53 vs. private) were independent predictors of lack of participation in a clinical trial. Conversely, treatment at an academic center (OR 6.36, CI 5.44-7.44 vs. non-academic) and higher neighborhood education level predicted enrollment (OR 2.0, CI 1.55-2.67 for <7% with no high school degree vs. > 21%.) Conclusions: Age, race, insurance, and geography are barriers to clinical trial enrollment for pancreatic cancer patients. While overall enrollment increased over time, Black patients and patients on Medicaid remain underrepresented. After adjusting for cancer-specific factors, SDH are still associated with clinical trial enrollment, suggesting need for targeted interventions.



Rates of clinical trial enrollment over time for all patients, Black patients, and Medicaid patients

P208

Opportunity Costs of Surgical Resection and Perioperative Chemotherapy for Pancreatic Adenocarcinoma S. Lim,* S. Hao, B. Boyd, A. Mitsakos, W. Irish, A.A. Parikh, R.A. Snyder. *Brody School of Medicine at East Carolina University, Greenville, NC.*

Introduction: Due to the intensity of multimodality treatment and high perioperative morbidity rates, patients with resected pancreatic ductal adenocarcinoma (PDAC) spend a substantial amount of time in clinical care. However, time spent in receipt of care relative to overall survival time has not been previously described. The primary aim was to determine the total time spent in receipt of surgical care and perioperative chemotherapy in patients undergoing resection for PDAC. Methods: A retrospective cohort study of all patients who underwent curative-intent resection for PDAC at a single-institution tertiary care center was performed (2015-2019). Patients who died within 30 days of resection were excluded. Exact times for all relevant clinician visits, laboratory, radiologic and procedural studies, and treatment visits were abstracted from the primary medical record, and estimated travel time was calculated based on patient address. Care time was divided into preoperative, surgical (including hospital length of stay, postoperative visits, and readmissions), and systemic therapy phases of care. Results: A total of 107 patients were included. Patients spent a median of 5.0% (IQR 2.4-10.1%) of survival time in receipt of clinical care for PDAC (Table). Preoperative, surgical, and systemic therapy phases of care required a median of 5 (IQR 3-9), 14 (IQR 11-24), and 53 (IQR 38-66) separate healthcare encounter dates. Median per-visit travel time was 30 minutes (IQR 18-54), and cumulative travel time for patients was 19.4 hours (IQR 11.8-46.0). A small cohort of patients (13.0%, n=14) spent more than 10% of total survival time in surgical care, and 7.8% (n=4) patients spent more than 10% of survival time in receipt of systemic therapy. Conclusions: Time spent in receipt of surgical care does

not appear to represent a substantial time burden relative to survival time for most patients with resected PDAC; however, for a subset of patients, the time burden is considerable. Further research to determine predictors of increased time spent in receipt of care is warranted to inform patient and surgeon communication and decision-making.

Time	Median	IQR
Overall Survival (months)	17.5	9.3-24.4
Median Overall % Survival Time	5.0%	2.4-10.1%
Preoperative Care		
Median # Healthcare Encounter Dates	5	3-9
Median Care Time (hours)	22.8	10.1-114.7
Median % Survival Time	0.3%	0.1-0.9%
Surgical Care		
Median # Healthcare Encounter Dates	14	11-24
Median Care Time (hours)	223.3	164.8-391.4
Median % Survival Time	2.1%	1.2-5.1%
Systemic Therapy Care		
Median # Healthcare Encounter Dates	53	38-66
Median Care Time (hours)	481.0	266.9-696.4
Median % Survival Time	3.6%	1.7-6.0%

P209

Association of Frailty with Loss of Independence in Older Adults After Cancer Surgery: A Population-Based Analysis J. Zuckerman,[1]* B. Haas,[1] B. Tillmann,[1] M.P. Guttman,[1] T. Chesney,[1] A.L. Mahar,[2] A. Hsu,[3] W. Chan,[1] R. Vasdev,[1] N. Coburn,[1] J. Hallet.[1] *1. University of Toronto, Toronto, ON, Canada; 2. University of Manitoba, Winnipeg, MB, Canada; 3. University of Ottawa, Ottawa, ON, Canada.*

Background: Functional outcomes after surgery are central to decision-making by older adults (OA). Yet, the long-term risk of functional decline after cancer surgery has not been described beyond one year nor is the impact of frailty on this risk well understood. We examined the association between frailty and loss of independence, defined as loss of ability to be alive and at home, after cancer surgery in OA. Methods: We performed a population-based retrospective cohort study of adults ≥ 70 years old undergoing cancer resection (2007-2017). Patients with pre-operative frailty were identified. Loss of independence was defined as admission to nursing homes or death. Time to loss of independence after surgery was evaluated with Kaplan-Meier methods and the association between frailty and loss of independence over time was examined with piecewise Cox regression. Results: Of 82,037 patients, 6,443 (7.8%) were frail. Most patients had gastrointestinal (39.1%) or breast (27.8%) cancer and high-intensity surgery (59.5%). 66.7% of non-frail and 60.2% of frail patients were discharged home after surgery. The median time to loss of independence was 45 months (IQR: 22-60). The 5-year probability of loss of independence was higher for frail patients (61%; 95%CI 60-62%) compared to non-frail patients (37.5%; 95%CI 36.1-37.9). After adjusting for patient and disease factors, frailty was associated with increased hazards of loss of independence. While the risk for loss of independence increased 2-fold between 31 to 90 days after surgery (hazard ratio – HR 2.00; 95%CI 1.78-2.24), the risk remained significantly elevated beyond 1 year (HR 1.56; 95%CI 1.48-1.64). This association was observed consistently across cancer sites, including breast and melanoma, and surgical procedure intensity. Conclusion: Frailty is independently associated with loss of independence after cancer surgery in OA. While most clinically significant in the immediate postoperative period, this relationship persists over 5 years for all cancers and procedural intensities. Surgeons should assess frailty and use this information when selecting, counselling, and preparing patients for surgery.

P210

Barriers to Completion of Gastric Cancer Treatment in One of the Poorest Zip Codes in America R.D. Salas-Parra,[1]* D. Hanssen,[1] K. Zorbas,[1] L. Tavares,[2] A. Nuzhad,[2] M. Furman.[1] *1. Surgery, Bronxcare Health System, Bronx, NY; 2. St. George's University School of Medicine, St. George, Grenada.*

INTRODUCTION: While surgical and medical therapies are available to effectively manage gastric cancer, there continues to be a disproportionately lower rate of completion of those therapies for our poorest patients. At our institution, which serves a predominately low socio-economic population, we examined both the clinical and non- clinical issues that lead to our patients not completing therapy for a documented gastric adenocarcinoma. METHODS: We performed a retrospective chart review of patients with diagnosed gastric adenocarcinoma (2009- 2019) from a community-based hospital system. We examined and analyzed the demographic, socio-economic, clinical, pathologic, and therapeutic completion data of all patients. RESULTS: Of the 77 eligible patients there was a mean age of 66.2 years, 43% were female and 57% were male. Most patients were Hispanic 57%, followed by African American 35%, and Caucasian 4%. Over half of the patients presented with 3 or more medical comorbidities. The majority of patients (71%) presented symptomatically, and tissue diagnosis was made via outpatient esophagogastroduodenoscopy. Cancer was identified in the cardia 14%, body/fundus 43%, antrum/pylorus 35%, and diffuse 8%. 32% of patients presented with localized gastric cancer, 34% with locoregional disease, and 34% presented as unresectable/ metastatic gastric cancer. 69% of patients with localized gastric cancer completed all planned treatment while only 36% of those with locoregional disease did the same. From our cohort, 21% of patients did not start or complete treatment secondary to a non-clinical factor. 75% of patients had Medicare or Medicaid as their only form of insurance. CONCLUSIONS: Delay in and failure to complete full treatment for gastric cancer is associated with worse outcomes. Over one-fifth of our patients were unable to initiate or complete therapy because of social factors such as inadequate time off work, and lack of transportation. These issues are significantly concentrated in a low socio-economic population. Safety net changes such as improved patient navigation, social and economic support, and community outreach are required to help patients complete cancer therapy.

P211

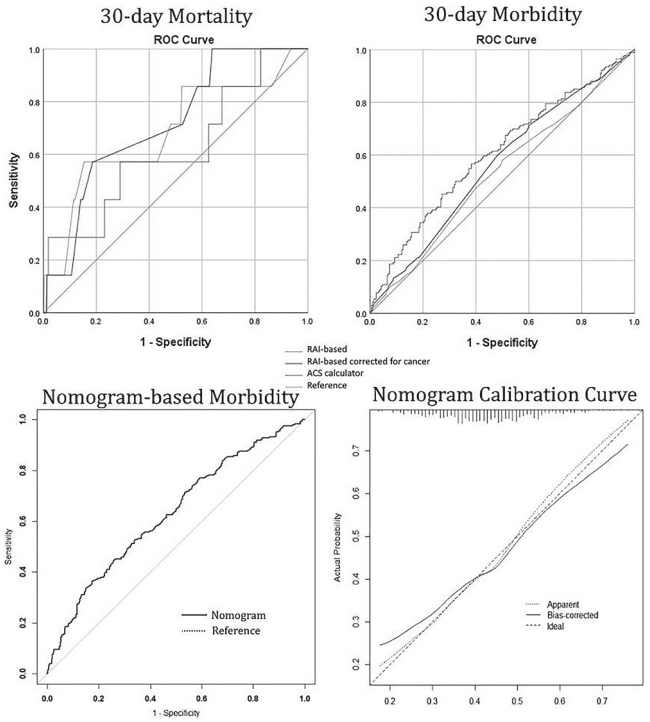
The Effect of Enhanced Recovery After Surgery Protocols on Pancreatic Surgery at a Community Hospital P.W. Appleby,* M. Fillion, R. Parikh, J. Faulkner, W.W. Hope, K. Duggan. *Surgery, New Hanover Regional Medical Center, Wilmington, NC.*

INTRODUCTION: Enhanced Recovery after Surgery (ERAS) protocols have gained increasing popularity over the past decade. These evidence-based approaches to perioperative care have been shown to shorten length of stay and optimize patient outcomes. The purpose of this study was to evaluate the safety and efficacy of ERAS protocols at our institution. METHODS: A retrospective chart review was performed at a single institution evaluating all elective pancreatic surgery performed from October 2012 through August 2019. Pancreaticoduodenectomy and Distal Pancreatectomy were the focus of the study and other procedures were excluded. A standardized enhanced recovery protocol was introduced in January 2018 and patients were divided into two groups according to pre-ERAS protocol or post-ERAS protocol implementation. Perioperative data was collected on patient disposition at discharge, mortality, length of stay, ICU days, readmission rates, and complications, and statistical analysis performed. RESULTS: One hundred and eleven patients (58 male, 53 female, mean age 63.4 years) met criteria during the study period with 66 patients in the Pre-ERAS group and 45 patients in the Post-ERAS group. There was no significant difference in the number of pancreaticoduodenectomies versus distal pancreatectomies performed between the two groups. Mean hospital length of stay was significantly lower in the Post-ERAS group (7.2 vs 10.5 days, $p < 0.016$). Mean ICU days were significantly lower in the Post-ERAS group (0.2 vs 1.03 days, $p < 0.005$). Readmission rates (20.3% vs 18.2%) were similar between the two groups. Complications including mortality, pancreatic fistula, bleeding, bile leak and wound infection were similar between the two groups. Patient disposition at discharge included Skilled Nursing Facility (SNF) or Home and these rates were similar between the two groups. CONCLUSIONS: Implementation of Enhanced Recovery after Surgery protocols in elective pancreatic surgery is both safe and efficacious in a community setting. ERAS protocols should be employed to significantly reduce length of stay and ICU days without an increase in readmission rates or complications.

P212

Feasibility of the ACS NSQIP Surgical Risk Calculator and Risk Analysis Index (RAI)-Based Model as Predictor of Outcomes After Total Pelvic Exenteration for Rectal Cancer J. Mesquita-Neto,[2] S. Mazzola Poli de Figueiredo,[1]* S. Kim,[2] F.I. Macedo.[3] *1. University of Texas Medical Branch, Galveston, TX; 2. Wayne State University School of Medicine, Detroit, MI; 3. University of Central Florida College of Medicine, Gainesville, FL.*

INTRODUCTION: Total pelvic exenteration (TPE) is a highly morbid operation for recurrent or locally advanced colorectal cancer (CRC). Current prediction models are based on European or Asian experience and may underestimate mortality and complications following TPE. METHODS: The American College of Surgeons (ACS) National Surgical Quality Improvement Program (NSQIP) database was queried to identify TPE performed for CRC between 2005-2016. Predicted morbidity and mortality based on ACS's NSQIP database were compared to predictors based on the frailty-based Risk Analysis Index (RAI). RESULTS: TPE accounted for 681 (1.1%) of 62,199 CRC resections. Median age was 59 years, and most patients had a normal BMI (42.1%) and were functionally independent (97.2%). Global 30-day mortality was 1.8%, morbidity was 42.7% and readmission rate was 21.8%. 19.8% of patients required discharge to rehabilitation or skilled-nursing facilities. On univariate analysis, additional resection (2.5% vs 0.4%; P=0.049) and ASA IV (P=0.002) were associated with increased mortality. Male sex (45.9% vs 36.6%; P=0.021), ASA IV (P=0.005) and increased operative time (P<0.001) were associated with higher morbidity. Median predicted mortality by ACS calculator was 0.9% [IQR 1.5%] and morbidity was 33.9% [IQR 14.5%], and median RAI was 24 [IQR 5]. Both RAI-based model and ACS calculators had low accuracy to predict either death (AUC 0.68 and 0.61) or complications (AUC 0.53 and 0.60). A nomogram was constructed using meaningful clinical variables, although it was also innacurate to predict complications after TPE (AUC 0.62). CONCLUSION: In the US, TPE for CRC is a rare procedure performed in highly selected patients. It is associated with low postoperative mortality rate, however morbidity remains exceedingly high. Approximately one fifth of patients are readmitted postoperatively. Current models underestimate complications risks after TPE and development of more accurate predictors of survival after TPE is warranted.



ACS NSQIP Surgical Risk Calculator and RAI-based model 30-day mortality and 30 day morbidity ROC curves; Nomogram based morbidity with calibration curve

P213

Current Hospital Price Transparency Policy Inadequate to Inform Surgical Oncology Patients J. Herb,[2]* K. Stitzenberg.[1] *1. Surgery, University of North Carolina at Chapel Hill, Durham, NC; 2. Cecil G. Sheps Center for Health Services Research, Chapel Hill, NC.*

Introduction: In 2019, the Centers for Medicare & Medicaid Services (CMS) implemented new price transparency rules requiring hospitals, at minimum, to post their standard hospital charges online. We evaluated the utility of readily available online price transparency information for common abdominal surgical oncology procedures at leading US cancer institutions, hypothesizing current readily available information does not adequately inform patients nor correlate with quality of care. Methods: We conducted a cross-sectional analysis of online price transparency information available at National Cancer Institute designated clinical cancer centers. We reviewed the availability of required hospital charges, as well as average diagnosis-related group (DRG) charges. The average DRG charge for several major abdominal cancer operations were obtained: esophageal/stomach procedures (DRG 328), small and large bowel procedures (DRG 331), and pancreas/liver procedures (DRG 407). Correlations were calculated between the average charges and cancer care quality ratings obtained from U.S. News and World Report, after adjusting charges for geographic variation using the hospital wage index. Secondary outcomes include the presence of an online out-of-pocket cost (OOPC) estimator, and financial navigation contact information for OOPC estimates. Results: All 64 hospital websites were reviewed. 98% had a standard chargemaster file, and 67% had average DRG charges available. 24% included an OOPC estimator, and 80% directed patients to financial services for an OOPC estimate. 19% had neither and directed patients to their insurance company. Median average charges varied widely and were not significantly correlated with quality ratings (Table). Conclusion: Current minimum price transparency rules do not lead to online information that adequately informs surgical oncology patients on potential OOPCs nor potential value (cost and quality). To be meaningful, CMS should require more readily available OOPC estimates. New CMS price transparency rules effective January 2021 may aid this goal, and the extent to which this informs surgical oncology patients will be the subject of future research.

Hospital reported charges for common surgical oncology diagnosis-related group codes required by Centers for Medicare & Medicaid Services and correlation with U.S. News and World Report cancer care quality rating.

Procedure	Median Average DRG Charge Listed, U.S. dollars (IQR)	Correlation with Quality Rating	P-value
Major Stomach/Esophageal Procedures	$52,672 ($42,928-$70,744)	0.17	0.31
Major Small and Large Bowel Procedures	$60,944 ($45,412-$75,941)	0.06	0.71
Pancreas/Liver Procedures	$82,476 ($63,003-$104,441)	-0.09	0.61

Hospitals listed average charges per unique DRG and for our analysis we calculated the median of those reported average charges across hospitals. Abbreviations: DRG, diagnosis related group; IQR: interquartile range

P214

How Integrated is Robotic Surgery Training in Surgical Oncology Fellowship: Is it Important for Applicants to Have Prior Training? C. Tung,* A.D. Shellito, S. Kapadia, C.E. Dauphine, J.J. Ozao-Choy. *General Surgery, Harbor-UCLA Medical Center, Torrance, CA.*

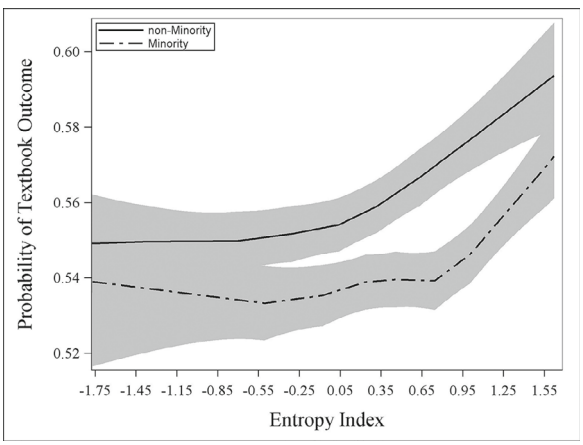
Introduction: Robotic surgery is being increasingly integrated into surgical oncology/hepatobiliary (SO/HPB) surgery; however, to date, the current role of robotics training in these programs is not well described. The goal of our study is to examine the current state of robotic surgery in SO/HPB fellowship. Methods: A web-based survey was sent to program directors (PDs) from all accredited SO/HPB fellowship programs within the US and Canada. PDs were asked about their robotics surgery training and their opinions on exposure to robotics training during general surgery residency. Results: Of 47 total programs, 26 (55%) responded to the survey. Twenty-five programs (96%) that responded were university-based or -affiliated with the majority being 2-year training programs (21/26, 81%). Twenty-five (96%) programs reported having a surgical robot at their institution, with 21 (81%) having access to a dual teaching console. 19 (73%) programs reported active participation of fellows at the console. 13 (50%) programs responded as having a formal

robotics curriculum in place with 4 of 6 programs that answered they did not, reporting there was a plan to implement such a curriculum within the next 2 years. An estimated average of 23% of abdominopelvic cases were performed robotically (range: 0-80%) as compared to 31% laparoscopic and 46% open. The most common types of cases where fellows functioned as the primary surgeon at the console were cholecystectomy/hepatobiliary cases, liver resections, and other solid organ surgeries. 19 PDs (73%) felt it was important for general surgery residents pursuing SO/HPB training to have had prior training in robotic surgery. Conclusions: Robotic surgery is already highly integrated into SO/HPB training with the majority of programs having already established or developing curriculums. The majority of PDs felt that prior robotic surgery training was an important prerequisite for applicants. These findings have potential interest for surgical residents pursuing further training in SO/HPB and should be considered by SO/HPB accreditation committees when evaluating the education curriculum of fellowship programs.

P215

Impact of Racial Integration on Postoperative Outcomes Among Medicare Beneficiaries Undergoing Resection for Cancer A. Paro,* D. Dalmacy, D.I. Tsilimigras, M. Hyer, A. Tsung, M. Dillhoff, J. Cloyd, A. Ejaz, T.M. Pawlik. *Department of Surgery, The Ohio State University Wexner Medical Center, Columbus, OH.*

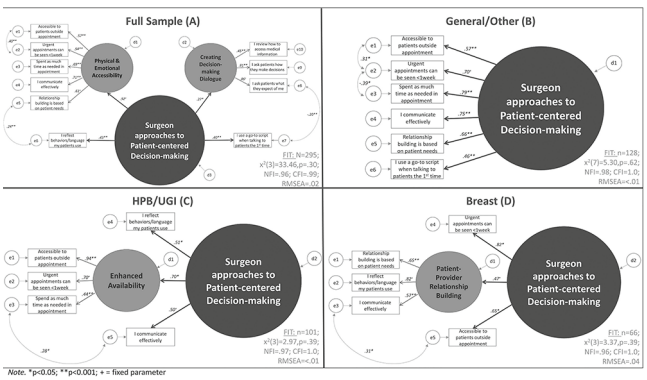
Introduction: The impact of residential segregation on surgical outcomes remains poorly defined. We sought to examine the association between residential segregation and likelihood of achieving a textbook outcome (TO) following cancer surgery. Methods: Medicare 100% Standard Analytic Files were reviewed to identify Medicare beneficiaries who underwent resection of lung, esophageal, colon, or rectal cancer between 2013-2017. Shannon's integration index, a measure of residential diversity/segregation, was calculated at the county level. Impact of residential integration on composite TO (no complications, no prolonged length-of-stay (LOS), no 90-day readmission, and no 90-day mortality) was examined. Results: Among 200,509 patients who underwent resection of lung (35.0%), esophageal (2.2%), colon (55.5%), or rectal (7.3%) cancer, most patients were female (n=101,911, 50.8%), White (n=181,875, 90.7%), and had a median age of 75 (IQR:70-80) years. The overall incidence of TO was 56.0% (lung: 43,435, 61.8%; esophageal: 1,398, 32.1%; colon: 60,183, 54.1%; rectal, 7,299, 49.6%). The unadjusted likelihood to achieve a TO was lower among patients in low integration areas (low integration: n=19,978, 55.0% vs. high integration: n=18,953, 59.3%; p<0.001). On multivariable analysis, after adjusting for relevant covariates, patients residing in low integration areas had higher odds of complications (OR 1.07, 95%CI 1.03–1.11), extended LOS (OR 1.13, 95%CI 1.08–1.18), and 90-day mortality (OR 1.29, 95%CI 1.21–1.37); in turn, odds of achieving a TO (OR 0.87, 95%CI 0.84–0.90) was lower compared with patients from highly integrated communities (Figure). Black/Latino patients who lived in less integrated areas had lower odds of achieving a postoperative TO (OR 0.93, 95%CI 0.86–0.99) versus minority patients in high integration areas. Conclusion: Patients who resided in counties with a lower integration index were less likely to have an optimal TO following resection of cancer compared with patients who resided in more integrated counties. The data highlight the importance of increasing residential racial/ethnic diversity as a means to improve community surgical outcomes.



P216

Surgeon Strategies to Patient-centered Decision Making in the Cancer Care Context E. Palmer Kelly,* J. McGee, M. Hyer, D.I. Tsilimigras, T.M. Pawlik. *Department of Surgery, The Ohio State University Wexner Medical Center, Columbus, OH.*

Introduction: Despite the positive impact of patient-centered decision-making (PCDM) strategies on patient satisfaction, their use varies widely within the context of surgical cancer care. We sought to construct an overall conceptual PCDM model and compare PCDM strategies by surgical specialty. Methods:PCDM strategies were assessed with a cross-sectional survey completed by board-certified cancer surgeons. Structural equation modeling was used to validate a PCDM model in the full sample and modifications were made according to surgeon specialties (i.e. general oncology, breast, HPB) Results: Among 295 surgeons, mean age was 51.7 years (SD=9.9); most respondents were male (68.9%), White (84.6%), and in practice ≥10 years (66.4%). Specialties included general oncology(43.4%), breast(22.4%), and HPB(34.2%). Within the full sample, various PDCM strategies mapped to two latent constructs: "physical & emotional accessibility"(β=0.92) and "creating decision-making dialogue"(β=0.27)(p<0.05) (Figure 1A). Individual strategies associated with surgeon PCDM included reflecting behaviors/language utilized by patients (β=0.43), as well as using a "go-to" script when sharing information with patients for the first time (β=0.40)(both p<0.001). Among general oncology providers, the strongest elements of PCDM were spending as much time as needed in patient appointments(β=0.79) and communicating effectively (β=0.75)(both p<0.001)(Figure 1B). Model structure was similar for HPB and breast surgeons(Figure 1C-1D). For HPB surgeons, "enhanced availability"(β=0.70), reflecting patient behaviors/language(β=0.51), and communicating effectively(β=0.50) were the strategies utlized for PCDM (p<0.05). Among breast surgeons, "patient-provider relationship building"(β=0.47), accommodating an urgent appointment request(β=0.82) and being available to patients outside of their appointment time(β=0.65) were important PCDM strategies(both p<0.05). Conclusions: Overall PCDM approaches among cancer surgeons varied but effective communication and being easily accessible to patients were present in all models. Tailoring PCDM to patient needs may improve patient satisfactionand lead to more patient-centric cancer care.



P217

Omission of Sentinel Lymph Node Biopsy in Merkel Cell Carcinoma M.J. Carr,[1]* E. McClure,[2] A. Patel,[2] J. Sun,[3] R. Panchaud,[2] S.M. Naqvi,[1] Y. Kim,[1] K. Tsai,[1] A.A. Sarnaik,[1] C.W. Cruse,[1] R. Gonzalez,[1] V.K. Sondak,[1] J.S. Zager.[1] *1. Surgical Oncology, Moffitt Cancer Center, Tampa, FL; 2. University of South Florida Morsani College of Medicine, Tampa, FL; 3. University Hospitals, Cleveland, OH.*

Introduction Sentinel lymph node biopsy (SLNB) improves prognostic accuracy and influences the treatment strategy in Merkel cell carcinoma. This study aimed to describe the outcomes of these patients who have had their SLNB omitted (oSLNB) Methods A single-institution, retrospective chart review was performed of AJCC8 clinical stage 0-2B Merkel cell carcinoma patients treated 2007-2017. oSLNB patients underwent a comparison with a second cohort of patients who did undergo SLNB using a multivariable Cox regression analysis to test the difference in outcomes. Results Of the 498 patients evaluated, oSLNB occurred in 131 (26%), due to comorbidities precluding the use of general anesthesia (n=55, 42%) or inability to successfully complete lymphoscintigraphy (n=76, 58%). oSLNB patients were older

(median 78 vs. 74 years, p<0.001). There was no significant difference in gender, race, immunosuppression status, tumor location or clinical stage between groups. oSLNB tumors demonstrated a higher rate of lymphovascular invasion (54% vs 35%, p=0.001). 123 (34%) of SLNB patients had nodal metastasis. Patients who underwent SLNB were more likely to receive adjuvant radiation to the primary tumor site (42% vs. 25%; p<0.001), but no difference was found between groups in adjuvant radiation to the regional lymph node basin (27% vs. 20%r; p=0.09). With a median follow-up of 20 months, the oSLNB group experienced a higher rate of local (29% vs 17%; p<0.001) and regional (47% vs 20%; p<0.001) recurrence, which held true on multivariable analysis. The oSLNB group had a lower rate of in-transit (10% vs 29%; p<0.001) and distant recurrence (14% vs 35%; p<0.001). Compared to those who underwent SLNB, patients in the oSLNB group demonstrated a higher rate of dying of disease (31% vs 14%, p<0.001), of which 33% (n=13) included oSLNB due to comorbidities. 19% in the oSLNB group died of unknown cause, of which 60% (n=15) included oSLNB due to comorbidities, while a 12% died of other causes, of which 44% (n=7) included oSLNB due to comorbidities. (Table 1) Conclusion oSLNB in Merkel cell carcinoma may lead to worse outcomes. If warranted, close follow up should be taken with high suspicion for locoregional recurrence.

Table 1. Comparison of Clinicopathologic Factors and Outcomes

oSLNB versus SLNB comparison				
Covariate	Level	oSLNB (n=131)	SLNB comparison (n=367)	p-value*
Adjuvant radiation to primary	No	72 (55%)	115 (31%)	< 0.001
	Yes	59 (45%)	252 (69%)	
Adjuvant radiation to regional lymph node basin	No	105 (80%)	267 (73%)	0.094
	Yes	26 (20%)	100 (27%)	
Recurrence site	Local	22 (29%)	17 (17%)	< 0.001
	In-transit	8 (10%)	29 (29%)	
	Regional	36 (47%)	20 (20%)	
	Distant	11 (14%)	35 (35%)	
Vital status	No evidence of disease	46 (35%)	230 (63%)	< 0.001
	Alive with disease	4 (3.1%)	19 (5.2%)	
	Dead of disease	40 (31%)	50 (14%)	
	Dead of other cause	16 (12%)	51 (14%)	
	Dead of unknown cause	25 (19%)	17 (4.6%)	
Multivariable Analysis of Locoregional[a] Recurrence Free Survival				
Covariate	Level	Hazard Ratio	p-value	
Cohort	oSLNB	3.68 (2.25-6.03)	< 0.001	
	SLNB comparison	Reference		
Primary tumor lymphovascular invasion	No	0.76 (0.50-1.16)	0.197	
	Yes	Reference		
Adjuvant radiation	No	1.35 (0.87-2.09)	0.174	
	Yes	Reference		

oSLNB: omission of sentinel lymph node biopsy
[a]Locoregional: local, in-transit, and regional nodal basin
Number of observations in the original data set = 498. Number of observations used for multivariable analysis = 424.
Backward selection with an alpha level of removal of 0.2 was used.
*Parametric p-value is calculated by ANOVA for numerical covariates and chi-square test for categorical covariates.

P218

From Abstract to Published Manuscript: Results from the 2018 Society of Surgical Oncology Conference Z.J. Brown,* A. Li, C. Shen, K. Park. *Division of Surgical Oncology, Department of Surgery, The Ohio State University Wexner Medical Center, Columbus, Ohio., Columbus, OH.*

Introduction: Recent Cochran review has shown only 37.3% of conference abstracts lead to full peer-reviewed publication. The scientific rigor of the abstracts presented at the Society of Surgical Oncology (SSO) meeting has not been recently evaluated. In this study, we seek to determine the rate at which abstracts presented at the 2018 SSO meeting were published in a peer-reviewed journal. Methods: Abstracts from the 2018 SSO conference were searching in PubMed using the abstract title and/or first or last author. Video presentations were not included. Publication date was determined by the online publication date and impact factor by 2019 number provided on Web of Science. Data was analyzed with t test and Fischer's exact test. Results: Five-hundred thirty-nine abstracts were presented at SSO 2018 conference and of that 215 (40%) resulted in a full publication. Out of the 215 published manuscripts, 76 (35.5%) were published in the Annals of Surgical Oncology (ASO). The average time from presentation to publication in the ASO was approximately 9.1 months (SD 7.0). Abstracts not published in ASO resulted in a significantly longer time to publication (12.6 months SD 7.9 p=0.002). There was no significant difference between the impact factor of ASO (4.1) and that of other journals (mean impact factor 4.2 SD 3.9 p=0.744). Parallel and plenary session were more likely to result in publications than Quick Shots or Poster Sessions (p<0.001). Studies classified as clinical trials were more likely to be published than retrospective or basic science abstracts (p=0.017). Studies performed at a single institution were more likely to be published (p=0.008) while there was no significant difference in nationality of institution. (Table 1). Conclusion: Approximately 40% of the abstracts presented at the 2018 SSO conference resulted in a published manuscript. Higher publication rate for plenary and parallel sessions indicate that the abstract review process properly stratifies the research. As virtual conferences become mainstream due to COVID-19 pandemic, the effects of this new format on overall research quality and publication rate is of interest in future studies.

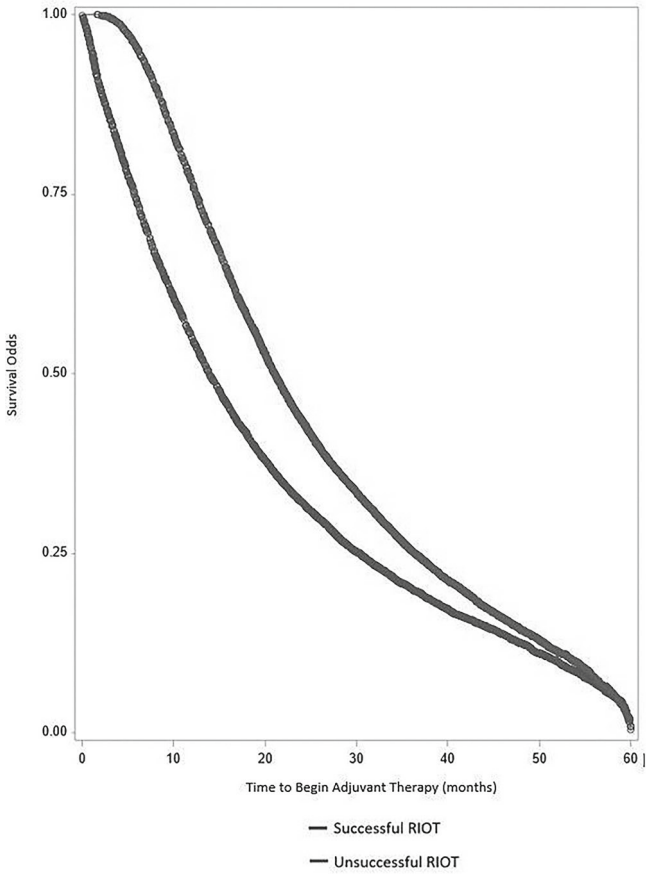
Table 1: Factors associated with publication in any journal.

	Published		P- value
	No (n=324)	Yes (n=215)	
Session			<0.001
Plenary	1 (0.3%)	7 (3.3%)	
Parallel	36 (11.1%)	65 (30.2%)	
Oral	3 (0.9%)	0 (0.0%)	
Quick Shot	33 (10.2%)	27 (12.6.0%)	
Poster	251 (77.5%)	116 (54.0%)	
Type of Data			0.017
Clinical Trial	10 (3.1%)	18 (8.4%)	
Retrospective	251 (77.7%)	165 (76.7%)	
Basic Science	62 (19.2%)	32 (14.9%)	
Institution			0.10
USA	259 (79.9%)	163 (75.8%)	
International	57 (17.6%)	39 (18.1%)	
Multinational	8 (2.5%)	13 (6.0%)	
Single Institution			0.008
No	104 (32.1%)	94 (43.7%)	
Yes	220 (67.9%)	121 (56.3%)	

P219

Return to Intended Oncologic Therapy in Patients Treated for Pancreatic Adenocarcinoma A. Fatunmbi,* B. Nuckles, S. Wang, K. Young, M. Shabahang, J. Blansfield. *General Surgery, Geisinger Medical Center, Danville, PA.*

Introduction: Return to intended oncologic therapy (RIOT) has emerged as an important metric to gauge the effectiveness in which patient's carry out their oncological treatment and has been utilized as a quality measure. Previous studies have shown that inability to RIOT is associated with reduced disease free and overall survival. Historically there has been poor compliance with RIOT however the cause has not been well studied. The aim of this study was to determine how RIOT affects survival and what factors contribute to inability to RIOT. Methods: This is a retrospective review of patients diagnosed with pancreatic adenocarcinoma between 2004 and 2017 who underwent adjuvant therapy after surgical resection for curative intent. Patient and tumor characteristics were described. Multivariate logistic regression was performed to identify the effects of demographics and hospital characteristics on ability to RIOT. Results: A total of 32,346 patients were included in the study. The majority of patients had malignancy within the head of the pancreas (78.2%) and had T2 or T3 disease (82.6%). Overall, 57.8% of patients over the study period had successful RIOT. The proportion of patients who completed adjuvant therapy increased steadily from 46.2% in 2006 to 65.6% in 2016. Multivariate analysis showed age over 70, distance from treatment center, facility type, inpatient length of stay, higher Charlson-Deyo comorbidity index, and year of diagnosis to be independent predictors of inability to RIOT. Patients who had successful RIOT had improved 5-year survival compared to those who did not. Conclusions: The proportion of population able to RIOT has increased over the past decade. Successful RIOT resulted in improved 5-year survival. Patient and tumor specific factors are involved in determining a patient's ability to RIOT. Modifiable factors such as comorbidity index, distance to treatment center, and hospital length of stay should be optimized to improve compliance with RIOT.



5-Year Survival: Successful RIOT vs Inability to RIOT

P220

10-Year Survivorship in Patients with Metastatic Gastrointestinal Stromal Tumor T.L. Sutton,* B.S. Walker, K.G. Billingsley, C. Corless, B.C. Sheppard, M. Heinrich, S.C. Mayo. *Surgery, Oregon Health and Science University, Portland, OR.*

Introduction: Patients developing metastatic gastrointestinal stromal tumors (mGIST) have heterogeneous disease biology and oncologic outcomes. Long-term survivorship requires tyrosine kinase inhibitor (TKI) therapy, yet prognostic factors in mGIST are incompletely characterized. Methods: We performed a review of patients with mGIST at our Comprehensive Cancer Center from 2003-2019 including only patients with either mortality or 10-year follow-up. Clinicopathologic data were used for Kaplan-Meier analysis, Cox proportional hazards modeling, and binary logistic regression to evaluate factors associated with progression-free and overall survival (PFS, OS), measured from the date of metastasis. Results: n=109 patients were identified with a median age of 57 years at metastasis. 62 (57%) patients had synchronous metastasis; liver (n=48, 44%), peritoneum (n=40, 37%), and liver + peritoneum (n=18, 17%) were the most common sites. 46 (42%) patients were 10-year metastatic survivors. Following metastatic diagnosis, radiographic progression occurred within 2 years in 45% (n=49), 2-5 years in 14% (n=15), and 5-10 years in 16% (n=17), with 10-year OS of 14%, 40%, and 88%, respectively. 17 (16%) patients did not progress, while 11 (10%) died prior to radiographic progression. 52 (47%) patients underwent metastasectomy. On multivariable regression, factors associated with improved 10-year OS were receipt of metastasectomy (HR 0.42, P=0.002) (Figure) and age at metastasis (HR 1.04, P<0.001). Factors associated with worse PFS were PDGFRA mutation (HR 2.56;, P=0.033), other non-KIT mutations (HR 3.46, P=0.016), primary mitotic count >5/50 high-powered field (HR 2.56, P=0.029), and ≥12 months of TKI therapy prior to metastasis (HR 1.73, P=0.039). These associations were largely preserved on subgroup analysis for KIT and non-KIT tumors. Conclusions: 10-year survivorship is achievable for patients with metastatic GIST and is associated with receipt of metastasectomy and time to first progression. An improved understanding of predictive factors for progression beyond driver mutation is needed to improve survivorship and further define the role of TKI treatment.

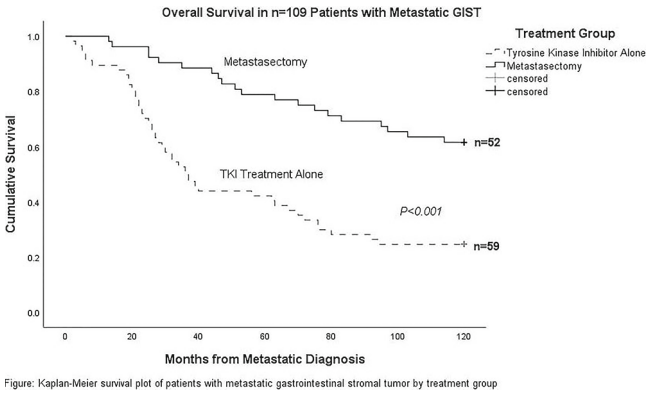


Figure: Kaplan-Meier survival plot of patients with metastatic gastrointestinal stromal tumor by treatment group

Figure: Kaplan-Meier survival plot of patients with metastatic gastrointestinal stromal tumor by treatment group

P221

Adjuvant Imatinib in High-Risk Resected GIST: Merely Delaying the Inevitable? T.L. Sutton,* B.S. Walker, K.G. Billingsley, C. Corless, B.C. Sheppard, M. Heinrich, S.C. Mayo. *Surgery, Oregon Health and Science University, Portland, OR.*

Introduction: Patients with high-risk resected gastrointestinal stromal tumors (GIST) receiving adjuvant imantinib have improved recurrence-free survival (RFS). Whether this is due to a cytocidal or cytostatic effect is unknown; prognostic tools for RFS and overall survival (OS) following adjuvant treatment are still lacking. We sought to investigate the effect of adjuvant imatinib on GIST recurrence using a normalized recurrence timeline. Methods: We reviewed patients with resected high-risk GIST at our Cancer Center from 2003-2018. RFS and OS were analyzed using Kaplan-Meier analysis and Cox proportional hazards modeling. The performance of the pre-imatinib era Memorial Sloan Kettering (MSK) GIST nomogram was assessed for predicting RFS following adjuvant therapy. Results: n=86 patients with high-risk resected GIST were identified, with a median of 104 months of post-surgical follow-up. Median age was 60 years. 29 (34%) patients did not receive adjuvant imatinib, while 57 (66%) did for a median of 2 years. Patients receiving adjuvant imatinib therapy had nearly identical predicted post-surgery 5-year RFS by the MSK nomogram compared to those without adjuvant imatinib (29% vs 31%, P=0.82). On multivariable analysis, years of adjuvant imatinib therapy (HR 0.66, P<0.006), but not MSK-predicted RFS, was independently associated with improved 5-year actual RFS. When RFS was measured from end of oncologic treatment (i.e., surgery or adjuvant therapy), MSK-predicted RFS was independently associated with actual post-therapy RFS (HR 0.22, P=0.015), while years of adjuvant imatinib was not (Figure). Neither receipt nor duration of adjuvant imatinib were associated with OS (P>0.7 for both). Conclusions: Prognostic nomograms from the pre-imatinib era can predict RFS after adjuvant therapy in patients with high-risk resected GIST. Based on our analysis, imatinib delays GIST recurrence without exerting an independent curative effect or survival benefit. In addition, many patients may receive adjuvant imatinib unnecessarily. Following curative-intent resection, awaiting radiographic recurrence prior to initiating imatinib may result in equivalent oncologic outcomes and is deserving of further study.

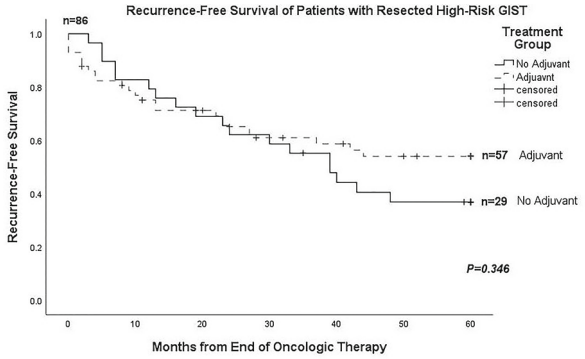


Figure: Kaplan-Meier recurrence plot of patients with resected high-risk gastrointestinal stromal tumor. Time to recurrence measured from end of oncologic therapy (i.e., date of surgery in patients not receiving adjuvant imatinib, or end date of adjuvant imatinib).

P222

Does Surgical Resection Improve Survival in Patients with Metastatic/Recurrent Gastrointestinal Stromal Tumors (M/R-GIST)? P. Miles,[1]* M.A. Rodriguez,[1] B. Zambetti,[1] D. Wong,[1] K.S. Cools,[1] P.V. Dickson,[1] J.L. Deneve,[1] M. Tsao,[1] E.S. Glazer,[1] E. Paulus,[2] D. Yakoub.[1] *1. Surgery, University of Tennessee Health Science Center, Memphis, TN; 2. CMU School of Medicine, Saginaw, MI.*

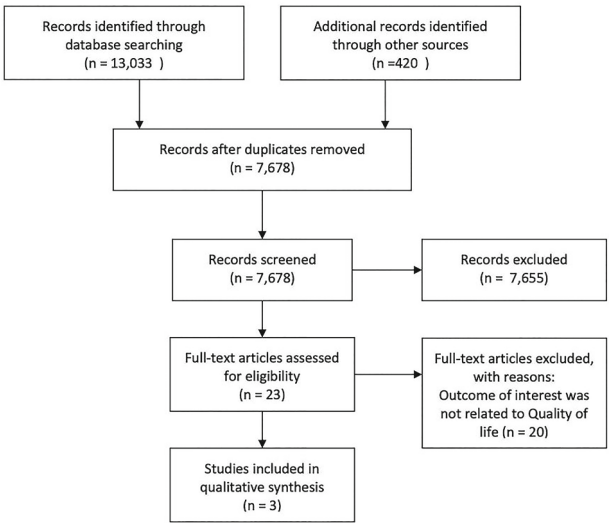
INTRODUCTION: We aimed to examine the long-term outcomes of surgical resection in Metastatic/Recurrent GIST patients receiving tyrosine kinase inhibitors (TKI). METHODS: A comprehensive search of electronic databases was conducted (Jan 2000 – Jul 2020). Studies comparing progression free (PFS) and overall survival (OS) in patients undergoing TKI therapy with or without surgery were included. Pooled risk ratios (RR) with 95% confidence intervals (CI) for PFS at 1, 2, and 3-years and OS at 1, 3 and 5-years were calculated. Study quality, heterogeneity and bias were assessed. RESULTS: Search strategy yielded 1,744 studies, of which 19 studies met the final selection criteria with a total of 2560 patients: 1800 received TKI alone, 760 received TKI+surgery. Demographic variables, comorbidities and tumor stage were similar in both groups. Meta-analysis showed an increased PFS at 1, 2, and 3 years (RR=0.87, 95% CI:0.75 – 0.99, p=0.04; RR=0.70, 95% CI: 0.57 – 0.85, p < 0.001; RR=0.64, 95% CI: 0.56 - 0.70, p < 0.001) and OS at 1, 3, and 5-years (RR=0.93, 95% CI 0.88 – 0.97, p = 0.002; RR=0.78, 95% CI:0.70 - 0.87, p < 0.001; RR=0.65, 95% CI:0.55 – 0.77; p <0.001) in the TKI+surgery group. Subgroup analysis of larger and higher quality studies confirmed overall results. CONCLUSION: Surgical resection improves PFS and OS in M/R GIST patients on TKI. The results should be viewed with caution since most included studies were retrospective. Randomized controlled trials are needed to examine the optimum timing and long-term outcomes of surgery in these patients.

P223

The Impact of Radical Resection for Retroperitoneal Sarcoma on Quality of Life: A Systematic Review G. Frenda,[2]* A. Al Mobarak,[2] L. Hales,[3] N. Al Busaidi,[2] S. Meterissian,[2] A. Gronchi,[1] S. Dumitra.[2] *1. Fondazione IRCCS Istituto Nazionale dei Tumori, Department of Surgery, Milan, Italy; 2. Department of Surgery, McGill University, Montreal, QC, Canada; 3. Medical Libraries, McGill University Health Center, Montreal, QC, Canada.*

INTRODUCTION About 50-60% of patients with retroperitoneal sarcomas(RPS) undergoing surgical resection will be long-term survivors. Quality of life(QOL) data for these patients are scarce. We conducted a systematic review assessing the impact of surgery on long term QOL in patients with RPS. METHODS A systematic search of MEDLINE, EMBASE, Cochrane Library, PubMed and Scopus for RCT or observational studies published without language restriction with a follow-up ≥12 months that examined the impact of RPS resection on QOL up until February 2020 was performed. RESULTS Of the 7678 studies assessed, 3 observational studies(n=201) met our inclusion criteria. One cross-sectional study(n=95) evaluated long term morbidity using the Lower Extremity Functional Scale & Brief Pain Inventory questionnaires with a median response time of 49 months after surgery. 76% of patients reported symptoms related to a sensory disorder of the thigh, groin or genitals after surgery, which persisted in 62% of patients at the time of the surveys. Total/partial resection of the psoas muscle was associated with sensory disorders when compared to fascial/no resection(96vs.52%, p<0.001). The second prospective cohort study(n=48) used EORTC QLQ-30 at various follow-up points to assess the impact of toxicity from both radiation therapy and surgery on QOL. In this cohort, 88% of patients reported chronic toxicities at 36-months post-treatment. However, patients had a significantly better QLQ-30 score at 36 months compared to pre-treatment (75vs.48.5, p=0.001). The third prospective cohort study(n=58) assessed long term QOL after surgery. QLQ-30 score difference at 12 months from baseline was 6.9 points higher (95%CI -0.3-14.2). Worsening of physical function was noted (mean: -7.5, 95CI -13.3 to -1.6, p=0.01) while 41.4% of patients reported neuropathic pain 12 months post-surgery. CONCLUSION Radical resection of RPS can have long term effects on QOL, some of which appear to improve over time. This review supports current management of RPS and findings can be helpful to inform patients about recovery. Efforts should be made to increase the use and reporting of patient reported outcomes (PRO) in RPS.

Figure 1: PRISMA Flow Diagram



P224

National Trends in Treatment for Retroperitoneal Soft Tissue Sarcoma: How Variable are Practice Patterns Amongst Low and High-Volume Centers? A.M. Villano,* R. Vidri, E.T. Vo, S.H. Greco, K.J. Howell, M. von Mehren, J.M. Farma. *Surgical Oncology, Fox Chase Cancer Center, Philadelphia, PA.*

Introduction: Owing to the rarity of retroperitoneal soft tissue sarcoma (RPS), little level 1 evidence exists to guide multimodality treatment. Decisions are thus generally based on expert opinion. This analysis aimed to describe national RPS treatment trends and explore potential variability amongst low/high volume hospitals (LVH/HVH). Methods: In total, 6,439 patients who underwent resection for primary RPS were retrospectively identified in the National Cancer Database (2004-2017). Time trend analyses examined rates of multivisceral resection (MVR), radiation, and chemotherapy use. LVH's were defined as <10 resections/year (N=5,668), whereas HVH's were defined as >10 (N=681). Descriptive statistics and Pearson coefficients compared trends amongst groups. Results: Both cohorts were similar in age (p=0.87) and comorbidities (p=0.15). HVH's treated larger, more high-grade tumors, more stage III tumors, and a higher proportion of liposarcomas (p<0.001). MVR was more frequent at HVH's (60.1% vs. 40.7%, p<0.001); however, over the study period MVR increased at LVH's (38.8% to 45.6%, p<0.001). Sequencing and use of radiation varied widely by hospital volume (Figure). HVH's more frequently

employed preoperative radiation as compared to LVH's (13.4% vs. 8.0%, p<0.001). Throughout the study period, LVH's increased utilization of preoperative radiation (2.5% to 11.7% p<0.001) whereas rates at HVH's remained stable. Overall, LVH's utilized postoperative radiation significantly more frequently as compared to HVH's (14.9% vs. 2.6%, respectively, p<0.001). Postoperative radiation use at LVH's remained stable until 2013 and sharply declined thereafter (20.4% to 6.6%, p<0.001). HVH's had low and statistically unchanged rates of postoperative radiation use (0.0% to 3.5%, p=0.213). Rates of R2 resection were stable over time and lower at HVH's (6.2% vs. 16.8%, p<0.001). Conclusions: Despite significant differences overall, strategies for resection and radiation use at LVH's have trended towards those of HVH's. Future investigation to understand how hospitals manage R2 resections and if this modulates recurrence/survival is warranted.

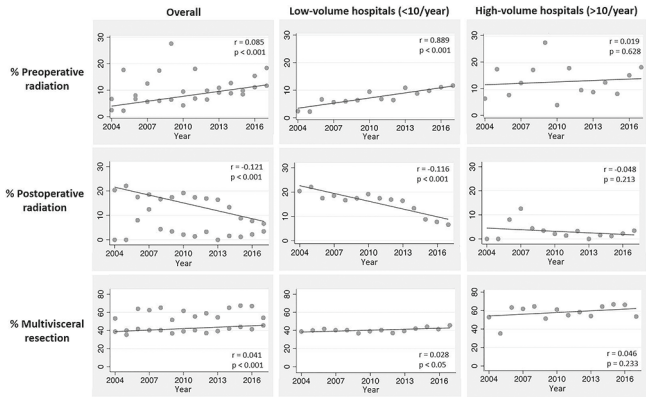


Figure. Time trend analysis exploring rates of multivisceral resection, preoperative radiation, and postoperative radiation amongst surgically resected RPS patients. Grey dots represent individual values for a given year. Red lines represent fitted trends. r = Pearson correlation coefficient.

P225

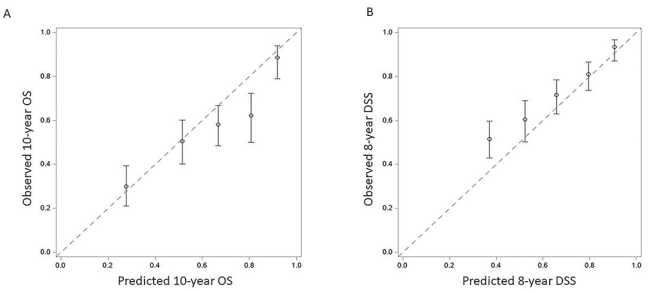
Preoperative Assessment of Bone Invasion and Prognostic Impact in Extremity Soft Tissue Sarcomas D. Garcia-Ortega,[1]* A. Alvarez-Cano,[2] M.A. Clara-Altamirano,[1] K.S. Martín-Tellez,[3] H. Martinez-Said,[1] C.d. Ruvalcaba-Gonzalez,[1] M. Cuellar-Hubbe.[1] *1. Skin and soft tissue tumors, Instituto Nacional de Cancerologia (Mexico), Tlalpan, Mexico; 2. Oncare Cancer Center, Monterrey, Mexico; 3. Hospital Angeles de las Lomas, Mexico, Mexico.*

Background: Soft tissue sarcomas are most frequently located in the extremities (eSTS) Surgery with negative margins is the treatment of choice, with chemotherapy or radiation therapy in selected cases. Seldom eSTS present with bone invasion, and this should be identified and surgery planned accordingly in order to achieve a negative margin. The objective of this study was to evaluate the presence of bone invasion in preoperative imaging studies and its association with histologically-proven invasion; as well as it's value as a prognostic factor in patients with eSTS. Methods: All patients who underwent surgery from 2012 to 2017 for eSTS were identified from a retrospective database with prospective follow-up at our institution. Demographic features were compared using chi-square analysis or independent-sample Student t-test. Disease outcomes were compared for those with and without bone invasion using a Kaplan-Meier survival analysis and the Cox model. Results: 411 patients with eSTS were included. 36 patients (8.7%) had evidence histological evidence of bone invasion, of these, only 15 (41.7%) were identified preoperatively through imaging studies (MRI or CT scan). Cases with bone invasion had a tumor median size of 11.7 cm (IQR 7.4-20.5 cm), 18 (50%) had synchronous metastatic disease, interestingly, in the remaining 18 cases without distant metastasis at presentation, eventually 83.3% developed it. The lower extremities were most frequently affected (thigh 25%, leg 22.2%, foot 19.4%), the most frequently found histological types were synovial sarcoma 15 (41.7%), dedifferentiated liposarcoma 4 (11.1%), UPS 3 (8.3%). Patients with bone invasion had an overall survival of 18 months (95% CI 12.6-23.3). Bone invasion was found to be a prognostic factor for overall survival in multivariate analysis (p <0.0001). Conclusion: Bone invasion was identified preoperatively in less than half of patients, this should raise clinical suspicion when planning the surgical procedure, the association with distant metastasis suggests and lower overall survival found in this patients, might be considered as a significant risk factor when deciding systemic adjuvant therapy.

P226

Extremity Soft Tissue Sarcoma: A Multi-Institution Validation of Prognostic Nomograms M.H. Squires,[1]* C.G. Ethun,[2] E. Donahue,[1] J.H. Benbow,[1] M. Manandhar,[8] C.J. Anderson,[1] J.C. Patt,[1] J.S. Kneisl,[1] J.C. Salo,[1] J.S. Hill,[1] R. White,[1] M.H. Jagosky,[1] W.A. Ahrens,[1] R.S. Prabhu,[1] M. Livingston,[1] N.L. Gower,[1] M. Needham,[1] S. Trufan,[1] R.C. Fields,[3] B.A. Krasnick,[3] K.I. Votanopoulos,[4] K. Chouliaras,[4] V. Grignol,[5] K.K. Roggin,[6] J. Tseng,[6] G. Poultsides,[7] T. Tran,[7] K. Cardona,[2] H.J. Harrison.[5] *1. Department of Surgery, Atrium Health, Levine Cancer Institute, Charlotte, NC; 2. Emory University, Atlanta, GA; 3. Washington University School of Medicine, St. Louis, MO; 4. Wake Forest University, Winston Salem, NC; 5. The Ohio State University, Columbus, OH; 6. University of Chicago, Chicago, IL; 7. Stanford University, Stanford, CA; 8. University of South Alabama, Mobile, AL.*

Introduction: Prognostic nomograms incorporating histology-specific variables have been developed for patients undergoing resection of extremity soft tissue sarcoma (STS). These include the Sarculator nomogram for 5- and 10-year overall survival (OS) and distant-metastasis free survival (DMFS), and Memorial Sloan Kettering (MSK) sarcoma nomogram for 4-, 8-, and 12-year disease-specific survival (DSS). We sought to validate the Sarculator and MSK nomograms within a large, modern multi-institutional cohort of primary extremity STS patients undergoing resection. Methods: Patients who underwent resection of primary extremity STS from 2000-2017 at 9 high-volume institutions were identified. Predicted 5- and 10-year OS and DMFS and 4-, 8-, and 12-year DSS were calculated from the Sarculator and MSK nomograms, respectively. Predicted survival probabilities stratified in quintiles were compared in calibration plots to observed survival assessed by Kaplan-Meier estimates. Discriminative ability of nomograms was quantified by Harrell's concordance index (C-index). Results: A cohort of 1326 patients with resected primary extremity STS was identified. Common histologies included undifferentiated pleomorphic sarcoma (35%), fibrosarcoma (13%), and leiomyosarcoma (9%). Median tumor size was 8.0cm (IQR 4.5-13.0) and tumor grade distribution was: Grade 1 (13%), Grade 2 (9%), Grade 3 (78%). Median follow-up time was 34 months. Median OS was 172 months, with estimated 5- and 10-year OS of 70% and 58%. The C-indices for 5- and 10-year OS (Sarculator) were 0.72 (95%CI:0.70-0.75) and 0.73 (95%CI:0.70- 0.75), and 0.72 (95%CI:0.69-0.75) for both 5- and 10-year DMFS. Calibration plots showed good predictability for 5- and 10-year outcomes. The C-indices for 4-, 8-, and 12-year DSS (MSK) were 0.71 (95%CI:0.68-0.75); plots demonstrated similarly good calibration ability. Conclusion: Both Sarculator and MSK nomograms demonstrated good prognostic ability for survival and recurrence outcomes in a modern, multi-institutional cohort of patients with resected primary extremity STS. External validation of the clinical utility of these nomograms supports their ongoing adoption into clinical practice.



Calibration plots of A) observed vs. predicted 10-year overall survival (OS) using the Sarculator nomogram, and B) observed vs. predicted 8-year disease specific survival (DSS) using the Memorial Sloan Kettering sarcoma nomogram. Dashed 45-degree line represents reference line along which ideal nomogram would lie.

P227

Modern Challenges in the Diagnosis and Management of Paratesticular Sarcomas N. Al Busaidi,* G. Frenda, S. Meterissian, S. Dumitra. *Surgery, McGill University, Montreal, QC, Canada.*

Introduction: Paratesticular sarcomas are rare tumors originating from the mesenchymal components of the paratesticular area that include the spermatic cord, testicular tunics, epididymis, and vestigial remnants. They are commonly discovered incidentally during inguinal hernia surgery, presenting as inguinal or scrotal masses. We aimed to assess the current patterns of presentation, histology, disease course, and sequence of treatments offered to patients with paratesticular sarcomas at a tertiary sarcoma center. Methods: Our cancer center registry was querried for patients who were diagnosed, assessed, treated for primary, residual, and recurrent paratesticular sarcomas from Jan 2005-Sep 2020. Baseline demographics, diagnosis, margin status, treatments received, and oncologic outcomes were reviewed. Results: Twenty patients with paratesticular sarcomas were identified, in men aged 41-85 years (median 61.5 years). These sarcomas involved the spermatic cord (n=9;45%), testicular tunics (n=10;50%), and epididymis (n=1,5%). Tumor size ranged from 2 to 25cm (mean 8.7cm; median 8cm). Histopathology varied with 50% well-differentiated liposarcoma(WDL), 20% de-differentiated liposarcomas(DDL), 10% leiomyosarcomas, and 20% were of other histological types. Importantly 35%(n=7) of cases were identified after resection for other indications (inguinal hernia, hydrocele, benign mass), 4(57%) of which underwent re-resection and 2 had mesh removal. Two patients(10%) had disease extension into the retroperitoneum. Only 3(15%) patients had a high ligation of the spermatic cord. Regarding the setting of receiving radiotherapy, 3 were adjuvant, 3 were neoadjuvant, and 1 was palliative. One third of patients had metastatic disease on presentation; all of whom received chemotherapy and only one is still alive with disease. Conclusion: This study emphasizes the rarity and persistent lack of awareness of paratesticular sarcomas despite recent improvements. Delays in diagnosis and staging lead to frequent unplanned resections, a high proportion of metastatic disease at presentation and poor overall outcomes. A multidisciplinary tumor board discussion with input from a sarcoma surgeon is paramount.

P228

Stratification of Leiomyosarcoma Disease Site with Similar Oncologic Outcomes Can Inform Clinical Trial Design M.J. Carr,[1]* J. Sun,[2] W.A. Adams,[3] S.M. Naqvi,[1] Y. Kim,[1] O. Binitie,[1] D.M. Joyce,[1] D.D. Letson,[1] R. Gonzalez,[1] J.S. Zager,[1] J. Mullinax.[1] *1. Surgical Oncology, Moffitt Cancer Center, Tampa, FL; 2. University Hospitals, Cleveland, OH; 3. University of South Florida Morsani College of Medicine, Tampa, FL.*

Introduction Given the rarity of leiomyosarcoma (LMS), efficient completion of clinical trials requires the creation of patient strata that have similar outcomes. LMS can arise within several distinct anatomic locations and understanding the prognostic impact of site could inform clinical trial design. The goal of this study was to understand the impact of site stratification in LMS patients to inform future trial design. Methods A single-institution retrospective chart review of clinicopathologic and outcomes data was conducted on LMS patients diagnosed 1998-2019. Patients were stratified by location of index diagnosis. Uterine and bone LMS were excluded. Analyses were performed using ANOVA, Chi-square association, log-rank and Cox proportional hazards regression. Results 373 LMS patients were evaluated. LMS site cohorts included cutaneous (24%), soft tissue (28%), retroperitoneal (RP, 13%), vascular (15%) and visceral (20%). (Table 1)Visceral patients were younger with median age of 58 at diagnosis (p=0.03). Cutaneous were smallest in diameter and least likely to be metastatic at presentation (median 1.4cm; n=1, <1%), where RP and visceral were largest and most often metastatic (median 9.5 and 7.7cm; n=13 (37%) and n=18 (35%), respectively; p<0.001). Preoperative radiation to the primary was used most often in vascular and soft tissue (n=10, 19% and n=18, 17%; p=0.03). Preoperative systemic chemotherapy was most often used in vascular and RP (n=20, 37% and n=15, 31%; p<0.001). There was no significant difference in adjuvant radiation, but visceral received adjuvant chemotherapy more often across locations. Cutaneous were more likely to be low grade, where RP and vascular were intermediate grade and soft tissue and visceral high grade. Patients with cutaneous and soft tissue were significantly less likely to experience recurrence compared to RP, vascular, and visceral (all p<0.001). (Table 1) Conclusions LMS patients stratified by five distinct sites demonstrated significant differences in grade, size and stage at diagnosis, and risk of recurrence. Using anatomic site as a composite factor for stratification may be applied to future clinical trial design.

Table 1. Oncologic Outcomes of Leiomyosarcoma by Location

Covariate	Level	Cutaneous (n=91)	Soft Tissue [a] (n=104)	Retroperitoneal (n=49)	Vascular [b] (n=54)	Visceral [c] (n=75)	p-value*
Grade	High	18	31	13	13	33	< 0.001
	Intermediate	30	17	16	18	17	
	Low	42	10	6	3	5	
Adjuvant chemotherapy	No	91	91	30	33	58	< 0.001
	Yes	0	6	7	6	12	
Adjuvant radiation to primary site	No	84	72	28	37	63	0.412
	Yes	7	25	9	2	7	
Local recurrence free survival	N	91	95	35	36	55	< 0.001
	Median years	NE	9.3	3.9	3.2	3.9	
	Hazard ratio (95% CI)	0.18 (0.09-0.39)	0.45 (0.27-0.74)	0.94 (0.52-1.68)	0.92 (0.51-1.67)	Reference	
Distant recurrence free survival	N	91	95	35	36	55	< 0.001
	Median years	NE	12.8	4.9	3.2	6.3	
	Hazard ratio (95% CI)	0.15 (0.06-0.39)	0.53 (0.30-0.92)	1.04 (0.54-1.99)	1.26 (0.66-2.39)	Reference	
Overall survival	N	91	104	49	54	75	< 0001
	Median years	NE	13.3	4.4	5.5	4.2	
	Hazard ratio (95% CI)	0.29 (0.14-0.59)	0.34 (0.2-0.58)	1.09 (0.64-1.84)	0.91 (0.52-1.59)	Reference	

N: number of events evaluated for covariate
NE: not estimable
[a]Soft tissue: leiomyosarcoma of the extremity, head and neck, and trunk soft tissue regions
[b]Vascular: leiomyosarcoma arising within a named vein (i.e. iliac, inferior vena cava, gonadal)
[c]Visceral: leiomyosarcoma of the thoracic, abdominal, and genitourinary organs
*The parametric p-value is calculated by ANOVA for numerical covariates and Mantel-Haenszel Chi-square test for categorical covariates.

P229

Recurrence of Cutaneous Leiomyosarcoma–Resection Margin or Biology? C.A. Harter,* L.L. Hoff, E. Olsen, A. Bhattacharya, N. Mott, C.V. Angeles, T. Hughes. *University of Michigan, Ann Arbor, MI.*

Introduction. Cutaneous leiomyosarcoma (cLMS) is a rare cancer. While the prognosis is generally favorable, there is heterogeneity between tumors confined to the dermis compared to those involving or arising in the subcutaneous tissues. Wide local excision (WLE) is commonly performed though recommendations for margins are not defined. We explored the relationship between both surgical margins and tumor subtype on the risk of cLMS recurrence. Methods. A retrospective chart review identified patients diagnosed with primary cLMS at a single institution. Patients were identified using the institutional cancer registry and an Electronic Medical Record Search Engine (EMERSE) and confirmed to have cLMS by pathology review. Patient and tumor characteristics and surgical and recurrence data were collected using REDCap. Descriptive statistics were used to explore recurrence rates by margin size and cLMS subtype. Results. The initial search identified 311 patients. Pathology review confirmed 131 patients with a diagnosis of cLMS. Median follow-up was 25 months (range: 1-160). Among patients with a diagnosis of cLMS, 78 patients had primaries confined to the dermis, 39 had tumors arising in the dermis with subcutaneous extension, 11 patients had primary subcutaneous lesions and 3 subtypes could not be determined. The recurrence rate among patients with isolated dermal lesions was 3.5%, compared to 45% among patients with subcutaneous primaries. (Table 1) Among those with cLMS, 28 patients had surgical margins that could not be determined, leaving 103 patients with margins available for analysis. The majority of patients had either 1 or 2 cm margins, with 46% of patients with 1cm and 27% of patients with 2 cm margins. Recurrence rates varied by margin size, though larger margins did not correspond to a lower recurrence rate. The highest recurrence rates occurred in patients with >2cm margins (40%) and exactly 2 cm margins (21%). (Table 1) Conclusion. Overall, recurrence rates are low and narrower margins are not associated with higher recurrence rates. cLMS subtype appears to be associated with risk of recurrence, with both origin in and extension to subcutaneous tissue being associated with a worse prognosis.

Recurrence Risk by Margin Size and Cutaneous Leiomyosarcoma Subtype

Margin Size (n=103)	Recurrences (%)	Location of Recurrence (count)	cLMS Subtype (n=128)	Recurrences (%)	Location of Recurrence (count)
<1 cm (n=10)	1 (10)	Local (1)	Dermal (n=78)	3 (3.8)	Distant (3)
1 cm (n=47)	1 (2.1)	Local and Distant (1)*	Dermal with subcutaneous extension (n=39)	6 (15.4)	Local (4), Distant (2)
>1 cm but less than 2 cm (n=8)	1 (12.5)	Distant (1)	Subcutaneous (n=11)	5 (45.5)	Local (1), Local and Distant (1)*, Distant (3)
2 cm (n=28)	6 (21.4)	Distant (4), Local (2)			
>2 cm (n=10)	4 (40)	Distant (3), Local (1)			

*Local and distant recurrences detected simultaneously

P230

Do Delays to Initiation of Treatment for Retroperitoneal Sarcoma Affect Oncologic Outcomes? G. Frenda,[1]* S. Jatana,[2] N. Al Busaidi,[1] S. Meterissian,[1] S. Dumitra.[1] *1. Department of Surgery, McGill University, Montreal, QC, Canada; 2. Faculty of Medicine, McGill University, Montreal, QC, Canada.*

INTRODUCTION Retroperitoneal sarcomas(RPS) are rare malignancies requiring specialized care in referral centers. With late onset of symptoms common in RPS & only select centers providing treatment, do delays in care affect outcomes? Our objective was to conduct a review of patients treated for RPS to assess if delayed initiation of treatment affected oncologic outcomes in RPS. METHODS A retrospective cohort study of patients seen in consultation for RPS at a tertiary referral center from 2008 to 2019 was performed. Time to treatment was defined by date of first consultation with surgical oncologist & date of initiation of surgery, radiation or systemic therapy depending on which treatment occurred first. Patients were grouped into 30(30DD),60(60DD) & 90(90DD) day delay groups. Multivariate Cox regression was used to assess Disease-Free(DFS) & Overall Survival(OS). RESULTS Inclusion criteria were met in 87 patients. In the 30DD group, 58(66.7%) patients had delays of 31+ days, & 29(33.3%) patients received their treatment in ≤30 days. In the 60DD group, 27(31%) patients had delays of 61+ days, & 60(69%) patients received their treatment in ≤60 days. In the 90DD group, 11(12.6%) patients had delays of 91+ days,& 76(87.4%) patients received their treatment in ≤90 days. All groups were comparable across baseline demographics. In the multivariate analysis, adjusting for age & histologic subtype, when looking at DFS, neither 30 day(HR=0.73, CI95%0.33–1.59, p=0.427), 60 day(HR=0.83, CI95%0.37-1.89,p=0.658) nor 90 day(HR=0.80, CI95%0.22-2.93,p=0.734) delays to initiation of treatment were statistically significant. Similarly, when looking at OS, neither 30 day(HR=1.01, CI95%0.45-2.29, p=0.981), 60 day(HR=0.69, CI95%0.29-1.63,p=0.391) nor 90 day(HR=1.20, CI95%0.42-3.44,p=0.737) delays to initiation of treatment were statistically significant. CONCLUSION In this study, 30, 60 & 90 day delays to initiation of treatment were not associated with a significant difference in DFS & OS, when adjusting for age & histologic subtype. The lack of association may be secondary to RPS commonly presenting at an advanced stage at consultation. Further studies are needed to support these findings.

Table 4: Cox Regression Analysis for Delays

Table 4a: Cox Regression Analysis for 30 Day Delay	Univariate Analysis HR (95% CI)	P-Value	Multivariate Analysis HR (95% CI)	P-Value
Disease–Free Survival				
30 Day Delay	0.53 (0.26–1.06)	0.073	0.73 (0.33–1.59)	0.427
Age (>60)			0.98 (0.45–2.09)	0.95
Histologic Subtype (Ref: WDLPS)				
DDLPS			2.15 (0.57–8.13)	0.261
LMS			2.83 (0.78–10.23)	0.113
Other			7.56 (1.80–31.77)	0.006
Overall Survival				
30 Day Delay	0.67 (0.33–1.38)	0.278	1.01 (0.45–2.29)	0.981
Age (>60)			0.97 (0.44–2.12)	0.94
Histologic Subtype (Ref: WDLPS)				
DDLPS			2.41 (0.50–11.64)	0.274
LMS			2.26 (0.47–10.77)	0.308
Other			6.88 (1.46–32.48)	0.015
Table 4b: Cox Regression Analysis for 90 Day Delay	**Univariate Analysis HR (95% CI)**	**P-Value**	**Multivariate Analysis HR (95% CI)**	**P-Value**
Disease–Free Survival				
90 Day Delay	1.05(0.32-3.47)	0.931	0.80(0.22-2.93)	0.734
Age (>60)			1.06(0.52-2.19)	0.865
Histologic Subtype (Ref: WDLPS)				
DDLPS			2.24(0.59-8.44)	0.234
LMS			2.85(0.78-10.38)	0.111
Other			8.99(2.24-36.09)	0.002
Overall Survival				
90 Day Delay	1.59(0.61-4.15)	0.346	1.20(0.42-3.44)	0.737
Age (>60)			0.99(0.47-2.08)	0.972
Histologic Subtype (Ref: WDLPS)				
DDLPS			2.50(0.52-12.16)	0.255
LMS			2.33(0.48-11.26)	0.292
Other			6.80(1.52-30.39)	0.012

HR= Hazard Ratio; WDLPS: Well–Differentiated Liposarcoma; DDLPS: Dedifferentiated Liposarcoma; LMS: Leiomyosarcoma

P231

Evaluating the Use of IORT in Retroperitoneal Sarcoma: Analysis of the NCDB S. Kryeziu,* G. Oh, L. Hani, E. Friedman, R.S. Berman, A.Y. Lee, C. Correa-Gallego. *NYU, NYC, NY.*

Background: The role of intraoperative radiotherapy (IORT) for retroperitoneal sarcoma (RPS) is not well defined. We aim to identify patient characteristics and clinicopathologic factors associated with IORT and to investigate its effect on overall survival (OS). Methods: Patients with non-metastatic soft-tissue RPS who underwent surgical resection and radiotherapy (RT) were identified from the NCDB (2004-2016). Those receiving IORT alone or in addition to pre- or postoperative RT were classified as IORT; the remaining patients receiving radiation were classified as RT. Descriptive statistics were used to identify sociodemographic and clinicopathologic factors associated with the use of IORT. OS between the two groups was compared with Kaplan Meier and log rank test. Results: A total of 6010 patients underwent curative-intent resection for non-metastatic RPS. Of these, 1472 (24%) received radiation, of which 6% had IORT (n=89). Demographics, hospital characteristics, and clinicopathologic factors are detailed in Table 1. The two groups were comparable at baseline. Histology subtypes were similar with liposarcoma and leiomyosarcoma being most common. Notably, a subset of patients in both treatment groups had fibrolipoma/fibromyxolipoma listed for histology. IORT was most commonly performed at academic or research centers (80%). Of the 35 centers at which IORT was conducted, four centers completed 47% of all cases. Patients in the IORT group commonly underwent multivisceral resection, although this difference did not reach statistical significance. 90-day mortality was higher in the IORT group (6% vs 1%, p=0.001). Median OS for the entire cohort was 87 months (IQR 53) and similar between the two groups (IORT 82 vs. RT 87 months, p=0.6). Conclusions: The use of IORT is uncommon and limited to a small number of centers. Patients undergoing IORT in this cohort experienced a higher postoperative mortality and no overall survival benefit. Since specific indications, operative details, and local recurrence are not evaluable with this dataset, a national registry of IORT in RPS would provide useful information to further characterize this highly selected population.

Table 1

	IORT (n=89)	RT (n=1383)	*p*
Patient Demographics			
Sex			0.398
Male	46 (52)	651 (47)	
Female	43 (48)	732 (53)	
Median Age, Years (IQR)	60 (17)	61 (18)	0.667
Race			0.785
White	75 (84)	1150 (83)	
Other	14 (16)	233 (17)	
Charlson/Deyo Morbidity Score			0.373
0	65 (73)	1074 (78)	
1	16 (18)	241 (17)	
2	6 (7)	47 (3)	
≥ 3	2 (2)	21 (2)	
Hospital-Associated Characteristics			
Facility Type			<0.001
Community Cancer Program	2 (2)	71 (5)	
Comprehensive Community Cancer Program	4 (5)	381 (28)	
Academic/Research Program	71 (80)	709 (54)	
Integrated Network Cancer Program	7 (8)	151 (12)	
Clinicopathologic Characteristics			
Histology			0.257
Liposarcoma	31 (35)	503 (36)	
Leiomyosarcoma	25 (28)	479 (35)	
Malignant Fibrous Histiocytoma/Undifferentiated	3 (3)	38 (3)	
Malignant Peripheral Nerve Sheath Tumor	--	31 (2)	
Fibrosarcoma	2 (2)	21 (2)	
Fibrolipoma/Fibromyxolipoma	22 (25)	207 (15)	
Other	6 (7)	104 (8)	
Grade			0.655
1	26 (29)	288 (21)	
2	15 (17)	232 (17)	
3	30 (34)	414 (30)	
4	14 (16)	225 (16)	
Tumor Size, cm (IQR)	18 (16)	15 (16)	0.091
Surgical Data			
Procedure			0.134
Local Tumor Resection	4 (5)	127 (9)	
Radical Resection*	35 (39)	601 (43)	
Resection with En Bloc Organ Resection	37 (42)	500 (36)	
Other	6 (7)	40 (3)	
Surgical Margins			0.340
R0	50 (56)	653 (47)	
R1	18 (20)	383 (28)	
R2	12 (14)	214 (16)	
Outcomes			
30-Day Mortality	2.4%	0.5%	0.098
90-Day Mortality	6.1%	1.0%	0.001
30-Day Readmission	9.1%	4.9%	0.616
Median Follow-up, Months (IQR)	46 (46)	43 (53)	0.538

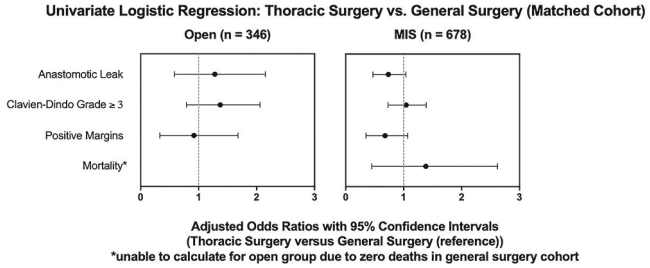
*includes simple/partial and total removal of primary site

Table 1

P232

Esophagectomies for Malignancy Among General and Thoracic Surgeons: A Propensity Score Matched NSQIP Analysis Stratified by Surgical Approach S. Leonard-Murali,[1]* T. Ivanics,[1] H. Nasser,[1] A. Tang,[2] Z. Hammoud.[3] *1. Henry Ford Hospital, Department of Surgery, Detroit, MI; 2. Henry Ford Health System, Department of Public Health Sciences, Detroit, MI; 3. Henry Ford Hospital, Department of Surgery, Division of Thoracic Surgery, Detroit, MI.*

Introduction: Training of general and thoracic surgeons in esophagectomy for malignancy continues to diverge, especially regarding minimally invasive surgery (MIS). We sought to evaluate perioperative outcomes of esophagectomy for malignancy stratified by surgical specialty and approach using a national database. Methods: The National Surgical Quality Improvement Program (NSQIP) Targeted Esophagectomy Dataset was queried for esophagectomies for malignancy and grouped by surgeon specialty: thoracic surgery (TS) or general surgery (GS). To account for confounding due to specialty selection bias, propensity score matching (PSM) was performed in a 1:1 ratio. Outcomes of interest were mortality, anastomotic leak, Clavien-Dindo grade ≥ 3, and positive margin rate. Univariate logistic regression analysis was performed for these outcomes on the matched cohort, with stratification by surgical approach (open vs. MIS). Results: 1463 patients met inclusion criteria (512 GS, 951 TS). After PSM each group was comprised of 512 patients with similar demographics, neoadjuvant therapy rates, and preoperative stage. The TS group consisted of 169 (33.0%) open and 343 (67.0%) MIS cases, while the GS group consisted of 177 (34.6%) open and 335 (65.4%) MIS cases. Mortality rates were similar overall (TS=14 (2.7%) vs. GS=10 (2.0%)) and by approach (MIS: TS=11 (3.2%) vs. GS=10 (3.0%), open: TS=3 (1.8%) vs. GS=0 (0%)). By univariate analysis, TS patients had similar odds as GS patients of anastomotic leak (open: adjusted odds ratio (AOR)=1.11, 95% confidence interval (95%CI)=0.58-2.15, p=0.75; MIS: AOR=0.70, 95%CI=0.47-1.04, p=0.08), Clavien-Dindo grade ≥ 3 (open: AOR=1.27, 95%CI=0.79-2.06, p=0.32; MIS: AOR=1.01, 95%CI=0.73-1.39, p=0.97), positive surgical margins (open: AOR=0.75, 95%CI=0.33-1.68, p=0.49; MIS: AOR=0.62, 95%CI=0.35-1.07, p=0.09), and mortality (open: unable to be calculated due to 0 deaths in the GS group; MIS: AOR=1.08, 95%CI=0.45-2.62, p=0.87). Conclusions: Esophagectomy for malignancy had a similar perioperative safety profile and positive margin rate among general and thoracic surgeons, regardless of surgical approach.



P234

Establishment of a Fast-track Post-Gastrectomy Pathway for Patients with Gastric Adenocarcinoma at a U.S. Academic Cancer Center G. Li,* E. Hersh, J. Wang. *Surgery, Brigham and Women's Hospital, Boston, MA.*

Introduction: Implementation of fast-track postoperative care pathways for gastric cancer patients in the U.S. has been challenging due to low disease incidence and limited safety and efficacy data. Our institution recently implemented such a pathway for gastric cancer patients undergoing gastrectomy, and we sought to study its effects. Methods: We analyzed data from consecutive patients who underwent gastrectomy for gastric adenocarcinoma by a single surgeon from January 2012 to August 2020. Patients who had surgery for recurrence, urgent surgery for obstruction, bleeding, or perforation, or an intrathoracic anastomosis were excluded. The primary predictor was whether the patient had surgery before or after implementation of a fast-track post-gastrectomy care pathway in July 2018, and the primary outcome was length of stay. Results: Eighty-four patients were identified, twenty-four post-pathway implementation and 60 pre-pathway implementation. The majority of cases (66%) were done minimally invasively, either laparoscopically (n=37) or robotically (n=19). Following pathway implementation, length of stay was significantly shorter (median 5 days vs. 10 days, $p < 0.001$). There was no significant difference in 30-day complication rates (25% vs. 25%) or readmission rates (13% vs 15%). Using a multivariable quantile regression model, distal/subtotal gastrectomy (versus total gastrectomy) and having surgery post-pathway implementation were independently associated with decreased length of stay. Conclusions: Fast-track post-gastrectomy care pathways are safe and feasible for U.S. gastric cancer patients undergoing gastrectomy, and are associated with significantly decreased length of stay.

Post-operative Measures and Outcomes Stratified by Pre- and Post-Pathway Implementation

	Pre-Pathway Implementation (n=60)	Post-Pathway Implementation (n=24)	P value
Nasogastric/nasojejunal drain (%)	59 (98%)	9 (38%)	<0.001
UGI prior to oral intake (%)	35 (58%)	3 (13%)	<0.001
Intra-abdominal drain	35 (58%)	9 (38%)	0.14
Median duration of intravenous fluids (days)	6 (5 - 8)	3 (2 - 3)	<0.001
Median duration of urinary catheter (days)	2 (1 - 3)	1 (1 - 2)	<0.001
Median time to advancement to post-gastrectomy diet or goal-rate enteral feeds (days)	7 (6 - 9)	4 (3 - 6)	<0.001
Median time to oral or enteral pain regimen (days)	7 (6 - 8)	3 (3 - 4)	<0.001
Median time to flatus (days)	5 (4 - 6)	3 (2 - 4)	<0.001
30-day complication (%)	15 (25%)	6 (25%)	1.00
Complication grade I II III IV V	 0 8/15 (53%) 2/15 (13%) 4/15 (27%) 1/15 (7%)	 1 (17%) 3 (50%) 2 (33%) 0 0	0.37
Median length of stay (days)	10 (8 - 14)	5 (5 - 7)	<0.001
30-day readmission (%)	9 (15%)	3 (13%)	1.00

UGI: upper gastrointestinal series; interquartile ranges provided for all median values

P235

Diagnostic Laparoscopy is Underutilized in the Staging of Gastric Adenocarcinoma Regardless of Hospital Type: A U.S. Safety Net Collaborative Analysis A.J. Leder Macek,[1]* A. Wang,[1] M.K. Turgeon,[2] R.M. Lee,[2] M.C. Russell,[2] M.R. Porembka,[3] R. Alterio,[3] M.R. Ju,[3] J. Kronenfeld,[6] N. Goel,[6] J. Datta,[6] A.V. Maker,[4] M. Fernandez,[4] H. Richter,[5] R.S. Berman,[1] C. Correa-Gallego,[1] A.Y. Lee.[1] *1. NYU Langone Health, New York, NY; 2. Emory University, Atlanta, GA; 3. University of Texas Southwestern Medical School, Dallas, TX; 4. University of Illinois at Chicago, Chicago, IL; 5. John H. Stroger, Jr. Hospital of Cook County, Chicago, IL; 6. University of Miami School of Medicine, Miami, FL.*

Background Diagnostic laparoscopy (DL) is a key component of staging for clinically locally advanced gastric adenocarcinoma (GA). We hypothesized that utilization of DL varied between safety net (SNH) and affiliated tertiary referral centers (TRC). Methods Patients diagnosed with primary GA eligible for DL by NCCN guidelines (clinical T2+ or node positive) were identified from the US Safety Net Collaborative database (2012-2014). Clinicopathologic factors were analyzed for association with DL and positive findings on DL (gross peritoneal disease or positive cytology). Overall survival (OS) by DL status was analyzed by Kaplan-Meier method. Results Among 233 eligible patients, 69 (30%) received DL, of which 24 (35%) were positive. There was no difference in clinical stage distribution between SNH and TRC. Clinicopathologic characteristics and association with use of DL are detailed in Table 1. On multivariate analysis, race was the only factor significantly associated with utilization of DL - specifically, non-Hispanic, white was the only race associated with decreased use of DL. For patients undergoing DL, only diffuse/mixed classification was significantly associated with positive findings on DL (45% vs. intestinal 10%, p=0.048); however there was a trend towards lower positivity rate for well/moderately-differentiated tumors (0% vs. poorly differentiated 38%, p=0.124) and for Asians (18%) compared to Hispanic whites (48%), non-Hispanic whites (45%) and African-Americans (35%, p=0.248). Nine cT2N0 patients underwent DL, of which 3 (33%) were positive. Median OS of patients with a negative DL was significantly better than those with no DL or a positive DL (not reached vs. 32 vs. 12 months, p<0.005). Conclusions Results from DL are a strong predictor of overall survival in gastric cancer. However, less than a third of eligible patients underwent this staging procedure. Limited access to care does not seem to explain this deficiency as DL was less commonly utilized in TRC and in non-Hispanic, white patients.

Table 1 - Demographic and clinicopathologic factors associated with use of laparoscopy

	Overall (n= 233)*	DL (n= 69)*	no DL (n= 164)*	P value
Age				
Median	62	58	64	NS
Gender				
Female	90	28 (31%)	62 (69%)	NS
Male	143	41 (29%)	102 (71%)	
Hospital setting				
Tertiary Referral Center	130	28 (22%)	102 (78%)	0.002
Safety Net	103	41 (40%)	62 (60%)	
Insurance				
Private	74	17 (23%)	57 (77%)	0.037
Government	97	36 (37%)	61 (63%)	
Hospital Card	10	0 (0%)	10 (100%)	
Uninsured	50	16 (32%)	34 (68%)	
Race				
African-American	65	17 (26%)	48 (74%)	<0.001
Hispanic white	56	22 (39%)	34 (61%)	
Non-hispanic white	81	11 (14%)	70(86%)	
Asian	28	17 (61%)	11 (39%)	
EUS nodal staging (available n=121)				
Positive	76	31 (41%)	45 (59%)	NS
Negative	45	12 (27%)	33 (73%)	
EUS T staging (available n=119)				
T2	72	23 (32%)	49 (68%)	NS
T3	34	11 (32%)	23 (68%)	
T4	13	9 (69%)	4 (31%)	
Signet ring cells on biopsy				
Yes	55	26 (47%)	29 (53%)	0.001
No	173	42 (24%)	131 (76%)	
Differentiation (available n=128)				
Poorly differentiated	102	48 (47%)	54 (53%)	0.012
Moderately differentiated	24	4 (17%)	20 (83%)	
Well differentiated	2	0 (0%)	2 (100%)	
Lauren Classification on biopsy (available n=80)				
Intestinal	18	10 (56%)	8 (44%)	NS
Diffuse/Mixed	62	29 (47%)	33 (53%)	
Location				
Proximal	91	19 (21%)	72 (79%)	0.016
Distal	140	50 (36%)	90 (64%)	

NS – not significant (*p>0.05*); DL – diagnostic laparoscopy
*some numbers may not total due to missing information

Table 1-Demographic and clinicopathologic factors associated with use of laparoscopy

P236

Risk Factors for Gastric Cancers in the US: Variation by Anatomic Site and Race/Ethnicity H. In,[1]* P. Friedmann,[1] S. Sarkar,[1] B. Rapkin,[2] P.E. Castle,[4] M. Epplein.[3] *1. Surgery, Montefiore Medical Center, Bronx, NY; 2. Albert Einstein College of Medicine, Bronx, NY; 3. Duke University, Durham, NC; 4. National Institutes of Health, Bethesda, MD.*

Background Risk factor differences for gastric cancer (GC) by anatomic location and race/ethnicity remain understudied in the US population. Methods Multiethnic Cohort (MEC) is a prospective cohort study that collected data on 5 racial/ethnic groups [Whites (W), Blacks (B), Latino (L), Japanese-American (JA), and Hawaiian (HA)] in 1993-1996. Participants completed a baseline survey and followed for development of incident cancer. Cox regression models were used to calculate hazard ratios (HR) and 95% confidence intervals (CI) to identify GC risk factors by anatomic location (cardia, non-cardia) and by race/ethnicity. Results Data from 192,626 participants was available. The cohort was 25% W, 17% B, 23% L, 28% JA, and 7% HA. During a median follow up of 20.3 years, 1,109 non-cardia and 201 cardia incident

GCs were diagnosed. Both cardia and non-cardia were associated with older age, male sex, and current or former smoking. Notably, race/ethnicity (ref W: B HR 3.0, 95% CI 2.2-4.0; L HR 2.5, 95% CI 1.8-3.3; JA HR 3.9, 95% CI 3.0-5.1; HA HR 3.9, 95% CI 2.8-5.5), foreign-born (ref: self & parents US born: HR 1.3 95% CI 1.1-1.7), and family history of GC (OR 1.9, 95% CI 1.5-2.3) were associated with non-cardia GC, while BMI ≥30 (HR 1.6, 95% CI 1.1-2.3), having ≥1 drink/week (HR 1.6, 95% CI 1.1-2.3), and being JA (ref W: HR 1.9, 95% CI 1.2-2.9) were associated with cardia GC. Risk factors other than age differed by race/ethnicity for non-cardia GC. Male sex was a risk factor for B, L and JA only. Having less than a high school education was a risk factor for B and JA only, smoking a risk factor for L and JA only, and having diabetes a risk factor for B only. Being in the highest sodium intake quartile was a risk factor among W and HA. A family history of GC was a risk factor for W, L, and JA. Having foreign-born parents was a risk factor for W and being foreign-born was a risk factor for JA. Conclusion GC risk factors differ between subtypes and, for non-cardia, between race/ethnic groups. These differences provide an insight into the etiology of GC and the disproportionate incidence rates in high-risk groups, potentially aiding in the design of targeted intervention strategies.

P237

Agreement Between Preoperative and Final Pathologic T and N Staging for Patients with Gastric Adenocarcinoma R.J. Vidri,* M.J. Minarich, M.A. Moslim, J.M. Farma, M.V. Hill. *Surgery, Fox Chase Cancer Center, Portland, PA.*

Introduction: Precise clinical staging is crucial for appropriate treatment planning in the management of gastric cancer. Despite modern imaging techniques, substantial differences persist between clinical and pathologic staging. We seek to evaluate this correlation in a contemporary dataset. Methods: Retrospective cohort study of patients diagnosed with gastric adenocarcinoma between 2010-2017 with complete staging data (TNM manual 7th ed.) who did not receive neoadjuvant therapy, included in NCDB. Hospitals were dichotomized into low (LV) (<10 cases/yr) and high volume (HV) (>10 cases/yr). Descriptive and kappa statistics were applied. Results: 9060 patients were included; the majority were male, white, with a mean age of 66 years. Initial, preoperative T classification was T1 (41.6%), T2 (20.9%), T3 (25.6%), and T4 (11.9%). Postoperative T classification resulted in the upstaging of 23.9% and downstaging in 8.9% of patients (Upstaged from T1, 25.9%; T2, 38.3%; T3, 19.6%). The greatest variability in T stage was observed in clinical stage 2 disease (39%). Agreement between pre and postoperative T staging was only moderate (67%, kappa 0.55; p<0.001). Preoperative N classification was N0 (72.9%), N1 (14.3%), N2 (6.7%), and N3 (6%). Pathologic evaluation led to 32% upstaging and 3.4% downstaging (Upstaged from N0, 34.3%; N1, 40%; N2, 18.4%); resulting in only fair agreement (64.7%, kappa 0.40; p<0.001). N upstaging occurred in 27.2% of patients with clinical stage 1 disease; with greatest variability in patients with stage 2 disease (53.1%). Analysis by year suggests an increase in disagreement between clinical and pathologic classification over time for T (31.2% to 39.5%, p<0.001) and N classification (33.3% to 39.5%, p<0.001). Agreement in T classification was moderate for LV and HV centers. For N staging, agreement was only fair in both volume groups. Conclusions: In patients who did not receive neoadjuvant treatment, clinical T and N stage often did not correlate with pathologic staging. Interestingly, increasing disagreement is observed over time. Improvements in preoperative staging techniques are necessary to improve therapeutic decision making.

P238

Risk of Lymph Node Metastasis in Early Gastric Cancer for a Western Population G.J. McKendry,* L. Yip, F. Donnellan, T. Hamilton. *University of British Columbia, Vancouver, BC, Canada.*

INTRODUCTION: Studies have demonstrated that endoscopic treatment of early gastric cancer (EGC) with favourable pathological features is appropriate given the low rates of lymph node metastasis (LNM). Eastern studies have demonstrated similar findings with the expanded criteria for endoscopic resection. However, there is a paucity of evidence in Western patients. We aimed to describe how clinical and pathological features of EGC predict overall survival (OS), recurrence, and LNM in a Western population. METHODS: 86 patients with T1 gastric cancer between 2000 and 2017 were retrospectively evaluated from a Regional Cancer Center prospectively collected database. Pathological and clinical data were used in a multivariate Cox Proportional Hazards regression model for survival and recurrence. A multivariate logistic regression model was used to determine predictors of lymph node metastases. Kaplan-Meier curve estimation was utilized. RESULTS: Among 86 patients, median age was 68 years and 72% were male. Node positivity was present in 30% of patients and median node harvest was 11. Proximal tumor location (HR 3.83 [95% CI 1.79 – 8.21], p < 0.001) and tumor size >2 cm (HR 2.44 [95% CI 1.17 – 5.09], p = 0.05) were predictive of survival. High tumor grade (HR 3.65 [95% CI 0.81 – 16.3] p = 0.09) and proximal tumor location (HR 3.50 [95% CI 0.97 – 12.6], p= 0.06) were clinically relevant to hazard of disease recurrence, but not significant. Patients with T1b disease (OR 41.2 [95% CI 1.62 – 1048], p = 0.02) and patients with LVI and/or PNI (OR 18.0 [95% CI 2.41 – 134], p = 0.01) were more likely to be node positive. The median OS for node-negative patients was 134 months vs. 84 months in node-positive patients (p = 0.004). In the entire cohort, 25 patients met expanded criteria for endoscopic resection, and 2 patients (8%) were node positive. CONCLUSIONS: The risk of LNM in this Western cohort with EGC is higher than reported in Eastern studies. Generalizability of the expanded criteria for endoscopic resection of EGC in Western patients should be interpreted with caution.

P239

What to Do When Decompressive Gastrostomy is Not an Option? A Scoping Review of Percutaneous Transesophageal Gastrostomy Tubes for Advanced Malignancies C. Zhu,[1]* G. Ghobrial,[1] R. Platoff,[1] J. Saddemi,[2] T. Evangelisti,[2] E. Bucher,[2] B. Saracco,[2] A. Adams,[2] Y. Hong.[1] *1. General Surgery, Cooper University Health Care, Camden, NJ; 2. Cooper Medical School of Rowan University, Camden, NJ.*

Introduction: In advanced malignant bowel obstruction, decompressive gastrostomy tubes (GT) may be infeasible due to massive ascites, peritoneal carcinomatosis, and altered gastric anatomy. In contrast, nasogastric tubes (NGT) allow temporary decompression. Percutaneous transesophageal gastrostomy tubes (PTEG) are an alternative for decompression. We performed a scoping review to determine outcomes with PTEG in advanced malignancy. Methods: A systematic literature search was performed. We considered all studies that reported the clinical results of PTEG for malignancy. No language, national, or publication status restrictions were used. We excluded case studies with 1 or 2 patients, pediatric patients, and indications other than malignancy. Results: From 202 studies, a full-text review of 58 studies resulted in 15 studies for analysis. These were published from 2002-2020 and comprised of 12 retrospective cohort studies, 2 prospective cohort studies, and 1 randomized controlled trial (RCT). There were 369 patients total with cohort sizes from 3-115 patients. In 12 studies, standard PTEG was inserted with a rupture-free balloon's placement into the mouth or nose, esophageal puncture under fluoroscopy or ultrasound, followed by a guidewire into the stomach with placement of a single-lumen tube. Double lumen PTEG was described in 2 studies and endoscopic placement in 1 study. Indications were decompression in 282 patients, nutrition in 56, both 2, and unknown in 29. Of 340 patients with explicitly documented complications, 65 (19.1%) had minor complications, and 5 (2.1%) had significant complications, including bleeding and severe aspiration pneumonia. Of 171 patients, 169 with PTEG (98.8%) reported relief of nasal discomfort from NGT and alleviation of obstructive symptoms. The 1 RCT reported a significantly higher quality of life with PTEG compared to NGT. Conclusion: When decompression for advanced malignancy is technically infeasible with a gastrostomy tube, PTEG is a viable, safe option for palliation. PTEG is associated with lower major complication rates than GT and higher patient-derived outcomes compared to NGT.

Scoping Review Results

Authors	Publication Type	Publication Year	Country	Language	Technique Described	Data Beginning	Data End	Study type	Number of PTEG Patients	Indication	Success Rate	Procedure Time	Minor Complications	Major Complications	Improved Comfort from NGT
Aragane et al	Journal	2008	Japan	Japanese	Double lumen PTEG	Not available	Not available	Retrospective cohort	6	3 obstruction, 1 nutrition, 2 both	6/6 (100%)	Not available	2 tube blockage, 1 dermatitis	None	4/5 (80%)
Aramaki et al	Journal	2013	Japan	English	Standard PTEG	2003	2005	Prospective cohort	33	33 obstruction	33/33 (100%)	Median procedure time 28.5 minutes (range 6-60 minutes)	1 aspiration pneumonia, 1 minor nasal bleeding	None	33/33 (100%)
Aramaki et al	Journal	2020	Japan	English	Standard PTEG	2009	2015	Randomized control trial	20	20 obstruction	20/20 (100%)	Not available	3 minor bleeding, 3 puncture site infection, 1 aspiration pneumonia, 4 tube malfunction	1 major bleeding, 1 severe infection, 1 severe aspiration pneumonia	Not available - separate NGT and PTEG groups compared
Iwase et al	Journal	2018	Japan	English	Double lumen PTEG	2015	2017	Prospective cohort	11	11 obstruction	11/11 (100%)	Not available	1 aspiration pneumonia, 1 wound infection, 2 reinsertion for reflux	None	Not available
Kato et al	Journal	2002	Japan	Japanese	Standard PTEG	Not available	Not available	Retrospective cohort	8	8 obstruction	8/8 (100%)	Not available	2 esophageal stricture, 1 abdominal wall fistula (had undergone gastrectomy), 1 neck abscess	None	Not available
Kato et al	Journal	2007	Japan	Japanese	Standard PTEG	Not available	Not available	Retrospective cohort	29	Not available	29/29 (100%)	Not available	Not available	Not available	Not available
Kawata et al	Journal	2014	Japan	English	Standard PTEG	2002	2011	Retrospective cohort	4	4 obstruction	4/4 (100%)	Not available	None	None	Not available
Konishi et al	Abstract	2019	Japan	English	Standard PTEG	2012	2018	Retrospective cohort	13	3 obstruction, 10 nutrition	13/13 (100%)	Not available	1 tube dislodgement	None	Not available
Mackey et al	Journal	2005	United States	English	Standard PTEG	2003	2004	Retrospective cohort	7	7 obstruction	7/7 (100%)	Not available	1 subcutaneous emphysema	None	Not available
Murakami et al	Journal	2013	Japan	English	Standard and endoscopically-inserted PTEG	1999	2004	Retrospective cohort	85	42 obstruction, 43 nutrition	Standard: 21/30 (70%), Endoscopic: 55/55 (100%)	Not available	2 fever, 3 minor bleeding, 1 subcutaneous emphysema, 3 thyroid puncture	1 major bleeding	Not available
Naganuma et al	Abstract	2019	Japan	English	Standard PTEG	2018	2019	Retrospective cohort	8	8 obstruction	8/8 (100%)	Not available	None	None	8/8 (100%)
Oishi et al	Journal	2003	Japan	English	Standard PTEG	1998	2002	Retrospective cohort	115	115 obstruction	Not available	Approximately 15 minute insertion	27 patients total with tube obstruction, stomal leakage, wound infection, tube migration, minor bleeding	None	115/115 (100%)
Shinya et al	Abstract	2015	Japan	English	Standard PTEG	2006	2012	Retrospective cohort	10	10 obstruction	10/10 (100%)	Median procedure time 40 minutes (range 25-60 minutes)	None	1 major bleeding	9/10 (90%)
Singal et al	Journal	2010	United States	English	Standard PTEG	Not available	Not available	Retrospective cohort	3	2 obstruction, 1 nutrition	3/3 (100%)	Not available	None	None	Not available
Udomsawaengsup et al	Journal	2008	Thailand	English	Standard PTEG	2003	2006	Retrospective cohort	17	16 obstruction, 1 nutrition	16/17 (94%)	Not available	2 esophageal leaks managed conservatively; 1 tube dislodgement	None	Not available

PTEG: percutaneous transesophageal gastric tube

P240

Is there a Difference in Utilization of a Perioperative Treatment Approach for Gastric Cancer Between Safety Net Hospitals and Tertiary Referral Centers? M.K. Turgeon,[1]* R.M. Lee,[1] J.M. Keilson,[1] M.R. Ju,[2] M.R. Porembka,[2] R. Alterio,[2] J. Kronenfeld,[3] J. Datta,[3] N. Goel,[3] A. Wang,[4] A.Y. Lee,[4] M. Fernandez,[5] H. Richter,[5] A.V. Maker,[5] S. Maithel,[1] M.C. Russell.[1] *1. Surgery, Emory University, Atlanta, GA; 2. University of Texas Southwestern Medical School, Dallas, TX; 3. University of Miami Miller School of Medicine, Miami, FL; 4. NYU Langone Health, New York, NY; 5. University of Illinois College of Medicine, Chicago, IL.*

Introduction Following the MAGIC and FLOT trials, perioperative therapy is a favored treatment strategy for patients with localized gastric cancer. We sought to assess utilization and completion of this approach at safety net hospitals (SNH) and tertiary referral centers (TRC). Methods Patients in the United States Safety Net Collaborative (2012-2014) with primary gastric cancer who underwent curative-intent resection across five SNH and their sister TRC in the same hospital system were included. Primary outcomes were receipt of neoadjuvant chemotherapy (NAC) and perioperative therapy. Results Of 284 patients, 46% and 54% received care at SNH and TRC, respectively. SNH patients were more likely to be Black/Asian, uninsured, and diagnosed in the emergency department. The distribution of stage II and III resectable disease was similar at both facility types (p>0.05). Receipt of NAC as part of a planned perioperative treatment strategy at SNH and TRC was similar (54% vs 46%, p=0.27). Compared to overall preoperative clinical stage, 38% and 36% were pathologically downstaged at SNH and TRC, respectively. Of those who received NAC, the proportion of patients who also received adjuvant therapy (chemotherapy or chemoradiation) at SNH and TRC was identical (66% vs 65%, p=0.99). Factors associated with an increased odds of receiving perioperative therapy were Asian race and higher stage at diagnosis (both p<0.05). Notably, treatment facility type was not associated with receipt of perioperative therapy. Conclusions In patients with resectable gastric cancer, there was no difference in utilization of a perioperative treatment strategy between facility types. Further, pathologic downstaging from neoadjuvant chemotherapy was similar across treatment facilities, suggesting a similar quality and duration of therapy. Treatment at a safety net hospital is not a barrier to receiving standard-of-care perioperative therapy for localized gastric cancer.

P241

Understanding Reasons for Treatment Delays in Gastric and Colon Cancer A.R. Kopp,[2]* V. Arientyl,[1] J.B. Schriner,[1] A. Kalam,[2] P. Friedmann,[1] J. Qin,[3] H. In.[1] *1. Department of Surgery, Montefiore Medical Center, Bronx, NY; 2. Albert Einstein College of Medicine, Bronx, NY; 3. Department of Epidemiology and Population Health, Albert Einstein College of Medicine, Bronx, NY.*

Background: Delays to treatment for cancer can adversely affect outcomes. We aim to understand when and why delays occur for gastric cancer (GC) and colon cancer (CC) to identify targets to expedite treatment. Methods: Chart review was conducted of CC and GC patients diagnosed in 2018 at an urban academic medical center. Time from presentation to treatment was considered delayed if ≥60 days (Total_Delay). Total time was examined as phases: presentation to diagnosis (PtoD), diagnosis to staging completion (DtoS), and staging completion to treatment (StoT). For each phase, ≥30 days was considered delayed. Reasons for delays by phase were collected. Results: Review included 33 GC and 121 CC patients. Patients were similar in age, race, and functional status. GC patients were healthier (Charlson Comorbidity Index ≥4; 9% vs 22%). They more often had Medicaid (42% vs 29%), defined symptoms (79% vs 60%), and stage IV disease (49% vs 24%). GC patients required fewer work-up events, including imaging, procedures, and consultations [mean 3.2 (SD 1)] than CC patients [mean 5.6 (SD 0.8)]. Despite this, Total_Delay occurred in 30% of GC and 21% of CC. For GC Total_Delay patients, delay occurred more frequently in earlier phases (PtoD=70%, DtoS=60%, StoT=20%), while for CC Total_Delay patients, delay occurred uniformly (PtoD=48%, DtoS=60%, StoT=48%). PtoD delays were most commonly due to endoscopy scheduling delays (3/7, 43%) and diagnostic uncertainty due to non-specific symptoms (2/7, 29%) for GC, and colonoscopy scheduling delays (7/16, 44%) for CC. DtoS delays were most commonly due to endoscopy scheduling delays (3/5, 60%) for GC, and patient-requested delays (7/18, 39%) and obtaining specialty appointment (5/18, 28%) for CC. StoT delays were most commonly due to patient illness (4/6, 67%) for GC, and obtaining specialty appointment (6/14, 43%) for CC. Conclusions: Systems issues, namely scheduling endoscopy & colonoscopies and obtaining specialty appointments, were more common than patient related issues as cause of delays. This analysis suggests that addressing systems issues to expedite diagnostic and staging work-up for suspected cancer patients will mitigate delays to treatment for cancer patients.

P242

Impact of Gender on Treatment and Survival of Patients with Esophageal Cancer in the United States C.C. Baumrucker,[1]* D. Franceschi,[1] A.S. Livingstone,[1] F.I. Macedo.[2] *1. University of Miami Miller School of Medicine, Miami, FL; 2. North Florida Regional Medical Center, University of Central Florida College of Medicine, Gainesville, FL.*

Introduction: Esophageal cancer (EC) is historically a male-predominant disease. Current evidence on the impact of gender on clinical presentation and survival outcomes of EC is limited by small sample size or single institutional series. Methods: Patients with EC (stage I-III) were identified in the NCDB (2004-2016). Clinicopathologic and treatment characteristics of male and female patients were compared using Chi-square analysis. Kaplan-Meier and Cox multivariable regression were used to estimate overall survival (OS). Results: Of 62,893 patients included, male gender was predominant (77.7%). Adenocarcinoma was the most common subtype (66.7%); however, squamous cell carcinoma was more predominant in females (57.1% vs. 26.5%, p<0.001). Females were older (68.5 vs. 66.1 yrs; p<0.001) and more likely African American (AA) than males (14% vs. 8.1%; p<0.001). Females presented with more local disease (stage I, 19.6% vs. 18.2%; p<0.001), while males presented with more locoregional disease (LRD, stage II/III, 80.4% vs 81.8%, p<0.001). Females had worse OS compared to males (18.1 vs. 19.7mo, p=0.001; cI: 23.5 vs. 31.9mo, p<0.001; LRD: 17.2 vs 18.3mo, p=0.473). White females had worse OS than white males (18.6 vs. 20.4mo, p<0.001), while AA females had better OS (13.5 vs. 12.6mo, p=0.001). Of those with LRD, females less frequently received chemotherapy (CT, 75.4% vs. 82.9%, p<0.001), radiation therapy (RT, 78.9% vs. 82.6%, p<0.001), and esophagectomy (28% vs. 40.5%, p<0.001). Females who underwent esophagectomy had improved OS over their male counterparts (40.3 vs. 32.7mo; p<0.001). White females who underwent esophagectomy had improved OS over white males (47.6 vs 38mo, p<0.001); however, AA males and females who underwent esophagectomy had similar OS (33.8 vs 32.6mo, p=0.473). Female gender, older age, AA race,

high comorbidity score and clinical stage, and lack of access to CT, RT, and esophagectomy were independent predictors of mortality (Table 1). Conclusion: Females with EC seem to have less access to CT, RT, and esophagectomy with worse OS compared to males. Healthcare policies should focus on increasing access to standard treatments for female patients with EC.

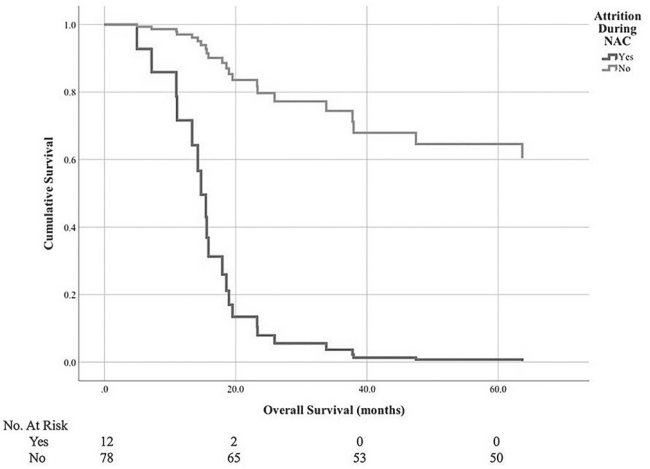
Table 1

		HR	95% CI	p-value
Age		1.012	1.011-1.013	<0.001*
Gender	Male	1.126	1.099-1.154	<0.001*
Race	White (Ref)			
	African American	1.11	1.072-1.149	<0.001*
	Hispanic	0.819	0.773-0.869	<0.001*
	Other	0.806	0.756-0.86	<0.001*
Insurance	Uninsured (Ref)			
	Private	0.727	0.686-0.77	<0.001*
	Medicaid/Medicare	0.804	0.759-0.851	<0.001*
	Other	0.719	0.658-0.785	<0.001*
Comorbidity Score	CDCC 0 (Ref)			
	CDCC 1	1.141	1.114-1.168	<0.001*
	CDCC 2	1.288	1.244-1.334	<0.001*
Area	Rural (Ref)			
	Metro	0.975	0.912-1.043	0.466
	Urban	1.047	0.976-1.123	0.199
Clinical Stage	LRD	1.678	1.63-1.727	<0.001*
Histology	SCC	1.03	1.006-1.054	0.013
Radiation		0.885	0.858-0.913	<0.001*
Chemotherapy		0.698	0.677-0.719	<0.001*
Esophagectomy		0.442	0.432-0.452	<0.001*

P243

Attrition During Neoadjuvant Chemotherapy for Gastric Adenocarcinoma is Associated with Decreased Survival: A United States Safety-Net Collaborative Analysis J.P. Kronenfeld,[1]* A.L. Collier,[1] N. Goel,[1] M.K. Turgeon,[2] M.R. Ju,[3] R. Alterio,[3] A. Wang,[4] M. Fernandez,[5] M.R. Porembka,[3] H. Richter,[6] A.Y. Lee,[4] A.V. Maker,[5] M.C. Russell,[2] N.B. Merchant,[1] J. Datta.[1] *1. Surgery, University of Miami Miller School of Medicine, Miami, FL; 2. Emory University, Atlanta, GA; 3. UT Southwestern Medical Center, Dallas, TX; 4. NYU Langone Health, New York, NY; 5. The University of Illinois College of Medicine, Chicago, IL; 6. Rush Medical College, Chicago, IL.*

Introduction: Neoadjuvant chemotherapy (NAC) is increasingly utilized for localized gastric cancer (GC). Attrition during NAC due to treatment-related toxicity or functional decline is considered a surrogate for worse biologic outcomes; however, data supporting this paradigm are lacking. We sought to investigate factors predicting attrition and its association with survival in resectable GC. Method: Patients with non-metastatic GC (clinical stage I-III) initiated on NAC were identified from the US Safety-Net Collaborative database (2012-14). Failure to complete prescribed NAC regimen (attrition) was recorded. Patient/treatment-related characteristics were compared between attrition and non-attrition cohorts. Cox models determined factors associated with overall survival (OS). Results: Of 122 patients initiating NAC (median age 62, 64% male), attrition occurred in 34 (28%) patients while 88 (72%) completed prescribed NAC. Patients treated at safety net hospitals were not more likely to suffer attrition compared with those treated at academic counterparts. No differences were observed in patient performance status, comorbidities, or clinicopathologic factors between cohorts. Despite this absence of distinguishing factors, attrition was associated with worse OS compared with completion of NAC (median 11 vs 37 months, P<0.001) and was an independent predictor of mortality (HR 8.1, P=0.001). A significantly smaller proportion of patients with attrition underwent curative-intent surgery compared with non-attrition patients (35% vs 89%, P<0.001). In a subgroup of resected patients (n=90), receipt of any adjuvant chemotherapy was similar between attrition and non-attrition cohorts (83% vs 80%). Notwithstanding, even in resected patients, attrition during NAC remained an independent predictor of worse OS (HR 11.2, P=0.01; Figure). Conclusions: Attrition during NAC for non-metastatic GC is independently associated with worse OS, even in patients who underwent curative-intent resection and received adjuvant therapy. Attrition during NAC may reflect unfavorable tumor biology not captured by conventional staging metrics.



P244

Predictive Value of PET Scan in Squamous Cell Carcinoma of the Esophagus Treated with Trimodality Therapy M.H. Squires, N.L. Gower, J.H. Benbow, E. Donahue, C.E. Bohl, R.S. Prabhu, M.E. Salem, J.S. Hill, J.C. Salo.* *Department of Surgery, Atrium Health, Levine Cancer Institute, Charlotte, NC.*

Background: For locally advanced esophageal squamous cell carcinoma (ESCC), chemoradiation (CRT) followed by surgical resection offers the best chance of cure, with a 40% pathologic complete response (pCR) rate. The additional benefit of surgery in patients who achieve robust clinical response to CRT is uncertain; small trials of ESCC with good response to CRT randomized to boost radiation vs surgery found no survival benefit to surgery. The ability to accurately predict which ESCC patients will have pCR from CRT alone is critical in decisions regarding surgery post-CRT. This study assessed pre- and post-therapy positron emission tomography (PET) in predicting the pCR rate after neoadjuvant CRT for ESCC. Methods: ESCC Patients treated with CRT followed by surgery from 4/2012 to 12/2019 at a single institution with pre- and post-therapy PET scans were identified. Standard uptake value (SUV) maximum, metabolic tumor volume, total lesion glycolysis, and first-order textual features of kurtosis and skewness were measured from PET scans with MIMvista software. Uni- and multivariable GLM analyses performed. A metabolic complete response (mCR) was defined as post-therapy PET scan with maximum SUV<4.0. Results: 27 patients underwent CRT followed by surgery with pre- and post-CRT PET scans (Table 1). Radiographic mCR was seen in 12(44%). Final pathology for these 12 patients revealed pCR (ypT0N0M0) in 5(42%) and persistent disease in 7(58%) patients. At median follow-up time of 30.6 (IQR 10.9-45.7) months, 22(82%) patients showed no evidence of disease recurrence. Univariate analysis did not reveal factors predictive of pCR. Conclusion: Treatment of ESCC with CRT often results in a robust clinical response. A mCR rate of 44% on post-CRT PET was found in this study. Disease persistence among patients with mCR after CRT is common, however, and was found in 58% of patients. Based on the results of this study, no radiographic features on pre- or post-treatment PET scans accurately identified patients who would achieve pCR with CRT alone. The inability of mCR on PET to predict pCR is important in the context of 'watch and wait' strategy for ESCC treated with CRT.

Table 1: Patient Demographics

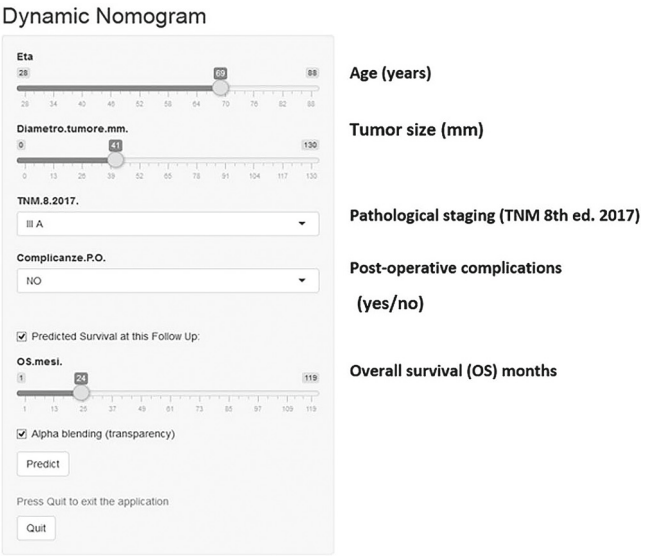
Variable	*N* (27)
Sex, no. (%)	
Male	17 (63.0)
Female	10 (37.0)
Age, Median (IQR)	61.0 (54.0-70.0)
BMI, Median (IQR)	25.1 (21.3-28.9)
Carboplatin and paclitaxel, no. (%)	24 (89.0)
Pathologic T Stage, no. (%)	
T0/T1	17 (63.0)
>T2/3	10 (37.0)
Pathologic N Stage, no. (%)	
N0	21 (78.0)
N+	6 (22.0)

P245

A Nomogram to Predict Overall Survival and Disease-Free Survival After Curative-Intent Gastrectomy: A Ten Years Single Institution Experience A. Tonello,[1]* G. Spolverato,[1] Q. Bao,[1] G. Capelli,[1] V. Chiminazzo,[3] G. Lorenzoni,[3] D. Gregori,[3] A. Marchet,[1] T.M. Pawlik,[2] S. Pucciarelli.[1] *1. Department of Surgical, Oncological, and Gastroenterological Sciences, First Surgical Clinic, University of Padova, Padova, Italy; 2. The Ohio State University, Columbus, OH; 3. Department of Biostatistics, University of Padova, Padova, Italy.*

BACKGROUND. Although surgery offers the best chance of curative-intent treatment for gastric adenocarcinoma, many patients will experience a recurrence. In turn, postoperative imaging protocols are used to monitor for recurrence. We sought to identify clinicopathological features associated with risk of recurrence and death after curative intent gastrectomy. Using these factors, we developed a nomogram to predict individual risk of recurrence to help inform postoperative surveillance. METHODS. Patients with gastric adenocarcinoma who underwent curative-intent resection between January 2010 and May 2020 at a single institution were identified. Patients with distant metastasis at diagnosis, peritoneal carcinomatosis or R2 resection at final histology were excluded. Univariable and multivariable Cox proportional hazards regression analyses were used to define patient demographics and tumor characteristics associated with recurrence and death. Nomograms to predict OS and DFS were developed using factors significant on multivariable analysis. RESULTS. Among 168 patients who underwent resection, age (HR 1.45, 95%CI 0.97-2.17), tumor size (HR 0.71, 95%CI 0.50-0.99), pathological staging and post-operative complications (HR 2.36, 95%CI 1.42-3.93) were independent predictors of OS, while age (HR 0.95, 95%CI 0.67-1.34), Lauren classification (diffuse Vs mixed HR 3.013, 95%CI 1.22-7.42) and lymph node ratio (HR 2.13, 95%CI 1.63-2.79) were strongly associated with DFS. Nomograms to predict OS and DFS were developed based on these factors (Figure). CONCLUSIONS. Nomograms based on age, tumor size, pathological staging, post-operative complications, lymph node ratio and Lauren classification were able to predict individual patient risk of death and recurrence after surgery for primary gastric adenocarcinoma. These data may help inform the frequency and algorithm of post-operative imaging surveillance among this cohort of patients.

Nomogram predicting Overall Survival



Nomogram used to predict Overall Survival

P246

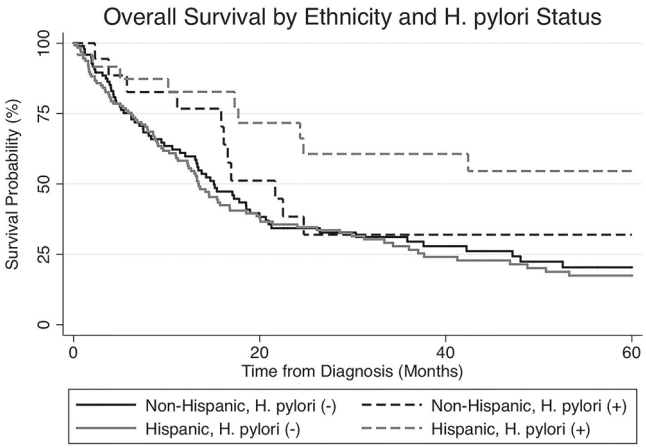
Assessing the Barriers of Care That Delay Gastric Cancer Diagnosis M.R. Ju,* R. Alterio, A. Yopp, H. Zeh, S. Wang, M.R. Porembka. *Surgery, University of Texas Southwestern Medical Center, Dallas, TX.*

Background: Gastric cancer is frequently diagnosed at an advanced stage when symptoms occur. Previous studies have suggested that symptomatic cancer patients often experience delays in diagnosis (DD). However, DD of gastric cancer within the US and etiology of those delays is not well understood. Our study aims to quantify the proportion of gastric cancer patients experiencing DD and contributing barriers of care. Methods: We conducted a single institution retrospective review of gastric cancer patients diagnosed between 2015-2020. The "opportunity window" was calculated as the number of days elapsed between date of symptom onset and date of diagnosis. Patients with an opportunity window of >90 days were classified as having delays. Following review of the medical records, patients with DD were categorized into one of the following barriers of care: access, provider knowledge/skills, and patient compliance. Chi-square tests were used to analyze categorical differences between groups with and without delays in diagnosis. Non-pooled t-tests were used to compare differences in group means. Results: We identified 231 patients of whom 50 (22%) had DD. Among patients with DD, the mean opportunity window was 241.0 days vs 28.7 days in the non-delayed group ($p<0.0001$). The median number of visits for patients with DD was 2 (IQR 1-3). The most common barrier of care faced was knowledge/skills (42%), followed by access (36%) and compliance (22%). The average opportunity window for those with access barriers was approximately 185 days compared with longer opportunity windows of 280 days for those with knowledge/skills barriers and 259 days for those with compliance barriers. Only 6% of patients who experienced delays reported abdominal pain alone, with the remaining 94% of patients all reporting at least one or more other symptoms of obstruction, gastrointestinal bleeding, or weight loss. Conclusions: Patients often face lengthy delays in gastric cancer diagnosis which frequently arise from healthcare system factors such as access barriers or gaps in provider knowledge/skills. Addressing these barriers will expedite patient diagnosis and is a prime opportunity to improve outcomes for gastric cancer patients.

P247

Previous Helicobacter Pylori Infection is Associated with Improved Survival in Hispanic Patients with Gastric Cancer M.E. Seaton,[1]* J. Kronenfeld,[1] A.M. Shah,[2] K. Khan,[2] A.L. Collier,[1] D. Franceschi,[1] A.S. Livingstone,[1] A.C. Lockhart,[2] N.B. Merchant,[2] J. Datta.[2]
1. University of Miami / Jackson Memorial Hospital, Miami, FL; 2. University of Miami, Miami, FL.

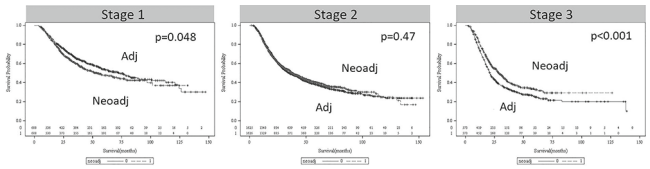
INTRODUCTION: Gastric cancer (GC) in Hispanic patients is associated with a distinct epidemiology and biology, as well as higher incidence of Helicobacter pylori infections. Emerging data suggests that prior H. pylori infection is associated with improved survival in US GC patients. However, the relationship between prior H.pylori infection, Hispanic ethnicity, and survival in GC has not been previously investigated. METHODS: All GC patients treated at our tertiary referral center were retrospectively reviewed (2010-2015). Overall survival was evaluated with Cox regression models and the Kaplan-Meier method. RESULTS: Of 274 patients (median age 60 years, 45% localized GC), 154 (56%) were Hispanic. The incidence of H. pylori-positivity was 16% in both the Hispanic and non-Hispanic cohorts. Age, stage, tumor location, signet ring histology, and the proportion treated with resection were not significantly different between H. pylori positive and negative patients. In Cox regression analysis, ethnicity and H. pylori status were not independently associated with survival, however there was a statistically significant interaction between these variables (p=0.014) suggesting that Hispanic ethnicity modified the effect of H. pylori on survival. In subgroup analyses, H. pylori-positivity was associated with improved survival among Hispanics (HR-adj 0.30; 95%CI 0.15, 0.60; p=0.001), but not among non-Hispanics (HR-adj 0.91; 95%CI 0.45, 1.82; p=0.790) (Figure). To corroborate these findings, we stratified the overall cohort into Hispanic and non-Hispanic subgroups and propensity-score matched H. pylori positive patients to H. pylori negative patients within each subgroup. In the matched Hispanic cohort, but not in the non-Hispanic cohort, H.pylori-positivity was associated with improved survival compared with H. pylori-negativity (median not reached vs. 13 months, p=0.006). CONCLUSION: This is the first study to identify the novel association between H. pylori-positivity and improved survival preferentially in Hispanic, but not non-Hispanic, patients. The environmental, molecular, and immunologic basis of this phenomenon warrants further investigation.



P248

The Order of Surgery and Chemotherapy Matters: Stage-Specific Survival Benefit of Multimodality Therapy in Gastric Cancer V.O. Ramos Santillan,[1]* P. Friedmann,[2] J. Chuy,[1] m. parides,[1] H. In.[1]
1. Surgery, Montefiore Medical Center, Bronx, NY; 2. Albert Einstein College of Medicine, Bronx, NY.

Introduction: Multimodality treatment improves survival for gastric cancer, however, the optimal timing (prior or after surgery) remains controversial. Outcomes by clinical stage and sequence of therapy, chemotherapy with or without radiation before (Neoadj) or after surgery (Adj), was examined. Methods: Patients with non-metastatic gastric cancer with clinical stage T2N0 or greater, who underwent surgical resection and chemotherapy either as Neoadj or Adj from 2005-2014 were identified using The National Cancer Database. Given differences in patient characteristics between Neoadj and Adj, 1-1 propensity score approach was used to balance the probability of receiving treatment between groups. Cox Proportional Hazards models were used to estimate Hazard Ratio (HR) and 95% CI on age, gender, race, tumor location, stage, histology, and grade propensity matched cohorts to compare overall survival (OS) for Neoadj vs Adj by stage. Results: We identified 11,984 patients, of which 55% of stage 1 (964/1760), 76% of stage 2 (6,105/8,074) and 57% of stage 3 (1,232/2,150) patients received Neoadj. A crude analysis examining the effect of neoadjuvant treatment on survival showed worse survival among stage 1 patients (HR 1.195 95% CI 1.04-1.38) and improved survival for stage 2 (HR 0.93 95% CI 0.87-0.998) and Stage 3 patients (HR 0.75 95% CI 0.68-0.84). Stage-specific propensity score matched cohorts were well matched and included 1,216 stage 1, 3,252 stage 2 and 1,146 stage 3 patients. Kaplan-Meier survival on propensity matched cohorts and Cox Proportional Hazards models showed that Neoadj in stage 1 patients results in worst OS with increased risk of death compared to Adj (HR 1.186, 95% CI 1.004-1.402). Stage 2 patients had no difference in OS (HR 0.98 95% CI 0.91-1.07). In stage 3 patients, Neoadj had improved OS (HR 0.78, 95% CI 0.69-0.90) compared to Adj. Conclusions: The benefit of neoadjuvant therapy prior to surgery was pronounced for clinical stage 3 GC patients, however resulted in worst survival for clinical stage 1 patients. A clinical trial to examine the optimal sequence of chemotherapy and surgery for gastric cancer is warranted.



OS by Stage for Neoadjuvant Treatment and Adjuvant Treatment after Propensity Score Matching

P249

Evaluation of Socioeconomic and Environmental Risk Factors in the Development of Gastric Cancer Using Qualitative Online Survey Administration S. Nah,* V. Helton, A. Ojeda-Prias, N. Owusu-Brackett, M. Kitano. *UT Health San Antonio, San Antonio, TX.*

Introduction: Gastric adenocarcinoma (GAC) has a higher incidence in Hispanics with earlier age of onset compared to non-Hispanics (NH). While studies have linked certain comorbidities with increased risk of cancer, there is a paucity of data on socioeconomic factors that may contribute to disparities in presentation of GAC. Utilizing Facebook support groups (FBSGs) specific to GAC, we recruited patients and family members to take a voluntary survey that focused on identifying environmental, socioeconomic, and demographic information. Methods: A multiple-choice comprehensive survey (English and Spanish) created on REDCap by medical practitioners and reviewed by patient advocates was administered to family members and patients with GAC on

FBSGs from August 17, 2020 to September 17, 2020. Results: Of 280 participants, 182 respondents completed the full survey. Respondents consisted of patients (59.3%) and family members (40.7%) (M: 83, F: 99) from 11 nations. Racially, 16.4% were Hispanics and 83.5% were NH. Hispanics had lower income (p=.04), less advanced degrees (p=.04), higher exposure to tobacco (p=.0023) and consumed more processed fish (p=.005). 50% of Hispanics had occupational exposure to factory or mining settings compared to 7% of NH (p<.0001). A higher proportion of Hispanics were uninsured whereas a higher proportion of NH had private insurance (p=0.0002). Hispanics were diagnosed at an earlier age (p=.025), and while both groups tended to be diagnosed with gastric cancer at more advanced stages, Hispanics were less likely to recall their stage at diagnosis (p=.0069). Conclusions: This unique study reports differences in socioeconomic and environmental factors associated with development of GAC across multiple nations from a large online survey. Our result is concordant with published trends with younger age at presentation among Hispanics. While there are limitations to survey analysis, this study showed significant differences in socioeconomic, lifestyle, and environmental factors that may be contributing to the higher incidence and earlier onset of gastric cancer in Hispanics.

	Hispanic		Non-Hispanic		
	n	(%)	n	(%)	
	30	16.5%	152	83.5%	
DEMOGRAPHIC					
Patient as Respondent	17	56.7%	91	59.9%	*p=.74*
Family Member as Respondent	13	43.3%	61	40.1%	
Patient					*p=.78*
Male	13	43.3%	70	46.1%	
Female	17	56.7%	82	53.9%	
Median Age at Diagnosis	48.5		54		*p=.025*
Income					*p=.0426*
< $100,000	19	63.3%	73	48.0%	
≤ $100,000	4	13.3%	54	35.5%	
Unknown	8		25		
Education					*p=.0438*
No highschool diploma	5	16.7%	10	6.6%	
Highschool diploma or Trade certification	14	46.7%	65	42.8%	
Associate's or Bachelor's degree	6	20.0%	63	41.4%	
Graduate degree	3	10.0%	29	19.1%	
Unknown	2	6.7%	3	2.0%	
EXPOSURES AT TIME OF DIAGNOSIS					
Cigarettes					*p=.0023*
Current	8	26.7%	10	6.6%	
Former	9	30.0%	74	48.7%	
Never	13	43.3%	68	44.7%	
Chewing Tobacco					*p<.0001*
Current	14	46.7%	1	0.7%	
Former	1	3.3%	15	9.9%	
Never	15	50.0%	136	89.5%	
Processed fish (servings/week)					*p=.0045*
0	13	43.3%	113	74.3%	
1	14	46.7%	24	15.8%	
2	1	3.3%	4	2.6%	
≥ 3	1	3.3%	7	4.6%	
Unknown	1	3.3%	4	2.6%	
Occupational Exposure					*p<.0001*
Factory / Mining Occupation	15	50.0%	11	7.2%	
ACCESS TO CARE AND CANCER DIAGNOSIS					
Insurance Coverage					*p=.0002*
Uninsured	12	40.0%	17	11.2%	
Private Insurance	10	33.3%	92	60.5%	
Subsidized coverage by country, state, county	8	26.7%	50	32.9%	
Stage at diagnosis					*p=.0069*
Stage I	5	16.7%	19	12.5%	
Stage II	1	3.3%	12	7.9%	
Stage III	7	23.3%	45	29.6%	
Stage IV	10	33.3%	70	46.1%	
Unknown	6	20.0%	5	3.3%	

Table: Baseline characteristics of survey respondents by race.

ABSTRACTS

Accepted for
VIDEO PRESENTATIONS

SSO 2021 – International Conference on Surgical Cancer Care
March 18-19, 2021
Virtual Meeting

V1

A Simplified Breast Oncoplastic Closure Technique for Partial Mastectomy Defects A.L. Collier,[1]* L. Weber,[1] G. de La Cruz Ku,[2] F.I. Macedo,[3] M. Moller.[1] *1. Division of Surgical Oncology, DeWitt Daughtry Family Department of Surgery, University of Miami Leonard M. Miller School of Medicine, Miami, FL; 2. Universidad Científica del Sur. Lima, Lima, Peru; 3. University of Central Florida College of Medicine, Gainesville, FL.*

Introduction: Breast reconstruction/oncoplastic surgery are important components in the surgical management of breast cancer. It is especially challenging in early breast cancer, as the primary goal is to achieve disease eradication while maintaining natural appearing breasts. This video details an oncoplastic closure technique for patients undergoing breast-conserving treatment (BCT) that is both aesthetic and easy to perform. Methods: This is a video of a 49-year-old female with a left lateral ductal carcinoma in situ (DCIS) spanning 0.6 cm in the greatest linear diameter who underwent BCT with lumpectomy, which created a 5 cm x 5 cm breast deformity. Oncoplastic closure was subsequently performed using 2-0 Vicryl suture in a purse-string fashion along the base of the cavity in three consecutive layers to restore the natural contour and projection of the breast. After placing the first round of purse-string sutures, tissue flaps are elevated medially and laterally from the wound for local tissue rearrangement. Tissue flap elevation allows for the release of wound tension, skin dimpling, and filling of negative space. The second round of purse-string sutures affixes the tissue flaps to the pectoral fascia in a similar circumferential fashion. This fascial to subcutaneous layer assists in creating a conical projection of the breast comparable to native tissue that is otherwise lost with simple closure. The third, final round of purse-string sutures are placed one-centimeter interior to the prior layers; promoting further breast projection, ablation of negative space, and improved cosmesis. Lastly, the wound is closed in layers using 3-0 Vicryl sutures and a running 4-0 Monocryl for the skin. Results: Following closure, the breast has no skin dimpling, loss of volume, or projection and appears symmetrical to the contralateral side. These results were maintained following post-operative radiation. Conclusion: This technique is easily learned by surgeons practicing in locations where plastic surgeons are not readily available. Using our oncoplastic closure, surgeons can be more confident in offering BCT to patients undergoing partial mastectomy.

V2

Transoral Endoscopic Modified Radical Neck Dissection for Papillary Thyroid Carcinoma D.Q. Ngo,* T.D. Tran, D.T. Le, Q.X. Ngo, Q.V. Le. *Head and neck surgery, Vietnam National Cancer Hospital, Hanoi, Viet Nam.*

INTRODUCTIONS: Recently, transoral endoscopic thyroidectomy via vestibular approach (TOETVA) has become popular worldwide. After controlling the technique, we have performed the transoral endoscopic approach to modified radical neck dissection (MRND) for papillary thyroid carcinoma with clinically positive lymph nodes at the lateral compartments. To the best of our knowledge, we report the first case of TOETVA for MRND. METHODS: A 27-year-old woman diagnosed with cT1aN1bM0 right papillary thyroid carcinoma (metastatic to a small right level IV lymph node). Hence, total thyroidectomy, bilateral central neck dissection, and MRND of right levels II, III and IV were performed via the transoral endoscopic approach. Total thyroidectomy and bilateral central lymph node dissections were carried out based on three-trocar Anuwong's technique. Then, the fourth incision was made near the sixth teeth in the right oral vestibular area in order to insert the fourth 5-mm trocar which was used to expose lateral lymph compartment as well as perform right MRND easily. RESULTS: The operation was completed successfully without conversion to open surgery. The total operative time was 170 minutes, and the operating time for MRND was 55 minutes. The numbers of harvested lymph nodes were 7 and 8 in the central and right lateral compartments, respectively. The numbers of metastatic lymph nodes were 2 and 1 in the central and lateral compartments, respectively. There were no major postoperative complications. CONCLUSIONS: Transoral endoscopic MRND of levels II, III and IV can be feasible and safe in highly selected patients.

V3

Robotic Completion Radical Cholecystectomy with Fluorescence Guidance A.D. Newton,* T.E. Newhook, N. Ikoma, M.G. White, C.D. Tzeng, Y. Chun, T.A. Aloia, J. Vauthey, H.S. Tran-Cao. *MD Anderson Cancer Center, Houston, TX.*

The application of minimally invasive surgery (MIS) techniques in the treatment of hepatobiliary malignancies offers advantages of shorter length of stay, quicker functional recovery, and decreased need for postoperative opioids. However, MIS completion radical cholecystectomy for incidentally diagnosed gallbladder cancer can be challenging due to a re-operative field and lack of tactile feedback. This video demonstrates the utility of the robotic platform and highlights the ways in which it assists surgeons in overcoming these limitations. These include 1) versatile wristed instruments and excellent visualization that facilitate a thorough regional lymphadenectomy, and 2) built-in fluorescence imaging technology that can be used with intravenous indocyanine green (ICG) to confirm porta hepatis anatomy in a re-operative field. ICG pharmacokinetics enable fluorescence angiography 15-20 seconds after ICG injection and fluorescence cholangiography 15-20 minutes after ICG injection as the dye accumulates in the biliary system. Systematic and intentional application of these techniques allows for the safe and oncologically sound performance of robotic completion radical cholecystectomy, with excellent perioperative outcomes.

V4

Robotic Excision of a Duodenal Gastrointestinal Stromal Tumor M.B. Torres,* M. Dixon, N. Gusani, J.S. Peng. *Surgery, Penn State Health, Hummelstown, PA.*

Introduction: The utilization of minimally invasive surgery (MIS) for oncologic indications increased over the years. The potential advantages of oncologic MIS include shorter length of stay, decreased morbidity, and faster recovery. Robotic surgery offers wristed instrumentation, allowing for increased degrees of freedom, and can expand the current use of MIS resection. This video demonstrates a robotic excision of a duodenal GIST with primary repair of the duodenotomy. Methods: The patient is a 45-year-old female with a body mass index of 45, who was found to have anemia on routine labs. Esophagogastroduodenoscopy and endoscopic ultrasound demonstrated a 3 cm ulcerated nodule at the second portion of the duodenum, across from the ampulla. Biopsy of the lesion was consistent with a low-grade duodenal GIST. Imaging demonstrated an exophytic and endophytic component. Results: The accompanying video demonstrates the port placement and approach for this operation. The operation is started by entering the lesser sac via the gastrocolic ligament, followed by mobilization of the right colon, and mobilization of the duodenum with the Kocher maneuver. The duodenum is entered using cautery and the lesion excised circumferentially. The defect was repaired primarily in a transverse fashion. The patient recovered well postoperatively, and pathology revealed a low grade, duodenal GIST with 2 mitotic figures per 50 high power field. At six months follow up, the patient remained asymptomatic and disease free. Conclusion: This video highlights that robotic excision of duodenal lesions can be performed with relative ease by taking advantage of wristed instrumentation of the robotic platform. MIS approaches can facilitate faster patient recovery and minimize potential wound complications.

V5

Robotic Extrahepatic Biliary Resection with Roux-en-Y Hepaticojejunostomy for Type 2 Klatskin Tumor I. Sucandy,* S.B. Ross, K.L. Crespo, A.S. Rosemurgy. *AdventHealth Tampa, Tampa, FL.*

Introduction: To date, nearly all Klatskin tumor resection is undertaken using the open approach. Minimally invasive approach for malignant extrahepatic biliary resection is rarely used due to technical complexity and concerns of oncological inferiority. In the United States, robotic technique for Klatskin tumor resection has not been described. This video is of a robotic extrahepatic biliary resection with Roux-en-Y hepaticojejunostomy undertaken in our hepatobiliary center. Methods: The patient is a 77-year-old man who presented with obstructive jaundice and hyperbilirubinemia. MRI/MRCP showed a focal lesion at the cystic duct entrance to the common hepatic duct, extending cephalad towards the biliary bifurcation. No obvious vascular invasion was identified on the CT scan. Endobiliary brushing confirmed adenocarcinoma.

Results: The operation was undertaken using five-port technique. A systematic portal dissection was undertaken to identify the extrahepatic biliary tree from the level of the pancreas toward the hepatic hilum. The distal common bile duct was transected, and the distal margin was sent for frozen section. The right hepatic artery coursing posterior to the common hepatic duct was skeletonized and preserved. Biliary duct bifurcation was transected at the level of right and left hepatic ducts at the hilar plate, removing the cancer completely. Portal lymphadenectomy was also completed as part of oncological staging and treatment. For the purpose of biliary reconstruction, a standard side-to-side stapled jejunojejunostomy was created. A 60 cm Roux limb was transposed antecolically for a Roux-en-Y hepaticojejunostomy end-to-side single anastomosis. Conclusions: This video demonstrates a safe and feasible application of the robotic platform in a challenging extrahepatic bile duct cancer resection with good outcomes. This technique should be considered as an alternative to the traditional open operation.

V6

Robotic Left Hepatectomy and Partial Caudate Resection for a Large Centrally Located Mass L. Mena-Albors, F. Jabbar, K.L. Crespo, I. Sucandy,* S.B. Ross, A.S. Rosemurgy. *AdventHealth Tampa, Tampa, FL.*

Introduction: Centrally located caudate lobe mass creates significant technical challenges for liver surgeons due to concerns of intraoperative bleeding from the inferior vena cava and potentially hepatic veins. Therefore, majority of the caudate lobe tumors are approached using the traditional open methods. Despite rapid dissemination of laparoscopic liver resection, minimally invasive technique is still rarely applied when vascular dissection is anticipated. This video described our technique of a robotic left hepatectomy with an en bloc resection of the caudate lobe tumor abutting the middle and right hepatic veins. Methods: The patient is a 27-year-old woman who presented with frequent epigastric abdominal pain requiring multiple emergency room visits. Workup included CT scan and MRI which showed a 6 cm caudate lobe tumor, requiring vascular dissection for parenchymal preservation. Results: The operation began with a complete mobilization of the left lobe of the liver. The gastrohepatic ligament was opened in a stellate fashion along the Arantius ligament toward to origin of the left hepatic vein. Using hook cautery and fenestrated bipolar, the left hepatic artery and portal vein were dissected and ligated using silk sutures for inflow vascular control. Ultrasound was utilized to map the intrahepatic vasculature following the trajectory of the left, right, and middle hepatic veins. The caudate lobe was dissected off the inferior vena cava by dividing the short hepatic veins. Parenchymal liver transection was undertaken with a vessel sealer. The tumor was dissected off the middle and right hepatic veins (preserved) to avoid venous congestion of the central liver sectors. Caudate lobe mass was ultimately resected en bloc with left lobe of the liver by transecting the left hepatic vein at its origin. Conclusions: Patient recovered well and was discharged from the hospital on POD 3. Her preoperative symptoms resolved completely. This video shows that the robotic approach can be safely utilized during a complex liver resection, even with the need for delicate vascular dissection.

V7

Robotic-Assisted Laparoscopic Left Lateral Segmentectomy and Partial Gastrectomy for Resection of Ruptured Hepatocellular Carcinoma L. Demyan,* Y. AlSalmay, C. Nofi, G. Deutsch. *Northwell Health, Queens, NY.*

Introduction: Minimally invasive approaches to hepatic segmentectomies have been on the rise. Due to anatomic considerations of the left lobe, the use of the DaVinci surgical system can aid in visualization and maneuverability, facilitating complex dissection of left lobe pathology. As more surgeons are training in and adopting robotics around the world, the robotic approach in hepatic surgery is gaining popularity for its ability to improve surgeons' technical control and finesse. Methods: We present a case of an 80-year-old male with hepatocellular carcinoma (HCC) presenting as hemorrhagic left lateral hepatic mass. Results: The patient was found to have a 3.7 cm mass of left lateral hepatic lobe with associated per-hepatic hemorrhage (12.1 x 4.2 cm), confirmed on pre-operative CT and MR of the abdomen. The patient was scheduled for robotic-assisted laparoscopic left lateral segmentectomy and partial gastrectomy for en-bloc resection of the complex hepatic mass. After establishing pneumoperitoneum and docking the robotic system, exposure of the left hepatic lobe was achieved. Dissection was carried out with the Harmonic curved shears on the left arm of the surgeon and the bipolar forceps on the right arm. The division of the vascular pedicles for segments II and III and the left branch of the hepatic vein was performed with Endo GIA staplers. Indocyanine green was given, lack of blood flow to these two segments, and intact blood flow to the remaining liver was confirmed. Additional parenchymal transection was performed with shears while the other port was used for retraction. To resect the mass en-bloc, sleeve gastrectomy was performed with a robotic stapler and the specimen was removed. The operation was carried out with minimal blood loss and the patient recovered expectantly. Conclusion: The case shown in the video demonstrates how fully-articulating instruments, multiple arms, and three-dimensional visualization utilizing the Da Vinci robot may be advantageous in performing a left lateral segmentectomy with en-bloc gastrectomy for resection of complex masses.

V8

Safe Anastomoses in Cytoreductive Surgery with Heated Intraperitoneal Chemotherapy: Technical Considerations and Modifications P. Barrios, I. Ramos, D. Sabia, O. Crusellas, L. Bijelic.* *Surgery, Hospital Sant Joan Despi Moises Broggi, Barcelona, Spain.*

INTRODUCTION: Cytoreductive surgery (CRS) with HIPEC is composed of peritonectomy procedures and visceral resections in order to achieve complete tumor clearance which can lead to the need of multiple gastrointestinal anastomoses. Gastrointestinal anastomotic complications are the most common type of severe complication after CRS and HIPEC and are reported to occur in 7-18% of cases. In addition to optimizing patient selection and perioperative management, technical aspects of performing anastomoses and various modifications can be applied to reduce the incidence of anastomotic leak. The aim of this video is to review key technical aspects and suggested modifications of the most frequent gastrointestinal anastomoses in CRS and HIPEC adopted in a very high volume center that has achieved reducing anastomotic leak rates to 0-3.6%. MATERIALS and METHODS: This is a video review of techniques used for performing the most commmon types of gastrointestinal anastomoses encountered during cytoreductive surgery: colo-rectal, ileo-rectal (with and without pouch), and ileo-colic anastomoses with special emphasis on technical details and modifications aimed at reducing the risk of anastomotic failure. RESULTS: Among 1300 patients treated with CRS and HIPEC from 2006 until 2020, 702 had at least one anastomosis with a mean of 1.15 (range 1-6). All of the anastomoses were performed before HIPEC without use of diverting ostomies. There were 11 anastomotic failures: 4/485 rectal anastomoses (0.8%), 4/408 ileo-colic anastomoses (1%) and 3/86 gastric or esophageal anastomoses (3.6%). There were no failures of primary small bowel anastomoses. In 4 of the 11 cases, a reoperation was required and one of the cases led to a 90-day mortality. The results were externally validated by the Catalonian Quality Agency (AQuAS). CONCLUSIONS: Gastrointestinal complications in patients undergoing CRS and HIPEC can be drastically reduced in a high volume dedicated center. This video demonstrates the technical approaches that have been systematically applied and are likely an important contributing factor to maintaining an extremely low rate of anastomotic failure.

V9

Safety and Eof Pressurized Intra-Peritoneal Aerosolized Chemotherapy (PIPAC) in Gynecologic, Gastric, and Colorectal Cancer Patients with Peritoneal Carcinomatosis: A Phase I Study G.K. Malhotra,* A. Kohut, M. O'Leary, T. Tran, M. Fakih, D. Lim, J. Chao, Y. Woo, B. Paz, Y. Fong, T. Dellinger, M. Raoof. *City of Hope, Duarte, CA.*

Introduction: Peritoneal carcinomatosis from ovarian, gastric, and colorectal origin can be treated with cytoreductive surgery with or without the addition of HIPEC for select patients. Unfortunately, not all patients are candidates for aggressive surgical debulking. For these patients, Pressurized Intra-Peritoneal Aerosolized Chemotherapy (PIPAC) has emerged as an alternative method of intraperitoneal (IP) chemotherapy administration. Here we are present an ongoing Phase I trial to evaluate the safety and efficacy of PIPAC. Methods: This is a prospective phase I clinical trial. Patients with histologically confirmed, ovarian, uterine, gastric, appendiceal or colorectal cancer with peritoneal metastases that have progressed on at least one evidence-based chemotherapeutic regimen are eligible. There are two clinical arms. Arm 1: includes patients with gynecologic and gastric malignancies who will be treated

with IP administration of cisplatin and doxorubicin. Arm 2: includes patients with colorectal and appendiceal malignancies and will be treated with intravenous fluorouracil and leucovorin followed by IP administration of oxaliplatin. All patients will be monitored for dose limiting toxicities and any adverse events. Tissue and serum samples will be collected with every PIPAC administration and analyzed for pharmacokinetics, germline sequencing, whole exome/transcriptome sequencing, special transcriptomics and immune correlatives. Results: Here we present practical and technical considerations for the administration of PIPAC including patient selection, operating room setup, and technical details for successful aerosolized chemotherapy delivery. Study results for the phase I trial will be reported separately once the trial has completed. Conclusions: PIPAC is a feasible, minimally invasive approach, that allows for intraperitoneal delivery of chemotherapy. The ongoing phase I trial will help provide safety and initial efficacy data once completed.

V10

Surgical Techniques to Increase Intestinal Transit Time Following Extensive Intestinal Resections in Cytoreductive Surgery P. Barrios, I. Ramos, D. Sabia, O. Crusellas, L. Bijelic.* *Surgery, Hospital Sant Joan Despi Moises Broggi, Barcelona, Spain.*

INTRODUCTION: One of the limiting steps in cytoreductive surgery (CRS) for peritoneal surface malignancies is the need for extensive intestinal resections associated with rapid intestinal transit time, malnutrition and frequent bowel movements that negatively affect quality of life. Some modifications of surgical techniques of reconstruction of intestinal continuity can help patients with residual small bowel length of less than 120 cm and absence of 2 or 3 intestinal valves to achieve slower intestinal transit time and diminish the associated nutritional and quality of life limitations. The aim of this video is to show 5 possible reconstruction options in patients with short residual bowel: interposition of a short antiperistaltic small bowel segment in jejuno-jejunal or jejuno-colic anastomoses, interposition of an antiperistaltic transverse colon segment in a jejuno-rectal anastomosis, interposition of an antiperistaltic cecal segment in a jejuno-rectal anastomosis and combinations of these techniques. METHODS: This is a video review of techniques used for slowing intestinal transit time in patients requiring extensive intestinal resections during CRS and resulting in residual small bowel length of less than 120 cm with loss of at least 2 intestinal valves. Among 1300 CRS procedures performed between 2006 and 2020, one of these reconstruction techniques was used in 47 cases. RESULTS: There were no anastomotic failures among the 47 patients. Eleven of the 47 patients presented with excessively slow intestinal transit during the postoperative period that resolved over days to weeks without preventing oral intake. The number of daily bowel movements varied between 2 to 9 after surgical recovery. None of the patients required long term parenteral nutrition. CONCLUSIONS: The presented techniques can expand the possibility of achieving complete tumor resection in patients with peritoneal malignancies that require extensive bowel resections. In experienced centers, well selected patients can safely undergo extensive bowel resections and the presented reconstructions techniques can offer a reasonably good quality of life and nutritional results.

V11

Robotic Proximal Gastrectomy for Gastroesophageal Junction Gastrointestinal Stromal Tumor E. Olecki,[1]* M. Kukar,[2] S.N. Hochwald,[2] J.S. Peng.[1] *1. General Surgery, Penn State Hershey Medical Center, Hershey, PA; 2. Rosewell Park Comprehensive Cancer Center, Buffalo, NY.*

Introduction: Minimally invasive approaches to gastric and esophageal tumors have been increasingly utilized due to decreased complications and improved functional outcomes. Proximal gastrectomies are uncommonly performed but is a preferable option over total gastrectomy in specific circumstances, with potential for decreased operative length and better long-term functional outcomes. This video vignette demonstrates our technique for robotic proximal gastrectomy with esophagogastric anastomosis. Methods: The patient was an 85 year old male presenting with dizziness, presyncope, and, anemia. He was found to have an 11 cm gastrointestinal stromal tumor (GIST) arising from the proximal stomach posteriorly, causing compression of his gastroesophageal (GE) junction. After neoadjuvant imatinib treatment, there was partial response of the tumor with a decrease in size to 6 cm. A wedge resection was attempted but unsuccessful due to adherence to the esophagus, and we proceeded with proximal gastrectomy. Results: The accompanying video demonstrates our approach for robotic proximal gastrectomy. The left gastric vessels are divided with a vascular load stapler. The gastrocolic ligament is opened, taking care to preserve the right gastroepiploic vessels, and the short gastric are divided. The esophagus is mobilized to enable subsequent anastomosis. A gastric conduit is created, based off of the gastroepiploic vessels. Reconstruction is performed using an EEA stapler, inserted via a GelPOINT Mini (Applied Medical, Rancho Santa Margarita, CA). The patient recovered well postoperatively and pathology demonstrated rare residual tumor cells. At 3 month follow up, the patient was maintaining his weight on a regular diet and has no symptoms of reflux or dysphagia. Conclusion: This video vignette demonstrates the successful resection and reconstruction of a GIST located at the GE junction via a robotic proximal gastrectomy.

ABSTRACTS

Accepted for

POSTER PRESENTATIONS

GLOBAL PARTNER POSTERS PROGRAM

SSO's Global Partner Posters Program is an important component of the Society's efforts to advance its mission to improve multidisciplinary patient care by advancing the science and practice of cancer surgery worldwide. Top abstracts from international surgical oncology and relevant cancer surgery meetings and their presenters are invited to be a part of the SSO International Conference on Surgical Cancer Care. These posters are identified by the leadership and program committees of the societies as the top abstracts presented at various meetings.

SSO 2021 – International Conference on Surgical Cancer Care
March 18-19, 2021

GPP1

Feasibility of Sentinel Lymph Node Biopsy in Melanoma Patients Following Radical Lymphadenectomy of the Same Lymph Node Basin

Alberto Julius Alves Wainstein,* Lucas Dias Cândido, Ana Paula Drummond-Lage. *Faculdade Ciências Médicas de Minas Gerais.*

Background: Patients with melanoma and positive Sentinel Lymph Node (SLN) are at high risk for systemic dissemination and can benefit from adjuvant treatment. The study of SLN is performed by the SLN Biopsy (SLNB) demonstrated by the lymphoscintigraphy and histologic analysis. However, some oncologic patients have previously undergone complete lymphadenectomy for other tumors. After lymphadenectomy, these patients developed melanoma, and until then, these patients have no alternative to assess regional lymph node involvement. No published studies are dictating the best conduct for nodal melanoma staging in these patients. Objectives: Evaluate the feasibility of performing SLNB in patients with melanoma after a previous complete lymphadenectomy. Methods: A database of 838 patients diagnosed with melanoma was evaluated. Six patients identified with a previous history of total lymphadenectomy as the standard treatment for melanoma, breast or thyroid tumors developed a second primary or recurrent cutaneous melanoma in the same extremities previously submitted to radical lymphadenectomy. All these patients had criteria for performing SLNB, but there is no scientific report that corroborates the performance of this procedure in this situation. They underwent preoperative lymphoscintigraphy to locate the SLN, then underwent radio-guided SLNB, and the SLN excised were evaluated by a pathologist. We evaluated the feasibility of a second preoperative lymphoscintigraphy followed by radio-guided SLNB for cutaneous melanoma in an area previously submitted to total lymphadenectomy. Results: All six cases of oncologic patients presented had SLN located, and three presented with metastasis in the excised lymph nodes. None of the patients presented morbidity or complications more severe or different from those prevalent for the SLNB technique. Conclusion: SLNB with drainage expected for regions previously submitted to radical lymphadenectomy is a safe and effective procedure. SLNB detected metastatic lymph nodes in 50% of the cases in this cohort, which provides essential information for prognosis and effective management for this group of patients.

GPP2

Multidisciplinarity in Minimally Invasive Therapeutic Management of Gastrointestinal Stromal Tumor (GIST): Advantages of Laparoscopy Endoscopy Cooperation Surgery (LECS) in the CLEAN-NET Technique (Non-Exposure)

Amanda da Silva Anjos,*[1] Filipe Vieira Kwiatkowski,[2] Thiago Ferreira Bartholomei.[3] *Faculdades Pequeno Príncipe,[1] Hospital Santa Casa de Misericórdia de Pelotas,[2] Hospital Ônix.[3]*

Introduction: The gastrointestinal stromal tumor is the most common mesenchymal neoplasia, and can be found in any portion of the digestive tract, being more common in the stomach and small intestine. Surgical resection remains the main therapeutic approach for this neoplasm. Aim: To report a case of gastrointestinal stromal tumor that was treated with cooperative laparoscopic and endoscopic surgery, in order to highlight the advantages of multidisciplinarity between surgical oncology and endoscopy in the management of this type of tumor. Case report: A 60-year-old male patient underwent an upper gastrointestinal endoscopy that showed an elevated formation covered by regular mucosa, hardened at the touch of the device, compatible with subepithelial formation in a small gastric curvature. The patient's therapeutic plan included performing laparoscopic and endoscopic cooperative surgery according to a technique without exposure. The anatomopathological report showed a 2x1.8 cm nodular fusocellular mesenchymal neoplasia, compatible with gastrointestinal stromal tumor. Conclusion: The advantages that the multidisciplinarity between surgical oncology and endoscopy offers in the treatment of gastrointestinal stromal tumor include a safe procedure, with complete oncological resection, requiring the least possible margins, thus preserving a greater amount of gastric wall, vessels and nerves. Consequently, the gastric function is maintained, with an improvement in the patient's quality of life and less morbidity and mortality when compared to other surgical procedures. In addition, the modified techniques of this procedure allow no exposure of the peritoneal cavity to gastric juice and direct contact with the tumor, thereby reducing the chance of tumor spread.

GPP3

Patient Navigation: Fighting for the Rights of Patients with Breast Cancer in Brazil

Sandra Gioia,*[1] Lucia Brigagão,[1] Marcelle Medeiros,[2] Lindsay Krush,[3] Don S. Dizon,[3] Paul E. Goss,[3] Ben Park.[3] *Maicon Rocha Secretaria de Estado de Saúde do Rio de Janeiro,[1] Fundação Laço Rosa,[2] Global Cancer Institute, Massachusetts General Hospital Cancer Center and Harvard Medical School.[3]*

Introduction: This article deals with the experience of the Patient Navigation Program (PNP) in a Breast Cancer (BC) Diagnostic Center of the Rio de Janeiro State Department of Health (SES/RJ). The theme is of interest for the planning and evaluation of cancer control actions to allow the correct application of the Ministry of Health Law No. 12,732/12, also called the Law of 60 Days. This law establishes that the treatment of any cancer for patients in the public health system must begin within 60 days after the definitive diagnosis. Methods: The navigator patient accompanied women from the Unified Health System (SUS) diagnosed with BC to start treatment at a specialized center within 60 days. Information was collected on the patients' clinical characteristics, clinical dates and barriers encountered. Univariate logistic regression was used to assess factors associated with 60-day treatment initiation. Results: From January to July 2020, 301 breast biopsies were performed with 126 (42%) of BC. The average age was 54 years old (26-88). 75% of the lesions were diagnosed in an advanced stage (IIB to IV). The average time to start treatment was 39 days (11-108). The main barriers found were: fear (93%), difficulty in communicating the patient with the medical team (81%), lack of coordination in health care (37%). Being in treatment outside the city of Rio de Janeiro (RJ) was the main factor associated with treatment in 60 days (79.5% x 20.5%, $p < 0.001$). Conclusions: The rate of compliance with the Law of 60 Days was 86%. Provisions must be made regarding the difficulty of complying with the legislation in the municipality of RJ due to the deficit in human and medical resources. In the context of a complex and fragmented health system for a population in a situation of socioeconomic vulnerability, PNP shows itself as an innovative tool to raise the policing rate in Brazil.

GPP4

Early Gastric Cancer: Case Report and Literature Review

Lindsay Lemes Pedrotti,* Rayanne Lima Rocha Vidal, Renato de Lima Rozenowicz. *Nove de Julho University.*

Goal: We have reported a case of early gastric cancer, subjected to gastrectomy with D2 lymphadenectomy with anatomopathological finding of multiple lymph node metastasis. Case Report: EG patient, 65 years old, white. He sought medical help for pain complaints in epigastric accompanied by weight loss (10 kg) in 6 months. Performed upper gastrointestinal endoscopy with a finding of 4 cm pre-pyloric ulcer with anatomopathological finding confirming gastric adenocarcinoma; he underwent subtotal gastrectomy with D2 lymphadenectomy. The anatopathological study showed little differentiated carcinoma with dimensions 4.5 cm x 4.0 cm x 0.7 cm, depth of submucosal invasion, macroscopic variant Borrmann type I, histological variant of signet ring cells, histological grade 3, angiolymphatic embolization present, inflammatory infiltrate moderate peritumoral, compromised lymph nodes 36 of 44 dissected anatomopathological staging. Discussion: In early gastric cancer the rates of ganglionic metastases are low, as well as metastases to other places are very rare as they do not penetrate beyond the mucosa and submucosa. The main factor that determines the extension of the surgical procedure is the possibility of the existence of lymph node metastases. According to the literature, early tumors have an average of 3.2% of lymph node involvement when restricted to the mucosa of 19.2% when they reach the submucosa. For an adequate staging of patients with early tumors, echoendoscopy is necessary to discover the depth of infiltration in the gastric wall and also in the affected lymph node. In a study by Bravo Neto a1 on lymph node metastasis in early gastric cancer, the authors found around 16% of patients with early gastric cancer to be high for Western standards and low for Easterners. In the same article, the authors found 42% of lymph node metastases in tumors restricted to submucosa, a high incidence, which suggests that radical D2 lymphadenectomy is maintained in. Conclusion: Our case report meets the data in the literature, corroborating that less extensive surgeries should be performed in extremely selected cases of early gastric cancer.

GPP5

The ALPPS Procedure for Hepatocellular Carcinoma Larger than 10 Centimeters

Mariusi Glasenapp dos Santos,* Lucas Feijó Pereira, Sharly Nataly Storch Schilling, Rosy Elvine Chindje Nganka. *Federal University of Santa Maria*.

Introduction: The hepatocellular carcinoma (HCC) is the most common primary tumor of the liver. According to tumor size, HCC larger than 10 cm is defined as very large. The only means of achieving chances to obtain long-term survival is complete tumor resection or liver transplantation. Associating liver partition and portal vein ligation for staged hepatectomy (ALPPS) is an innovative surgical technique, which permits to extend the indication of hepatectomy to liver tumors considered unresectable by other techniques This procedure induces rapid liver hypertrophy and is indicated in selected patients with HCC. Presentation of case: A 51-year-old woman presented with abdominal pain, weight loss and jaundice. She has diabetes, hypertension, dyslipidemia and osteoarthrosis, but no history of hepatitis virus infection. Contrast-enhanced computed tomography (CT) was performed which revealed a large tumor measuring 14 cm in segment 4, compressing the right portal vein and confluence of hepatic ducts, without signs of thrombosis and no signs of liver cirrhosis. The case was discussed in a multidisciplinary meeting and ALPPS was indicated, after tract biliary drainage and chemoembolization. During the first procedure, it was performed hepatotomy in the left margin of tumor with ligature, section of glissonian pedicle of segment 4A and 4B until retro-hepatic vena cava and right portal vein were ligated. After seven days, the second procedure was performed. The vessels of inferior vena cava were ligated and the definitive ligature of right portal vein was performed. The right hepatic artery and the right hepatic duct also were ligated. After hepatotomy, the right and middle supra-hepatic veins were sectioned and the tumor was removed. The postoperative course was adequate and after 90 days of follow-up, the patient is well, with no signs of recurrence. Discussion: HCC is a complicated disease and ALPPS is not considered an optimal treatment option. However, patients with large tumors can benefit, when they are not considered for liver transplantation or chemotherapy. Conclusion: ALPPS should be considered in selected patients with large hepatocellular carcinomas.

GPP6

Endoscopic Inguinal Dissection. A State of Art.

Hisham Abdel Mageed,* Ihab Saad. *National Cancer Institute - Cairo*.

Introduction: Inguinal lymph node dissection is an integral part of surgical oncology. But this procedure comes with a very high complication rate especially skin complications in the form of skin dehiscence which causes extended hospital stay and delays adjuvant treatment. In the last decade a new technique was introduced which uses minimally invasive techniques with ports inserted in the lower thigh above the knee area to address the inguinal region while avoiding any incision at the inguinal region which is notorious for its complications. Objectives: The objective of this series was to examine safety and feasibility of this novel technique and to compare its results with the traditional open method. The aim was to see if the new technique was as efficient as the traditional technique while comparing oncological outcomes and complication rates with the traditional open procedure. Methods: 27 cases were performed since 2014. Results were compared to 27 traditional open cases. Outcomes like operative time, discharge day, complications and lymph node retrieval were compared. Results: Decrease of operative time with experience with median duration of 2 hours, same number of lymph nodes when compared to open procedure, easy learning curve with 5 conversions in the early phase of the learning curve. Markedly decreased skin complication rates and markedly decreased hospital stay when compared to the open procedure. Conclusion: The new minimally invasive technique was found to be a good alternative to the open technique which caused marked decrease in the complication rate while maintaining good oncological outcomes.

GPP7

The Initial Experience and Outcome of Peritoneal Surface Malignancies (PSM) Managed with Cytoreductive Surgery (CRS)/ Hyperthermic Intraperitoneal Chemotherapy (HIPEC) and Enhanced Recovery Protocol (ERAS) in Limited Resource Settings in Egypt.

Wael M.S.A Gawad,*[1] Wahid Y. Gareer,[1] Bahaa Ahmed,[1] Ahmed Samy,[2] Mohga Samy,[1] Mohamed Hegazy,[1] Ahmed Morsi.[1] *National Cancer Institute - Cairo,[1] Ismailia Cancer Centre.[2]*

Background: Cytoreductive Surgery (CRS)/ Hyperthermic Intraperitoneal Chemotherapy (HIPEC) is an increasingly expanding effective approach for peritoneal malignancy which used to have a dismal prognosis with palliative chemotherapy. Proper patient selection through a multidisciplinary team is mandatory. Methods: A retrospective review of all cases of Peritoneal Metastases that underwent CRS & HIPEC from 2014-2019 in two tertiary referral cancer centres was conducted. The outcome for ERAS Protocol (2017-2019) was compared to the Pre ERAS-era (2014-2016) to identify the demographic profile, associated morbidity & mortality and the preliminary oncologic outcome. Results: 86 females & 14 males were enrolled; 50 patients were equally distributed in the Pre & ERAS periods. Disease sites were (73- Ovarian Cancer/12-Colorectal Cancer / 10- Appendiceal Cancer and 5- Gastric Cancer). The mean age was 53.1 years, PCI had a mean of 16.8 (<16 in 48.3%, 16-20 in 44.6% and more than 20 in 7.1%). Regarding Completeness of Cytoreduction, CC0 was achieved in 77%, CC1 in 20 % and CC2 in 3%. On comparing the Pre-ERAS /ERAS Era, the mean total Intravenous fluid use was 30.5 & 17.1 Litres (P<0.003) whereas the mean hospital stay was 10.2 & 8.3 days respectively (P<0.001). The average operative time was 11.30 hours. Postoperative 30 days morbidity was documented in 48.3% with no mortality. The 2 years DFS was 55.9% & the 2 years overall survival was 78%. Conclusion: Management of PSM is feasible in limited resource settings. It should be performed in highly specialized centres with well-trained teams, and proper patient selection through a MDT. The ERAS Protocol has resulted in significant decrease in hospital stay and Intravenous fluids.

GPP8

Sternal Tumors Resection and Reconstruction: Survival Analysis

Abdelrahman Mohamed, Ayman Hanafy, Galal Ghaly,* Iman Loay, Ismail Morad. *National Cancer Institute - Cairo*.

Introduction: Sternal tumors should be considered malignant until proved otherwise. We sought to determine the prognostic variables for both Disease Free Survival (DFS) and Overall Survival (OS) in patients with primary and secondary sternal tumors treated with surgical resection. Methods: We collected and analyzed retrospective data on the clinical presentation, radiologic imaging, pathology, operative details and follow up of patients with sternal tumors who underwent surgery at our institute between January 2005 and January 2015. OS and DFS were estimated using the Kaplan-Meier method, and predictors of OS and DFS were analyzed. Results: Twenty one patients underwent sternal resection, 19 (90.5%) were malignant tumors [of which 8 (42%) were primary and 11 (58%) patients were secondary malignancies] and 2 (9.5%) patients were benign tumors. Sternal resections were partial in 6 patients (28.6%), subtotal in 13 (61.9%), and total in 2 (9.5%) patients. There was 1 perioperative death. Postoperative flail chest occurred in 6 (28.6%) patients, three of them treated by mechanical ventilation, other complications were noted in 10 (47.6%) patients. Median follow-up period was 31 (2-124) months. One, 2 and 3-year OS were 89.5%, 76.9 % and 69.2% respectively. Defect size ≤10 cm was associated with better OS on univariate analysis (p=0.012). One, 2 and 3-year DFS were 84.2%, 72%, and 64.8% respectively. Low grade tumors were associated with better DFS on univariate analysis (p=0.007). Conclusions: Wide Sternal resection followed by anterior chest wall reconstruction, is associated with favorable long-term OS and DFS for both primary and secondary sternal tumors.

GPP9

Tumor-Stroma Ratio Is Associated with Miller-Payne and Pathological Response to Neoadjuvant Chemotherapy in HER2-Negative Early Breast Cancer

Sophie C. Hagenaars,*[1] Stefanie de Groot,[1] Danielle Cohen,[1] Tim J.A. Dekker,[1] Ayoub Charehbili,[1] Elma Meershoek-Klein Kranenbarg,[1] Marjolijn Duijm-de Carpentier,[1] Hanno Pijl,[1] Hein Putter,[1] Rob A.E.M. Tollenaar,[1] Judith R. Kroep,[1] Wilma E. Mesker.[1,2] *Leiden University Medical Center,[1] Dutch Breast Cancer Research Group (BOOG).[2]*

Background: The tumor-stroma ratio (TSR) has proven to be a strong prognostic factor in breast cancer, demonstrating better survival for patients with stroma-low tumors. Since the role of TSR as a predictive marker for neoadjuvant chemotherapy outcome is yet unknown, this association was evaluated for HER2-negative breast cancer in the prospective DIRECT and NEOZOTAC trials. Methods: The TSR was assessed on 375 hematoxylin and eosin-stained sections of pre-treatment biopsies. Associations between the TSR and chemotherapy response according to the Miller-Payne (MP)

grading system, and between the TSR and pathological response were examined using Pearson's chi-square, Cochran-Armitage test for trend and regression analyses. Results: A stroma-low tumor prior to neoadjuvant chemotherapy was significantly associated with a higher MP score (p = 0.005). This relationship remained significant in the estrogen receptor (ER)-negative subgroup (p = 0.047). The univariable odds ratio (OR) of a stroma-low tumor on pathological complete response (pCR) was 2.46 (95% CI 1.34-4.51, p = 0.004), which attenuated to 1.90 (95% CI 0.85-4.25, p = 0.119) after adjustment for relevant prognostic factors. Subgroup analyses revealed an OR of 5.91 in univariable analyses for ER-negativity (95% CI 1.19-29.48, p = 0.030) and 1.48 for ER-positivity (95% CI 0.73-3.01, p = 0.281). Conclusions: A low amount of stroma on pre-treatment biopsies is associated with a higher MP score and pCR rate. Therefore, the TSR is a promising biomarker in predicting neoadjuvant treatment outcome. Incorporating this parameter in routine pathological diagnostics could be worthwhile to prevent overtreatment and undertreatment.

Note. This abstract was published in the European Journal of Surgical Oncology, Vol 47, Issue 2, Hagenaars SC, et al, "Tumor-Stroma Ratio Is Associated with Miller-Payne and Pathological Response to Neoadjuvant Chemotherapy in HER2-Negative Early Breast Cancer," ©Elsevier 2021.

GPP10

10-year Outcome of a Randomized Trial Comparing Neoadjuvant Chemoradiotherapy and Surgery with Surgery Alone for Esophageal Cancer (CROSS trial)

Ben M. Eyck,*[1] J. Jan B. van Lanschot,[1,2] Maarten C.C.M. Hulshof,[2] Berend J. van der Wilk,[1] Joel Shapiro,[1] Pieter van Hagen,[1] Mark I. van Berge Henegouwen,[2] Bas P.L. Wijnhoven,[1] Hanneke W.M. van Laarhoven,[2] Grard A.P. Nieuwenhuijzen,[3] Geke A.P. Hospers,[4] Johannes J. Bonenkamp,[5] Miguel A. Cuesta,[2] Reinoud J.B. Blaisse,[6] Olivier R. Busch,[2] Geert-Jan M. Creemers,[7] Cornelis J.A. Punt,[5,8] John Th.M. Plukker,[4] Henk M.W. Verheul,[2,5] Ernst J. Spillenaar Bilgen,[6] Maurice J.C. van der Sangen,[7] Tom Rozema,[5,9] Fiebo J.W. ten Kate,[1] Jannet C. Beukema,[4] Anna H.M. Piet,[2] Caroline M. van Rij,[1] Janny G. Reinders,[10] Hugo W. Tilanus,[1] Ewout W. Steyerberg,[1,11] Ate van der Gaast,[1]; for the CROSS study group. *Erasmus MC - University Medical Center Rotterdam,[1] Amsterdam University Medical Centers, University of Amsterdam,[2] Catharina Hospital, Eindhoven,[3] University of Groningen - University Medical Center Groningen, Groningen,[4] Radboud University Medical Center, Nijmegen,[5] Rijnstate Hospital, Arnhem,[6] Catharina Hospital, Eindhoven,[7] Julius Center for Health Sciences and Primary Care, University Medical Center Utrecht,8 Verbeeten Institute, Tilburg,[9] Arnhem Radiotherapeutic Institute ARTI,Arnhem,[10] Leiden University Medical Center, Leiden.[11]*

Background: Neoadjuvant chemoradiotherapy according to the ChemoRadiotherapy for Oesophageal cancer followed by Surgery Study (CROSS) has become a standard of care for patients with locally advanced resectable esophageal or junctional cancer. However, the long-term benefits and harms remain unclear. We aimed to assess the long-term outcomes of this regimen. Materials and Methods: From 2004 through 2008, 366 patients were randomly assigned to either five weekly cycles of intravenous carboplatin (area under the curve of 2 mg/mL/min) and paclitaxel (50 mg/m2 body-surface area) on days 1, 8, 15, 22, and 29 with concurrent radiotherapy (41.4 Gy in 23 fractions, 5 days per week) followed by surgery, or surgery alone. Follow-up data were collected through 2018. Overall survival was estimated with the Kaplan-Meier method and compared with Cox regression analyses. The effect beyond 5 years of follow-up was assessed by using landmark analyses. Also, cause-specific mortality was estimated with cumulative incidence functions and compared with Cox regression. Results: The median follow-up was 147 months (IQR 134-157). Patients who received neoadjuvant chemoradiotherapy had better overall survival (HR 0.70, 95%CI 0.55-0.89), with 10-year overall survival of 38% (95%CI 31-45) in the neoadjuvant chemoradiotherapy plus surgery arm and 25% (95%CI 19-32) in the surgery alone arm. Landmark analyses showed that the overall survival benefit that was gained in the first 5 years, persisted beyond 5 years. The risk of death from esophageal cancer was lower for patients who received neoadjuvant chemoradiotherapy plus surgery (HR 0.60, 95% CI 0.46-0.80), while death from other causes was comparable between both study arms (HR 1.17, 95%CI 0.68-1.99). Conclusions: The overall survival benefit of patients with locally advanced resectable esophageal or esophagogastric junctional cancer who received neoadjuvant chemoradiotherapy plus surgery according to the CROSS regimen persists for at least 10 years, compared with surgery alone.

Note. This abstract was published in the European Journal of Surgical Oncology, Vol 47, Issue 2, Eyck BM, et al, "10-year Outcome of a Randomized Trial Comparing Neoadjuvant Chemoradiotherapy and Surgery with Surgery Alone for Esophageal Cancer (CROSS trial)," ©Elsevier 2021.

GPP11

Prioritizing Elective Surgery Under the COVID-19 Pandemic Pressure: The SWALIS-2020 New Model to Face a Sustainability Challenge

Roberto Valente,*[1] Stefano Di Domenico,[1] Matteo Mascherini,[1] Gregorio Santori,[1] Francesco Papadia,[1] Giovanni Orengo,[1] Angelo Gratarola,[1] Sofia Paola Martigli,[1] Alexandru Boscaneanu,[1] Selene Deiana,[1] Marta Iakubowska,[1] Ferdinando Cafiero,[2] Franco De Cian.[3] *Policlinico S. Martino, Genoa.[1] Regional Healthcare Trust, Liguria Region Health Administration,[2] University of Genoa, Genoa.[3]*

Background: The COVID-19 pandemic burdens non-covid elective surgical patients by reducing service capacity, forcing extreme selection of patients most in need. New tools are urgently required to prioritize operations and optimize the process sustainably. Our study assesses the SWALIS-2020 model ability to prioritize access to surgery during the highest viral outbreak peaks. Methods: A 2020 March - May feasibility-pilot study, tested a software-aided, inter-hospital, multidisciplinary pathway. All specialties patients in the Genoa Departments referred for urgent elective surgery were included in a multidisciplinary pathway adopting a modified Surgical Waiting List InfoSystem (SWALIS) cumulative prioritization method (PAT-2020) based on waiting time and clinical urgency, in three subcategories: A1-15 days (certain rapid disease progression), A2-21 days (probable progression), and A3-30 days (potential progression). We have studied the model applicability and its ability to prioritize patients by monitoring their waiting list and service performance. https://www.isrctn.com/ISRCTN11384058. Results: Following the feasibility study (N=55 patients), 240 referrals were evaluated in 4 weeks without major criticalities (M/F=73/167, Age=68.7 +/- 14.0). Waiting lists were prioritized and monitored. The SWALIS-2020 score (% of waited-against-maximum time) at operation was 88.7 +/- 45.2 at week 1 and then persistently over 100% (efficiency), over a controlled variation (equity), with a difference between A3 (153.29 +/- 103.52) vs. A1 (97.24 +/- 107.93) (p <0.001), and A3 vs. A2 (88.05 +/- 77.51) (p <0.001). 222 patients underwent surgery, without related complications or delayed/failed discharges. Conclusions: The pathway has selected the very few patients with the greatest need, even with +30% capacity weekly modifications, managing active and backlog waiting lists. We are setting up collaborations for multi-center research.

Note. This abstract was published in the European Journal of Surgical Oncology, Vol 47, Issue 2, Valente R, et al, "Prioritizing Elective Surgery Under the COVID-19 Pandemic Pressure: The SWALIS-2020 New Model to Face a Sustainability Challenge," ©Elsevier 2021.

GPP12

CDH1 Gene Mutation Hereditary Diffuse Gastric Cancer: A Systematic Review of Endoscopic Surveillance Effectiveness and Population-Level Analysis Estimation of Secondary Cancer Risk

Matthew G.K. Benesch,* Morag G. Ryan, Cecily C. Stockley, Alexander Mathieson. *Memorial University of Newfoundland, St. John's, Newfoundland and Labrador.*

Introduction: Hereditary diffuse gastric cancer (HDGC) is a rare signet ring cell adenocarcinoma (SRCC) linked to autosomal dominant truncating mutations of CDH1 (e-cadherin). Carriers have a 70% lifetime risk with a mean diagnosis age of 37 years, and women have a 42% risk of lobular breast cancer. Risk management involves prophylactic total gastrectomy (PTG), often already haboring intramucosal cancer foci. The utility of endoscopic surveillance to delay gastrectomy has long been questioned, as early disease has no macroscopic findings. The current standard by the Cambridge Protocol employs a systemic examination with 30 biopsies with five each from the prepyloric area, antrum, transition zone, body, fundus, and cardia in addition to any targeted biopsies of suspected gastric abnormalities. It is not known if this protocol improves foci detection rates in asymptomatic patients over random biopsies. Other secondary cancer risks beyond breast cancer are postulated in this patient population. Methods: We conducted a systematic review of the literature comparing endoscopic biopsy foci detection via random sampling versus the Cambridge Protocol relative to PTG findings in asymptomatic CDH1 patients, and a population-level risk estimation of secondary cancer risk using the Surveillance, Epidemiology, and End Results

(SEER) database. Results: There is no statistically significant improvement in endoscopic detection rate using the Cambridge Protocol. The estimated test sensitivity and negative predictive value for random biopsies is 20.9% and 15.2% respectively, while for Cambridge Protocol, these values are 27.1% and 22.1%, respectively. After competing risk analysis, the hazard ratio for developing a secondary SRCC is 3-fold higher relative to patients with conventional adenocarcinomas, especially for colorectal cancers. Conclusion: Patients cannot safely rely on endoscopic surveillance to delay PTG. Post-PTG patients may be at risk of secondary SRCCs, particularly colorectal cancers, for which aggressive surveillance may be warranted.

GPP13

Incidence and Characteristics of Colorectal Cancer Except Adenocarcinoma

Youngki Hong,*[1] Yoon Jung Choi,[2] Jung Gu Kang.[3] *National Health Insurance Service Ilsan Hospital,[1] Yongin Severance Hospital, Yogni,[2] Cha University Ilsan Medical Center, Goyang.[3]*

Background/Aims; The colorectal cancer is the third leading cause of death in Korea. While adenocarcinoma is the predominant malignancy, non-adenocarcinoma colorectal cancers including lymphoma, neuroendocrine tumor, sarcoma, melanoma and so on can be found in the colon and rectum. Although these non-adenocarcinoma colorectal cancers are rare, the surgeons need to be aware of the incidence and characteristics to facilitate the diagnosis and treatment. The aim of study is to evaluate the incidence and characteristics of colorectal cancer except adenocarcinoma in Korea. Method; Data from 267,142 patients with pathologic proven colorectal cancer were identified from the Korea Central Cancer Registry between 2007 and 2016. 14,495 patients (5.43%), excluding adenocarcinoma, were included in this study. Results; Among these 14,495 patients, carcinoma accounted for 12,373 patients (85.3%). Neuroendocrine tumor was most common type of carcinoma corresponding 88.2% followed by squamous cell carcinoma (2.3%). Lymphoma, melanoma, and sarcoma accounted for 1431(9.9%), 142(1.0%), and 35(0.2%), respectively. Carcinoma (60.8%), sarcoma (60.0%), and lymphoma (61.8%) are more common in male patients whereas Melanoma in female patients (63,4%). The non-adenocarcinoma colorectal cancer was prevalent in the 50's (28%), and 40's (24%) than in other ages. While lymphoma (54.0%) was most common non-adenocarcinoma colorectal cancer under 20 years of age, neuroendocrine tumor was most common over 20 years of age. The most common site of non-adenocarcinoma colorectal cancer was rectum (76.1%). Conclusion: Our data showed the incidence and characteristics of non-adenocarcinoma colorectal cancer which varies according to age and gender. The non-adenocarcinoma colorectal cancer seems to occur at a younger age than adenocarcinoma. This data could be helpful for managing patients with non-adenocarcinoma colorectal cancer.

GPP14

Automatic Real-Time Parathyroid Detection Algorithm During Robotic Thyroidectomy via Deep Learning Technology

Joon-Hyop Lee,*[1] Jeong-Heum Baek,[1] Young Jae Kim,[2] Kwang-Gi Kim.[2] *Gachon University College of Medicine,[1] Gachon University, Incheon.[2]*

Purpose: Thyroid surgery is one of the most frequently conducted endocrine operations and the recent increase in thyroid cancer incidence has led to an increase in the number of thyroidectomies worldwide Many medical fields have benefited from the recent advent of deep learning technology but they were mainly confined to radiologic image findings. The application of deep learning technology in surgical video clips is in its elementary stage at the moment because of the difficulty in acquiring a large number of reliable intraoperative images compared to radiologic images. The purpose of this study was to develop a real time-parathyroid detection algorithm based on deep learning technology, which could aid endocrine surgeons in identifying the parathyroid gland during robotic thyroidectomy in the future. Methods: In this paper, we collected surgical videos of 152 patients who underwent thyroid surgery at Gachon University Gil Hospital. This study was approved by the institutional review board (GBIRB2019-110) and informed consent was obtained from all participants. Of the collected videos, 70 were taken with DSLR, a commercial camera, while 82 were filmed with 10mm 30 degrees; endoscope. The size of each video was 1920 x 1980 pixel, and consists of 30 frames per second. For annotation data to be used for learning, the surgeon drew a box-shaped region of interest (ROI) directly to the parathyroid region, which was used as a gold standard for learning and validation. The ROI was drawn with in-house software, developed to draw the ROI on a frame basis in surgical videos. After the preprocessing stage, deep learning was performed using the Retinanet deep learning model based on ResNet152 backbone. The learning model was based on Deconvolution Network architecture and trained with 6~12 batch sizes and 100 epochs. True object detection condition was defined as intersection over union (area of overlap/area of Union) * 0.3 and probability * 0.5. A 10-fold cross validation was performed for learning. The deep learning algorithm was developed for all images (camera, 30 + endoscope, 45), camera only and endoscope only and their true positive, false negative, false positive numbers and sensitivity were calculated and compared. Results: Based on still cut frame numbers, the camera + endoscope algorithm produced 40501 true positive, 42696 false negative and 24864 false positive detections which resulted in a sensitivity of 0.49. The camera algorithm made 25041 true positive, 26098 false negative, and 18679 false positive detections demonstrating a 0.49 sensitivity. Finally, the endoscope model produced 10726 true positive, 21332 false negative and 5079 false positive detections translating into a 0.33 sensitivity. The camera + endoscope algorithm produced 7 true positive and false negative cases which resulted in a sensitivity of 0.95. The camera algorithm detected 27 true positive and 3 false negative cases which translates to a 0.9 sensitivity. Finally, the endoscope model produced 41 true positive and 4 false negative detections which translates to a 0.91 sensitivity. Conclusion: The preliminary results demonstrate feasible results. Further learning is necessary to fine-tune the performance of the parathyroid detection algorithm.

GPP15

Different Clinical Features and Outcomes of Conversion Surgery Between Initially Resectable and Unresectable Stage IV Gastric Cancer

Yosuke Kano,*[1] Takaaki Hanyu,[1] Hiroshi Ichikawa,[1] Takashi Ishikawa,[1] Hiroshi Yabusaki,[2] Shirou Kuwabara,[3] Yasuyuki Kawachi,[4] Tetsuya Naito,[5] Hiroshi Hirukawa,[6] Toshifumi Wakai.[1] *Niigata University Graduate School of Medical and Dental Sciences, Niigata,[1] Niigata Cancer Center Hospital, Niigata,[2] Niigata City General Hospital, Niigata,[3] Nagaoka Chuo General Hospital, Nagaoka,[4] Japanese Red Cross Nagaoka Hospital, Nagaoka,[5] Tachikawa General Hospital, Nagaoka.[6]*

Background: Treatment strategy of Stage IV gastric cancer (GC) is different between initially resectable states (IR), such as positive for peritoneal lavage cytology (CY1), No. 16a2 and/or b1 para-aortic node metastasis (16a2/b1PAN), and solitary liver metastasis, and the other unresectable states (UR). The aim of this study was to clarify the difference in clinical features and outcomes of conversion surgery (CS) between IR and UR. Methods: A total of 74 patients who underwent CS for Stage IV gastric cancer at 6 institutions from January 2008 to July 2019 were enrolled in this multi-institutional retrospective study. According to the metastatic lesions, these patients were divided into IR (N=23) and UR groups (N=51). Clinicopathologic features and surgical outcomes were compared between the two groups. Results: The preoperative incurable factors of IR group included CY1 in 12 and No. 16a2/b1PAN in 11 patients, and those of UR group included peritoneal metastasis in 34, distant lymph node metastasis in 13, multiple liver metastases in 10, and the others in 6 patients. The median age was 65 years in IR group and 62 years in UR group, respectively. IR group had a significantly lower number of cycles for preoperative chemotherapy than UR group (2 vs. 5 cycles, P<0.01). R0 resection rate was 100% in IR group and 78.4% in UR group (P=0.01). The 5-year overall survival (OS) rates after the initial treatment were 73.5% in IR group and 17.8% in UR group (P<0.01). Multivariate analyses showed that IR (HR: 0.37, 95% CI: 0.17-0.82, P=0.01) and R0 (HR: 0.41, 95% CI: 0.19-0.87 P=0.02) were significantly independent favorable prognostic factors for OS. Conclusions: IR Stage IV GC had a significantly better OS with a higher R0 resection rate in CS following preoperative chemotherapy with a lower number of cycles than UR. The different treatment strategies may be suitable for IR and UR Stage IV GC.

GPP16

The Oncological Outcomes of Repeat Resection for Recurrence After Hepatectomy for Colorectal Liver Metastases

Yoshiaki Maeda,* Toshiki Shinohara, Nozomi Minagawa. *Hokkaido Cancer Center.*

Introduction: Liver resection is the standard and only curative treatment for colorectal liver metastases, however, recurrence occurs in up to 70% of the patients. The outcomes of repeat metastasectomy after hepatectomy

have been reported, however, the long-term survival benefit and prognosis factors regarding repeat metastasectomy have yet to be determined. This study aimed to clarify the oncological outcomes of repeat metastasectomy for recurrence after hepatectomy and to determine the prognostic factors after repeat surgery. Methods: A consecutive series of 132 patients who underwent hepatectomy for colorectal liver metastases was included in this retrospective study. Potential prognostic factors after repeat metastasectomy were analyzed. Results: There were 99 recurrence cases after hepatectomy, and 42 patients underwent metastasectomy (first repeat metastasectomy) to achieve R0 (17 liver cases, 16 lung cases, and 9 other cases), while the other 57 cases were diagnosed as unresectable and subsequently underwent chemotherapy and/or BSC. Nineteen patients underwent subsequent second repeat metastasectomy (4 liver cases, 7 lung cases, and 8 other cases). The 5-year overall survival rate of the patients who underwent first repeat metastasectomy was 60%, which was significantly higher than that of chemotherapy/BSC patients (P<0.0001). Furthermore, the 5-year overall survival rate of the patients who underwent second repeat metastasectomy was significantly higher than that of chemotherapy/BSC patients (P=0.024). A multivariate analysis revealed that lack of adjuvant chemotherapy following initial hepatectomy (HR 5.41), a short (<12 months) disease-free interval between initial hepatectomy and first repeat metastasectomy (HR 12.9), and right-side colon primary (HR 4.26) were independent poor prognostic factors for the overall survival after repeat metastasectomy Conclusion. This study clearly demonstrated the survival benefit of both first and second repeat metastasectomy for recurrence after initial hepatectomy for colorectal liver metastases, especially for patients with favorable predictive factors.

GPP17

Fluorescence Imaging of Human Hepatocellular Carcinoma Using a β-Galactosidase-Activatable Fluorescence Probe

Soichiro Ogawa,* Ryo Morimura, Hisashi Ikoma, Kazuma Okamoto, Eigo Otsuji. *Kyoto Prefectural University of Medicine*.

Introduction: Fluorescence-guided surgery has been developed as a safe and reliable surgical method. Intraoperative fluorescence diagnostic methods using indocyanine green and 5-aminolevulinic acid have been reported to be useful for liver resection of hepatocellular carcinoma (HCC). Recently, activatable fluorescence probes, which are normally non-fluorescent but can be activated through cancer-specific enzymes, have been developed as novel fluorescent diagnostics that can specifically image cancer rapidly after topical spraying. However, target enzymes and fluorescence probes that are sufficiently effective for use in HCC have not been determined. This study aimed to examine the feasibility of fluorescence imaging of HCC using a β-galactosidase (β-Gal)-activatable fluorescence probe SPiDER-βGal. Methods: Live cell imaging of HCC cell lines (Hep-G2, HuH-7, PLC/PRF/5, and Li-7) and imaging of tumor-bearing mouse model were performed using SPiDER-βGal. β-Gal activity was measured in cryopreserved HCC tissues from 68 patients. Furthermore, fluorescence imaging was performed in 27 freshly resected human HCC specimens. Result: Fluorescence was also observed in 4 types of HCC cell lines. In HuH-7, Li-7, and PLC/PRF5 tumor-bearing mice, the tumors displayed stronger fluorescence than normal liver tissue. In cryopreserved samples, β-Gal activity was significantly higher in tumor tissues than in non-tumor tissues ($p < 0.001$). In freshly resected specimens, fluorescence intensity in the tumor was significantly higher than that in non-tumor liver specimens as early as 2 min after spraying. Receiver operating characteristic curves were constructed to determine the diagnostic value of the increase in fluorescence intensity in tumor and non-tumor tissues at 10 min. The sensitivity, specificity, and area under the curve at 10 min after spraying were 85.2%, 74.1%, and 0.864, respectively. Conclusion: SPiDER-βGal is useful for rapid fluorescence imaging of HCC. Fluorescence imaging guided by SPiDER-βGal would help surgeons detect tumors rapidly and achieve complete liver resection.

Global Partner Posters Program Disclosures

Relevant Financial Disclosures

As required by the Accreditation Council for Continuing Medical Education (ACCME) and in accordance with the Society of Surgical Oncology (SSO) policy, all educational planners, presenters, instructors moderators, authors, reviewers and other individuals in a position to control or influence the content of an activity must disclose all relevant financial relationships with any commercial interest that have occurred within the past 12 months. This includes the disclosure of all financial relationships with a commercial interest of a spouse or partner. A commercial interest is any entity producing, marketing, reselling, or distributing health care goods or services consumed by, or used on, patients. ACCME does not consider providers of clinical service directly to patients to be commercial interests. The ACCME considers financial relationships to create conflicts of interest when individuals have both a financial relationship with a commercial interest and the opportunity to affect the content of CME about the products or services of that commercial interest. All identified conflicts of interest must be resolved and the educational content thoroughly vetted for fair balance, scientific objectivity, and appropriateness of patient care recommendations. It is required that disclosure be provided to the learners prior to the start of the activity. Individuals with no relevant financial relationships must also inform the learners that no relevant financial relationships exist. Learners must also be informed when off-label, experimental/investigational uses of drugs or devices are discussed in an educational activity or included in related materials. Disclosure in no way implies that the information presented is biased or of lesser quality. It is incumbent upon course participants to be aware of these factors in interpreting the program contents and evaluating recommendations. Moreover, expressed views do not necessarily reflect the opinions of the SSO. (Please note that Posters are not certified for credit.)

The Global Partner Posters Program Abstract Authors and Presenters have reported that they have no relevant financial relationships with commercial interests to disclose.

Author Index

Relevant Financial Disclosures
Oral Abstracts
SSO 2021 – International Conference on Surgical Cancer Care
March 18-19, 2021

Disclosures Policy and Disclosures

As required by the Accreditation Council for Continuing Medical Education (ACCME) and in accordance with the Society of Surgical Oncology (SSO) policy, all educational planners, presenters, instructors moderators, authors, reviewers and other individuals in a position to control or influence the content of an activity must disclose all relevant financial relationships with any commercial interest that have occurred within the past 12 months. This includes the disclosure of all financial relationships with a commercial interest of a spouse or partner. A commercial interest is any entity producing, marketing, reselling, or distributing health care goods or services consumed by, or used on, patients. ACCME does not consider providers of clinical service directly to patients to be commercial interests. The ACCME considers financial relationships to create conflicts of interest when individuals have both a financial relationship with a commercial interest and the opportunity to affect the content of CME about the products or services of that commercial interest. All identified conflicts of interest must be resolved, and the educational content thoroughly vetted for fair balance, scientific objectivity, and appropriateness of patient care recommendations. It is required that disclosure be provided to the learners prior to the start of the activity. Individuals with no relevant financial relationships must also inform the learners that no relevant financial relationships exist. Learners must also be informed when off-label, experimental/investigational uses of drugs or devices are discussed in an educational activity or included in related materials. Disclosure in no way implies that the information presented is biased or of lesser quality. It is incumbent upon course participants to be aware of these factors in interpreting the program contents and evaluating recommendations. Moreover, expressed views do not necessarily reflect the opinions of the SSO.

The following Oral Abstract Main Authors and Presenters have disclosed financial relationships with commercial interests:

Hallet, Julie, 34, 73, 74
Honorarium: Ipsen, AAA

Piessen, Guillaume 94
Advisory Board: Bristol Myers Squibb, Medtronic, Nestle, Stryker; Consultant: Bristol Myers Squibb, Medtronic, Nestle, Stryker; Honoraria: Roche; Speaker: Roche

Voss, Rachel, 84
Employment: Stryker (Spouse)

The following Oral Abstract Main Authors and Presenters have reported that they have no relevant financial relationships with commercial interests to disclose:

AlMasri, Samer 44
Angeles, Christina 83
Aquina, Christopher 78
Ayala-Navarro, Carlos 67
Batchu, Sai 29
Bateni, Sarah 34
Bauer, Philip 25
Baumgartner, Joel 64, 66
Benbow, Jennifer 88
Bianchi, Anna 51

Burchard, Paul 38
Chouliaras, Konstantinos 85
Corn, Sarah 89
Crystal, Jessica 87
Dahdaleh, Fadi 96
Daniell, James 35
Datta, Jashodeep 51
Diaz, Adrian 75
Doan, Nguyen-huong 66
Erali, Richard 70
Erstad, Derek 97
Fuzesi, Sarah 11
Gauvin, Gabrielle 79
Gazivoda, Victor 69
Grignol, Valerie 86
Gupta, Nikita 81
Hakim, Abraham 29
Hamad, Ahmad 27
Hammad, Abdulrahman 42
Hanna, Andrew 31
Hoff, Lauren 83
Hue, Jonathan 30
Ibrahim-zada, Irada 49
In, Haejin 93
Irfan, Ahmer 80
Kearney, Joseph 48
Keilson, Jessica 24
Khan, Sonia 17
Khan, Tahsin 68
Kolbeinsson, Hordur 39
Kroon, Hidde 23
Larson, Kelsey 82
Leick, Katie 46
Lim, David 9
Lwin, Thinzar 19
Mangieri, Christopher 65
Mann, Bruce 5
McKevitt, Elaine 2
Melkus, Michael 17
Meneveau, Max 4
Moncrieff, Marc 59
Morano, William 71
Morin, Claudya 1
Morrison, Steven 55
Mouw, Tyler 72
Mrdutt, Mary 13
Naffouje, Samer 10
Nakauchi, Masaya 99
Neelands, Brittany 15
Nelson, Erek 43
Panni, Usman 53
Parker, Cassandra 92
Pawlik, Timothy 40
Plichta, Jennifer 6
Pothuri, Vikram 54
Prigoff, Jake 7
Quadri, Humair 61
Ramiscal, Judi Anne 60
Rizki, Onaisa 94
Ruffolo, Luis 52
Satyananda, Vikas 16
Shannon, Adrienne 63, 98
Sharib, Jeremy 50
Sherman, Scott 33
Smith, Paula 20
Spielbauer, Katie 56
Spolverato, Gaya 90
Squires, Malcolm 88
Straker, Richard 62
Subramanian, Chitra 56
Sun, Steven 57
Swords, Douglas 77
Taskindoust, Mahsa 6
Taylor, Kathryn 76
Thalji, Sam 41
Thiesmeyer, Jessica 28
Thornblade, Lucas 37
Tillmann, Bourke 73
Tran, Catherine 32
Tsilimigras, Diamantis 40
Turgeon, Michael 22
Turner, Michael 91
Verheij, Floris 26
Walker, Brett 21
Wang, Ton 3
Weiser, Roi 18
Weiss, Anna 12
Wetzel, Catherine 14

White, Amy Kathryn 1
White, Richard 15
Wilson Mesquita-Neto, Jose 45
Wong, Denise 36
Wong, William 58
Zhu, Clara 47, 95
Zuckerman, Jesse 74

AUTHOR INDEX

SSO 2021 – International Conference on Surgical Cancer Care
March 18-19, 2021
Virtual Meeting

D

E

F

G

H

M

N

S

T

U

V

W

Y

Z