An Ultrasound-Based Scoring System to Stratify Risk of Axillary Metastasis in Breast Cancer

Spencer Van Decar MD
Brooke Army Medical Center

Introduction/Background

Ultrasound is the imaging modality of choice in the evaluation of axillary involvement in breast cancer. In this study, we sought to create a scoring method to predict axillary lymph node metastasis (ALNM) based on ultrasound characteristics.

Methods:

Chart review was conducted for all patients treated for breast cancer at a single institution between the years of 2019-mid 2021 (n=362). Univariate and multivariate logistic regression were performed. The receiver operating characteristic (ROC) curve for the model was drawn, the area under the curve (AUC) calculated to evaluate the discrimination of the model, and a score developed to predict ALNM as determined by fine needle aspiration or sentinel lymph node biopsy.

Results:

After applying exclusion criteria, 218 patients were included in the analysis. Multivariate analysis demonstrated node length, cortical thickness, loss of a hilum, and shape were independent predictors of ALNM. AUC of the ROC curve was 0.776, indicating favorable discrimination of the model. The developed scoring system is summarized in Table 1, ranging from 0-9 with increasing score indicating increasing probability of ALNM (mean score 1.7, SD 2.0). All patients were stratified to low (score 0-1, n=139), medium (score 2-4, n=53), and high (score 5-9, n=26) risk categories. Low risk patients mean probability of a positive node was 18.0%, medium 50.9%, and high 88.5%. For the overall cohort, sensitivity and specificity of a score ≥2 was 0.684 and 0.820. Sensitivity and specificity for ER positive, HER-2 negative, HER-2 positive, and triple negative breast cancers were 0.553 and 0.848; 0.636 and 0.815; 0.909 and 0.889; and 0.882 and 0.619, respectively.

Conclusion

A scoring system to predict ALNM was successfully developed from a multivariate model based on axillary ultrasound characteristics in patients with biopsy-proven breast cancer. Sensitivity and specificity of a score>=2 were particularly high among HER2+ patients. This scoring system could assist in stratifying patients' risk for ALNM to guide axillary lymph node biopsy decision-making.

Predictor	Level	Score Value
Ultrasound Length (mm)	≤ 10 mm	0
	≤ 20 mm	1
	> 20 mm	2
Cortical Thickness (mm)	≤ 3 mm	0
	> 3 mm	1
Presence of Hilum	Yes	0
	No	2
Shape	Oval	0
	Irregular	1
	Round	4

Table 1. Scoring System for Likelihood of ALNM based on Ultrasound Characteristics.

Evaluation of Indocyanine Green Injection for Sentinel Lymph Node Identification in Breast Cancer Patients with Lymphatic Disruption

Erika Nourishirazi MD
University of Texas Southwestern Medical Center

Introduction/Background
Several tracers are currently used for sentinel lymph node (SLN) detection in breast cancer. Although radioisotope (RI) and Lymphazurin Blue (LB) have been reliable tracers, Indocyanine Green (ICG) is emerging as a potential alternative. Many patients have disruption of lymphatic pathways from prior surgery, neoadjuvant chemotherapy, large hematomas post-biopsy, or prior radiation, making dual tracing and optimizing tracer methods crucial. LB has limitations, including anaphylactic reactions, contraindication in pregnancy, and in patients undergoing axillary reverse mapping, thereby inhibiting its use the second tracer for breast injection. In this study, we assess the non-inferiority of ICG to LB as a tracer in patients who have disrupted lymphatic pathways.

Methods:
Forty-four patients who underwent axillary surgery at our hospital from May to September 2022 were retrospectively analyzed. All patients were injected with 3 tracers, RI, LB, and ICG, prior to SLN biopsy. The patients were stratified based on disruption of lymphatic pathway (21 patients with and 23 patients without lymphatic disruption). The detection rate (DR) of lymph nodes (LN) and false negative rate (FNR) of metastatic LN were compared among the overall cohort and between disruption groups. FNR is the tracer failure to identify a metastatic LN identified by either of the other 2 tracers.

Results:
Overall, 155 SLNs were detected with 8% (13/155) having metastasis. 15.9% of patients had nodal metastasis. LB dye DR and FNR were 74.2% and 15.4%, respectively. ICG DR and FNR were 80% and 30.8%. RI DR and FNR were 93.6% and 0%. There was significant difference in DR between LB and RI ($p<0.0001$), as well as between ICG and RI ($p=0.0004$), but not between LB and ICG ($p=0.2238$). There was no statistical difference between metastatic LN disease DR among the tracers: LB vs ICG ($p=0.6447$), LB vs RI ($p=0.48$), or ICG vs RI ($p=0.0957$). Within the disruption group, there were 79 SLNs detected. LB DR and FNR were 69.6% and 20%, respectively. ICG DR and FNR were 80% and 20%. RI DR and FNR were 88.6% and 0%. There was statistical difference in DR between LB and RI ($p=0.0033$), but not between the LB and ICG tracers ($p=0.1433$) or ICG and RI tracers ($p=0.1270$). There was no statistical difference between metastatic LN DRs among the three tracers ($p=0.9999$). 61.5% (8/13) of metastatic LNs contained all 3 tracers. 7.7% (1/13) of metastatic LNs were detected only by RI and 0% by LB or ICG alone. In the disruption group, 60% of metastatic LNs were detected by all 3 tracers and 0% with any one tracer alone.

Conclusion
ICG combined with RI is a reliable method for dual tracer sentinel lymph node detection in breast cancer patients who have lymphatic disruption, those who have contraindication to LB, or for patients in whom reverse axillary mapping is planned.

Disparities in receipt of guideline concordant adjuvant radiation after breast conserving surgery for early stage breast cancer

Gloria Chang MD
University of Texas Southwestern Medical Center

Introduction/Background
Breast conservation therapy (BCT) with adjuvant radiation (XRT) has long been shown to be equivalent to a mastectomy in terms of survival. While many women choose BCT to preserve their breasts, the omission of XRT leads to higher recurrence rates and inferior survival. The purpose of this study was to determine the proportion of women who complete BCT with XRT and to identify factors associated with incomplete treatment.

Methods:
Women 18-69 years old with Stage I or II breast cancer who underwent breast conserving surgery (BCS) and were recommended adjuvant XRT in 2018 or 2019 were identified in the National Cancer Database (NCDB). Complete BCT was defined as completion of planned course of XRT after BCS, partial XRT (pXRT) as early discontinuation of planned XRT after BCS, and no XRT as no initiation of the recommended XRT after BCS. Univariate and multivariable log-binomial regression were used to compare clinicopathologic characteristics, covariate-adjusted treatment use, and overall survival (OS).

Results:
Of the 124,440 women included, 118,231 (95%) completed BCT, 1,458 (1.2%) received pXRT, and 4,751 (3.8%) received no XRT. Blacks were less likely (OR 0.77, 95%CI 0.71-0.84) while Hispanics (OR 1.20, 95% CI 1.07-1.34) and Asians (OR 1.29, 95%CI 1.12-1.48) more likely to complete BCT compared to whites. No insurance (OR 0.48, 95%CI 0.40-0.58), Medicaid (OR 0.49, 95%CI 0.45-0.54), and Medicare (OR 0.55, 95%CI 0.52-0.59) were associated with decreased likelihood to complete BCT compared to those with private insurance. In a subgroup analysis examining women who at least initiated XRT, Blacks remained more likely (OR 1.36, 95%CI 1.17-1.59) and Asians less likely (OR 0.61, 95%CI 0.44-0.85) to discontinue XRT early. Lack of insurance (OR 1.89, 95%CI 1.32-2.71), Medicaid (OR 2.01, 95%CI 1.69-2.38), and Medicare (OR 1.65, 95%CI 1.44-1.89) were also associated with increased likelihood to discontinue XRT early. 3-year OS was 97.8% for complete BCT, 88.1% for pXRT, and 91.5% for no XRT. Both no XRT (HR 4.98, 95%CI 4.1.4-5.97) and incomplete XRT (HR 4.00, 95%CI 2.97-5.58) were independently associated with worse OS.

Conclusion
While rates of guideline concordant adjuvant XRT receipt after BCS are overall high, significant race/ethnicity and insurance related disparities appear to play a role in the failure to complete BCT which in turn is associated with worse OS.

Demographics, clinical presentation, and outcomes of HIV infected and uninfected patients with hepatocellular carcinoma

Lucia Zhang BS
University of Texas Southwestern Medical Center

Introduction/Background
Since the introduction of highly active antiretroviral therapy (HAART), HIV infected individuals have seen longer survival, which is associated with increased mortality and morbidity from chronic liver diseases. Due to high rates of coinfection with hepatitis C (HCV) and hepatitis B (HBV), immunosuppression, and hepatotoxicity from HAART, HIV infected patients are 7 times more likely to develop HCC. To date, the clinical course and outcomes of HIV infected patients with HCC is not well defined. We compared the survival of HCC patients with and without HIV infection, and whether survival of both groups are impacted by demographic factors, clinical presentation, and treatment patterns.

Methods:
We performed a retrospective cohort study of patients diagnosed with HCC at two hospitals within the same system in Dallas, Texas between January 2010 and June 2022. We excluded patients without a known HIV diagnosis status. Demographics, prognostic measures, tumor characteristics, treatment modalities, and survival were compared between patients with and without HIV infection. Survival curves were generated using Kaplan-Meier plots and compared with the log rank test.

Results:
Of the 1,391 patients diagnosed with HCC identified, 43 (3.1%) were HIV infected. HIV infected patients were more likely to have Medicare (51% vs 29%; P=0.012) and less likely to be uninsured (0% vs 9.9%; P=0.012). Etiologies of chronic liver disease were different between the groups with HIV infected patients less likely to have alcohol-related liver disease (4.7% vs 17.6%; P<0.001) and more likely to have HBV infection (32.6% vs 5.1%, P<0.001). There were no significant differences in the prognostic measures and tumor characteristics between the two groups.

Median overall survival (OS) was similar between HIV infected and uninfected patients (17.2 months vs 21.1 months; P=.318). Overall survival was also compared between controlled and poorly controlled HIV infected patients and also found to be similar with median OS of 19.2 months vs 16.0 months, respectively (P=.521).

On multivariable analysis, factors associated with worse OS included underlying fatty liver disease (HR 1.533, 95% CI 1.1-2.1) and HBV (HR 1.703, 95% CI 1.2-2.5). ECOG functional status>=2 (HR 1.331, 95% CI 1.0-1.7), Child Pugh class B (HR 1.278, 95% CI 1.1-1.5), and having multiple lesions at time of diagnosis (HR 1.213, 95% CI 1.1-1.4) were also associated with worse survival. HIV infection was not independently associated with worse survival (HR 1.295, 95% CI .858-1.955).

Conclusion
The relationship between HIV infection and HCC in affecting clinical outcomes remains complex. HIV infected patients present with different underlying liver disease but similar prognostic and tumor characteristics. Overall survival was ultimately found to be similar between HIV infected and uninfected patients with HCC.

Treatment Patterns and Outcomes in Patients with Pancoast Tumors: A National Cancer Database Analysis

Jessica Cox MS
University of Texas Medical Branch - Galveston

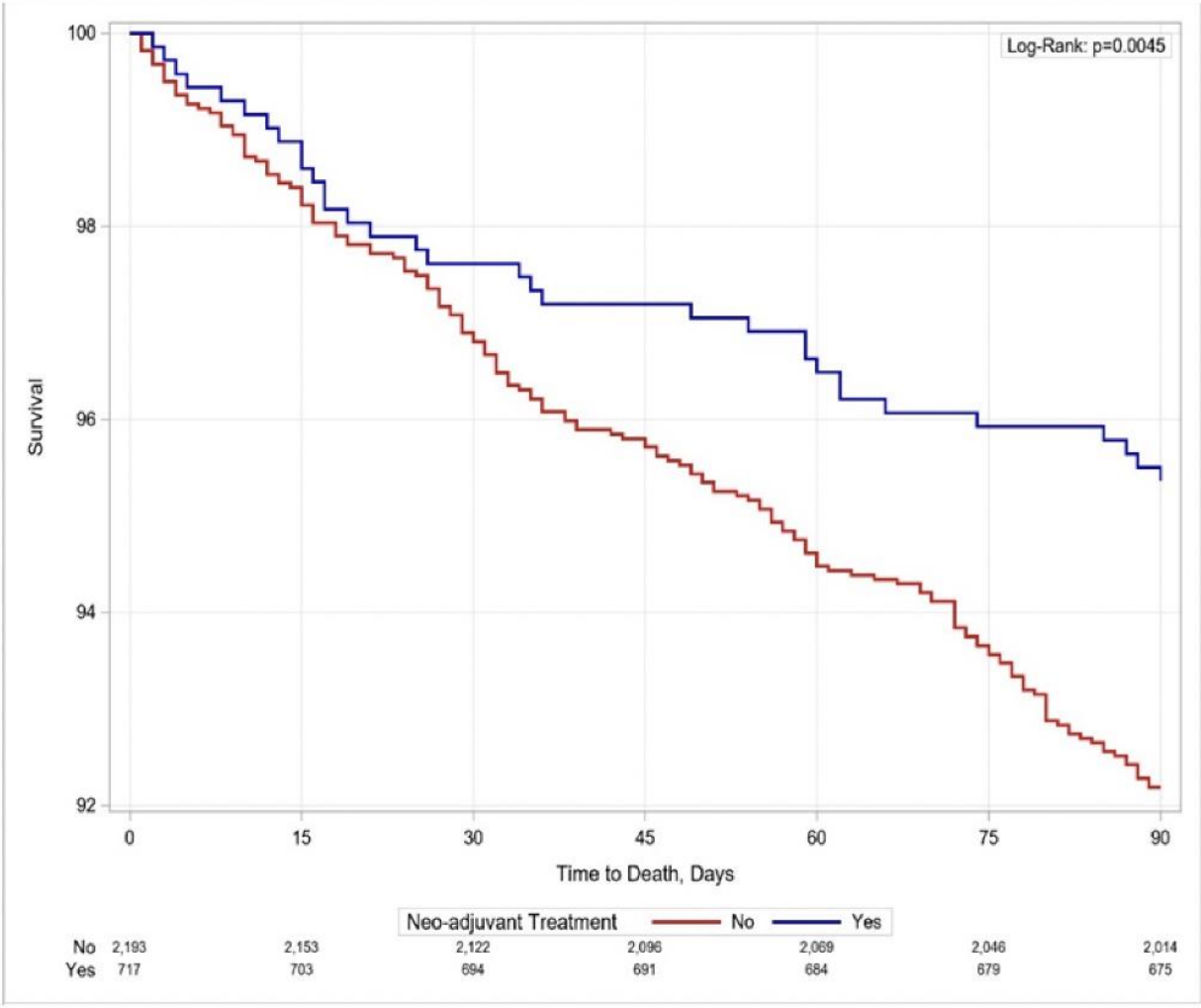
Introduction/Background
Pancoast tumors represent 5% of non-small cell lung cancers. Complete surgical resection and no lymph node involvement are important positive prognostic factors. Previous literature has identified neoadjuvant chemoradiation treatment, followed by surgical resection, as the standard of care. But many institutions choose upfront surgery. Our goal was to identify the treatment patterns and outcomes in patients with node-negative Pancoast tumors using the National Cancer Database.

Methods:
The National Cancer Database was queried from 2004 through 2017 to identify all patients who had undergone surgery for a Pancoast tumor. Treatment patterns, including the percentage of patients who received neoadjuvant treatment, were recorded. Logistic regression and survival analyses were used to determine outcomes based on different treatment patterns. Secondary analyses were performed on the cohort who received upfront surgery.

Results:
A total of 2,910 patients were included in the study. Overall 30-day and 90-day mortality were 3% and 7% respectively. Only 25 percent (717/2,910) of the group received neoadjuvant chemoradiation treatment prior to surgery. Patients who received neoadjuvant chemoradiation treatment experienced significantly improved 90-day survival ($p < 0.01$) and overall survival ($p < 0.01$).

When analyzing the cohort who received upfront surgery, there was a statistically significant difference in survival based on adjuvant treatment pattern ($p < 0.01$). Patients in this group who received adjuvant chemoradiation had the best survival, whereas patients who received adjuvant radiation only or no treatment had the worst outcomes.

Conclusion
Patients with Pancoast tumors receive neoadjuvant chemoradiation treatment in only a quarter of cases nationally. Patients who received neoadjuvant chemoradiation treatment had improved survival compared to patients who had upfront surgery. Similarly, when surgery is performed first, adjuvant chemoradiation treatment improved survival compared to other adjuvant strategies. These results suggest underutilization of neoadjuvant treatment for patients with node-negative Pancoast tumors. Future studies with a more clearly defined cohort are needed to assess the treatment patterns being utilized on patients with node-negative Pancoast tumors.



90-day Kaplan-Meier survival curves of neoadjuvant chemoradiation group compared to upfront surgery group

Abstract| Surgical Oncology

Serum IL-6 level predicts survival and treatment response in gastric and gastroesophageal junction cancer

John Karalis MD
University of Texas Southwestern Medical Center

Introduction/Background
There are few biomarkers to guide treatment for gastric and gastroesophageal junction adenocarcinoma (G+GEJ). The systemic inflammatory response, which is reflected by circulating serum cytokine levels, of G+GEJ patients is associated with survival. In this study, we evaluated the relationship of circulating serum cytokine levels with overall survival (OS) and pathologic tumor regression grade (TRG) in G+GEJ patients.

Methods:
A retrospective review of a prospectively maintained biobank was performed to identify patients diagnosed with G+GEJ from 2016-2022. Pre-treatment serum was collected at the time of diagnosis. For patients who received neoadjuvant therapy, an additional serum sample was collected immediately prior to surgical resection. A multivariable Cox proportional hazards model was used to assess the association of cytokine concentration with OS. In patients who received neoadjuvant therapy, we assessed whether the change in IL-6 (ΔIL-6) after therapy was associated with TRG.

Results:
We first measured the pre-treatment levels of 17 different cytokines in a 67-patient cohort to determine if certain circulating cytokines were prognostic for OS. In a multivariable analysis adjusted for clinical stage and the expression level of the other cytokines, the only circulating cytokine level that was independently associated with OS was IL-6 (HR: 1.06 per 1 pg/ml increase, 95% CI: 1.04-1.08). We then analyzed the serum IL-6 level in an additional 134 patients, resulting in a final cohort of 201 patients. Serum IL-6 level ranged from 0.3-196.7 pg/ml. In a multivariable analysis adjusted for age, sex, clinical stage, pathologic differentiation, Lauren classification, H. pylori status and neutrophil-to-lymphocyte ratio, IL-6 level was independently associated with OS (HR: 1.012 per 1 pg/ml increase, 95% CI: 1.006-1.019). Patients in the top tercile of pre-treatment IL-6 level had worse median OS (10.6 months) compared to patients in the intermediate (17.4 months) and bottom tercile (35.8 months, $p < 0.0001$). Among patients who received neoadjuvant therapy ($n = 50$), $\Delta IL\text{-}6 \leq 0$ had a sensitivity of 80% and specificity of 80% for predicting complete or near-complete pathologic tumor regression (TRG 1).

Conclusion
Pre-treatment serum level of IL-6 is a promising prognostic biomarker for patients with G+GEJ. ΔIL-6 may predict response to neoadjuvant therapy.

Results of a phase I trial of neoadjuvant PalloV-CC vaccine in colorectal cancer

Ankur Tiwari MBBS
University of Texas Medical Center - San Antonio

Introduction/Background

Increased CD8+ tumor infiltrating leukocytes (TILs) and a decreased ratio of CD4:CD8 TILs are associated with a better prognosis in colon cancer. A vaccine that can lead to these changes may be more likely to have clinical benefit. The PalloV-CC (particle-delivered, allogeneic tumor cell lysate vaccine for colon cancer) vaccine utilizes silicate-capped yeast cell wall particles to deliver allogenic colon cancer tumor lysate. Here we present the first-in-human results from a phase I neoadjuvant window trial looking at effects of the vaccine on the tumor immune microenvironment.

Methods:

This is a single arm, phase I, open label study evaluating the effects of neoadjuvant vaccination with PalloV-CC on TIL levels. Patients with a new diagnosis of colon cancer on endoscopic biopsy, who were candidates for elective colectomy, were prospectively enrolled and vaccinated with Pallo-V-CC weekly for 4 weeks prior to surgery. The pre- and post-treatment tissue was evaluated for the quantification of CD4+ and CD8+ TILs by immunohistochemistry and compared with a paired t-test.

Results:

15 patients were enrolled. Mean age of the participants was 60±3.8 yrs. Most common site of malignancy was the sigmoid colon (8/15, 53%). Four patients (27%) reported adverse events from the vaccine, that were limited to grade 1 or 2 toxicities. There were no reported surgical complications. Paired tissue samples were available for 7 patients. Quantification of CD4+ and CD8+ lymphocytes revealed a non-statistically significant increase in mean CD8+ TIL in post-treatment samples (85.0 ± 28.1 cells/mm3) compared to pre-treatment (55.8 ± 13.1 cells/mm3; p=0.37). CD4+ TIL decreased with treatment, though again, the change did not meet statistical significance (222.6 ± 48.4 to 112.7 ± 25.1 cells/mm3, p=0.14). The CD4:CD8 ratio within the tumor decreased with treatment (5.1 ± 1.6 to 2.5 ± 0.7, p=0.21).

Conclusion

The PalloV-CC vaccine is safe with minimal adverse events. An increase in CD8+ TIL and decreased CD4:CD8 ratio was observed with neoadjuvant administration, although a larger sample size is needed to confirm this finding.

Prognostic Value and Survival of Positive-Margin Resections for Pancreatic Adenocarcinoma in The Era of Neoadjuvant Therapy

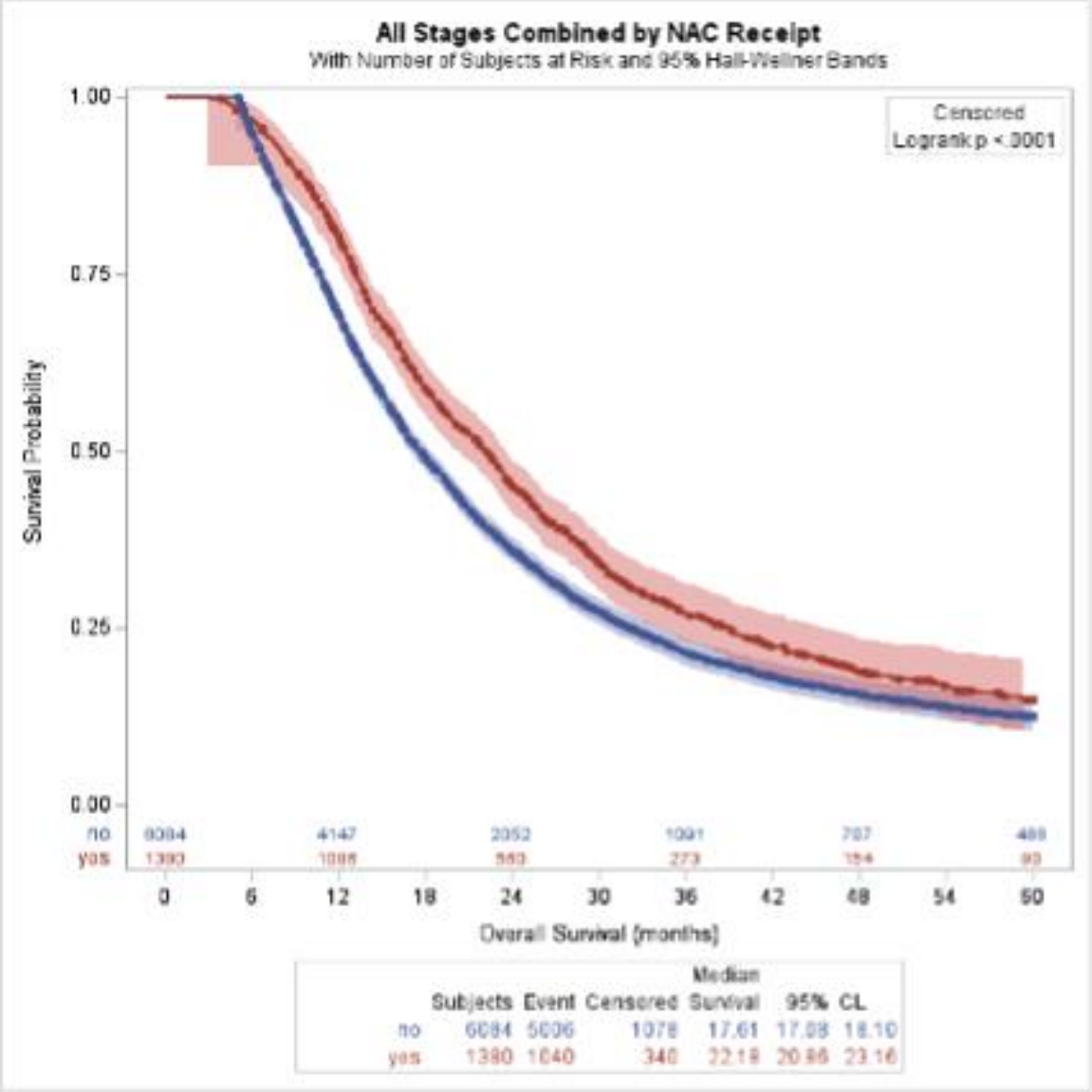
Amr Al Abbas MD
University of Texas Southwestern Medical Center

Introduction/Background
It has been reported that positive margins of resections for pancreatic adenocarcinoma (PDAC) have significant worse prognosis and limited survival benefit. With the increased use of neoadjuvant therapy (NAT) in locally advanced and borderline resectable PDAC, it is unclear if positive margins remains to be an ominous finding. In this work, we aim to evaluate the prognosis value and survival of positive-margin resections in a national cohort of PDAC patients. We hypothesized that NAT is associated with improved survival in patients with positive margins at time of resection.

Methods:
The National Cancer Database was queried for pancreaticoduodenectomies (PD) performed for PDAC from 2004 to 2019. Patients with positive margins who received NAT were compared with those who did not receive NAT and underwent upfront resection (UR). Primary outcome was overall survival from diagnosis (OS). Secondary outcomes were positive nodes, lymph node ratio, prolonged length of stay, 30 day and 90-day mortality. Conditional survival analysis was used to control for immortal bias in the NAT group.

Results:
In total, 10,408 patients underwent PD for PDAC and had positive margin resections. After excluding patients who had unknown chemotherapy receipt and had incomplete data, 8,542 patients remained. Of the remaining cohort, 1,380 (16.2%) received NAT. Patients in the NAT group tended to be younger, to be male and to have private insurance ($P<0.05$). These patients were also more likely to have earlier stage disease by pathology, less positive nodes, LN ratio ≤0.4 and lower rates of 30-day and 90-day mortality ($P<0.05$). Patients receiving NAT were more likely to have prolonged length of stay ($P<0.05$). On multivariable analysis, adjusted for age, sex, race, Charlson-Deyo score and NCDB analytic stage, receipt of NAT was independently predictive of lower LN ratio (OR: 0.62, 95% CI: 0.53-0.71. On conditional survival analysis, patients receiving NAT had longer median OS compared to those who had not (22.18 months vs 17.61 months, $P<0.001$). On cox-proportional hazards model, receipt of NAT was independently predictive of reduced all-cause mortality (HR: 0.82, 95% CI: 0.77-0.88).

Conclusion
Receipt of NAT was associated with improved survival in patients who had positive margins after PD. Median survival of positive-margin resected patients that received NAT is like previously reported survival of negative-margins patients in this national dataset. These finding suggests that exploration and resection should be considered in “margin at-risk” patients with borderline/locally advanced PDAC after receipt of NAT.


All Stages Combined by NAC Receipt
With Number of Subjects at Risk and 95% Hall-Wellner Bands
Censored
Logrank p <.0001
Survival Probability
1.00
0.75
0.50
0.25
0.00
no 6084 4147 2052 1091 707 489
yes 1390 1086 560 273 154 93
0 6 12 18 24 30 36 42 48 54 60
Overall Survival (months)
Median
Subjects Event Censored Survival 95% CL
no 6084 5006 1078 17.61 17.08 18.10
yes 1390 1040 340 22.18 20.86 23.16

Evaluation of surveillance intervals in high-risk intraductal papillary mucinous neoplasms that maximizes resection of malignancy

Menghan Zhao MD
University of Texas HSC - Houston

Introduction/Background
Malignant transformation rates of side-branch intraductal papillary mucinous neoplasms (SB-IPMNs) are proportional to cyst size and accumulate to 7-20% in cysts ≥2cm. In the absence of compelling symptoms, worrisome features (WFs), or high-risk stigmata (HRS), SB-IPMNs ≥2cm may undergo close surveillance at varying intervals. To determine optimal surveillance strategies in this patient population, we prospectively followed SB-IPMN≥2cm patients to determine the incidence of malignant transformation and WF/HRS development following initial evaluation.

Methods:
We queried our prospectively maintained cyst database (started 2016) to identify all patients with SB-IPMNs>2cm with and without WF/HRS at presentation (n=83, 10 lost to follow-up). Cysts resected within 6 months of initial assessment were excluded. Patients were usually seen within 6 months of initial presentation to ensure stability and followed with abdominal CT, MRI, or EUS every 6-12 months thereafter. Interval WF/HRS development, surgical intervention, and malignant transformation were recorded. Categorical data were compared with Chi squared tests and numerical data were compared using Mann Whitney U tests.

Results:
Of 73 study patients (n=53, 2.1-3cm cysts; n=20 >3cm cysts), ~50% were female with a median age at first visit of 71.2 years (Table 1). At baseline, 2/73 (2.7%) cysts had HRS and 14/73 (19.2%) had WFs (excluding size ≥3cm, Table 1). Patients were followed at approximately 6-month intervals over a median time of 35.2 months. Overall, 26/73 (35.6%) patients developed new WF/HRS, 6 (23.1%) of whom developed WF/HRS other than rapid cyst growth (Table 1). 6/73 (8.2%) cysts were resected at a median time of 42.1 months after initial presentation. Factors impacting decision for surgery included baseline cyst size or growth to ≥3cm (n=3), cyst growth ≥5mm within 2 years (n=2), and persistent or development of an enhancing nodule >5mm confirmed by EUS (n=2). 3/6 resected cysts had malignancy (all HGD) on pathology (rest non-malignant); 2/3 malignant cysts developed new HRS/WFs during surveillance (nodule >5mm, growth ≥5mm within 2 years). No unresected patients developed overtly invasive cancer, and we observed 2.49 malignancies per 100 patient follow-up years.

Conclusion
Close interval surveillance of patients with SB-IPMNs ≥2cm can identify the development of WF/HRS. A standardized, short-interval surveillance protocol in patients with SB-IPMNs ≥2cm may allow for the early detection and resection of malignancy.

	Total	Cyst 2.1-3cm	Cyst >3cm	p-value
Number	73	53	20	n/a
Sex (%)	40F (54.8) / 33M (45.2)	28F (52.8) / 25M (47.2)	12F (60) / 8M (40)	0.58
Median Age (yrs, Range)	71.2 (39.7-90.2)	70 (39.7-87.2)	73.1 (53.6-90.2)	0.25
HRS at Dx (%)	2 (2.7) - Nodule >5mm	1	1	0.47
WF at Dx Excluding ≥3cm (%)	14 (19.2)	10 CA 19-9>35U/L - 6 Growth ≥5mm in 2 years - 2 Nodule <5mm - 1	4 CA19-9>35U/L - 2 Growth ≥5mm in 2 years - 2	0.91
Median Initial Cyst Size (mm, Range)	26 (21-58)	25 (21-30)	36 (31-58)	**<0.001**
Median Latest Cyst Size (mm, Range)	27 (8-77)	26 (8-51)	38.5 (20-77)	**<0.001**
Median Cyst Change (mm, Range)	1 (-19-24)	1 (-19-24)	2.5 (-19-22)	0.66
Median F/u Time (months, Range)	35.2 (6.1-161)	31.9 (6.2-152)	36.2 (6.1-161)	0.9
Median Time from Initial Visit to 1st F/u	6.53 (0.47-24.7)	6.4 (0.7-24.7)	6.88 (0.47-12.1)	0.68
Frequencies Initial F/u Interval (%)	<3 months - 14 (19.2) 3-6 months - 10 (13.7) 6-12 months - 34 (46.6) 1-2 years - 14 (19.2) >2 years - 1 (1.4)	<3 months - 10 3-6 months - 7 6-12 months - 23 1-2 years - 12 >2 years - 1	<3 months - 4 3-6 months - 3 6-12 months - 11 1-2 years - 2 >2 years - 0	0.73
Median Number of F/u Visits (Range)	4 (1-16)	3 (1-16)	5 (1-11)	0.59
Median F/u Intervals After 1st Visit (months, Range)	6.68 (1.7-28.3)	6.68 (1.7-28.3)	6.68 (2.4-14.7)	0.35
Number Endoscopy (%)	37 (50.7)	27	10	0.94
Number FNA (%)	33 (45.2)	24	9	0.98
Pathology (% FNA)	Acellular specimen - 10 (30.3) Ductal epithelium w/o atypia - 2 (6.1) Mucinous epithelium w/o dysplasia - 18 (54.5) Mucinous epithelium w/LGD - 3 (9.1)	Acellular specimen - 7 Ductal epithelium w/o atypia - 1 Mucinous epithelium w/o dysplasia - 13 Mucinous epithelium w/LGD - 3	Acellular specimen - 3 Ductal epithelium w/o atypia - 1 Mucinous epithelium w/o dysplasia - 5 Mucinous epithelium w/ LGD - 0	n/a
Number Resected (%)	6 (8.2)	4	2	0.73
Pathology (% resected)	LGD - 3 (50) HGD - 3 (50)	LGD - 2 HGD - 2	LGD - 1 HGD - 1	n/a
Median Time to Resection (months, Range)	42.1 (17.6-113)	62.6 (25.4-113)	34.7 (17.6-51.8)	0.53
Number Malignant (%)	3 (4.1)	2	1	0.81
Number Significant Change in F/u (%)	26 (35.6)	20	6	0.54
Number Significant Change (not growth) in F/u (% Significant Change)	6 (23.1)	6 CA19-9>37U/L - 1 MPD 5-9.9mm - 1 Nodule ≤5mm - 2 Nodule >5mm - 2	0	0.15

Delineating the role of social vulnerability in colorectal cancer treatment and survival

Jennie Meier MD, MPH
University of Texas Southwestern Medical Center

Introduction/Background
Colorectal cancer mortality is amenable to healthcare access and treatment, which is affected by social determinants of health. Although prior studies have identified individual disparities in cancer care and survival, the social vulnerability index has not been previously used to compare healthcare access and survival in colorectal cancer patients or if that differs according to patient age. We hypothesized that there would be census tract-level disparities in colorectal cancer access to treatment and mortality, especially in patients less than 65 years who may be particularly sensitive to social determinants of health.

Methods:
We queried the Texas Cancer Registry from 2004-2019 to identify those with localized colorectal adenocarcinoma and further categorized patients into <65 years and ≥65 years. Our primary outcomes were survival and access to surgical intervention. The primary independent variable of interest was census tract social vulnerability index, with higher scores indicating more social vulnerability. We used chi square analysis, Wilcoxon Rank Sum Test, multivariable logistic regression, and Cox proportional hazards to compare outcomes.

Results:
In total, we included 28,863 patients with localized colorectal cancer with a median age of 68 years (IQR 58-78) and 11,321 (39.2%) less than 65 years. Overall median social vulnerability index percentile was 55.3 (28.3-77.4). Older patients were less likely to be alive at 5 years (52.4% vs 70.7%, p<0.0001) and there was not a difference in resection rates between older and younger patients (88.0% vs 88.3%, p=0.4), however, older patients tended to live in census tract with higher social vulnerability (55.6 percentile vs 53.2 percentile, p<0.0001).

On multivariable analysis in those less than 65 years, increased social vulnerability was associated with increased risk of death at 5 years (HR 1.22, 95% CI 1.03-1.43, p=0.02) as well as decreased odds of surgical intervention (OR 0.76, 95% CI 0.57-0.99, p=0.04). This was primarily driven by housing/transportation and socioeconomic themes within the social vulnerability index. However, in older patients, social vulnerability was not associated with either death (HR 1.07, 95% CI 0.97-1.18, p=0.2) or surgical intervention (OR 0.92, 95% CI 0.75-1.14, p=0.4).

Conclusion
Although 5-year survival was better in younger patients, likelihood of death and surgical treatment in this group was more sensitive to social factors. Although this study is limited to a narrow group of patients in a single state, it highlights the association of social factors on colorectal cancer survival and treatment and amplifies the need for policy changes at the state, local, and federal level to improve survival, reduce amenable mortality, and increase access to surgical care.

Abstract| Surgical Oncology

Predictors and Benefits of Multi-Agent Chemotherapy for Pancreatic Adenocarcinoma: Timing Matters

Todd Smolinksy MD
Brooke Army Medical Center

Introduction/Background

Benefit of multi-agent chemotherapy (MC) has been demonstrated for patients with PDAC in the adjuvant (A) setting. Tolerating MC following a morbid operation may be difficult and thus neoadjuvant (NA) treatment may be preferable. This study examined the effect of multiplicity and timing of chemotherapy on overall survival (OS) in non-metastatic PDAC.

Methods:

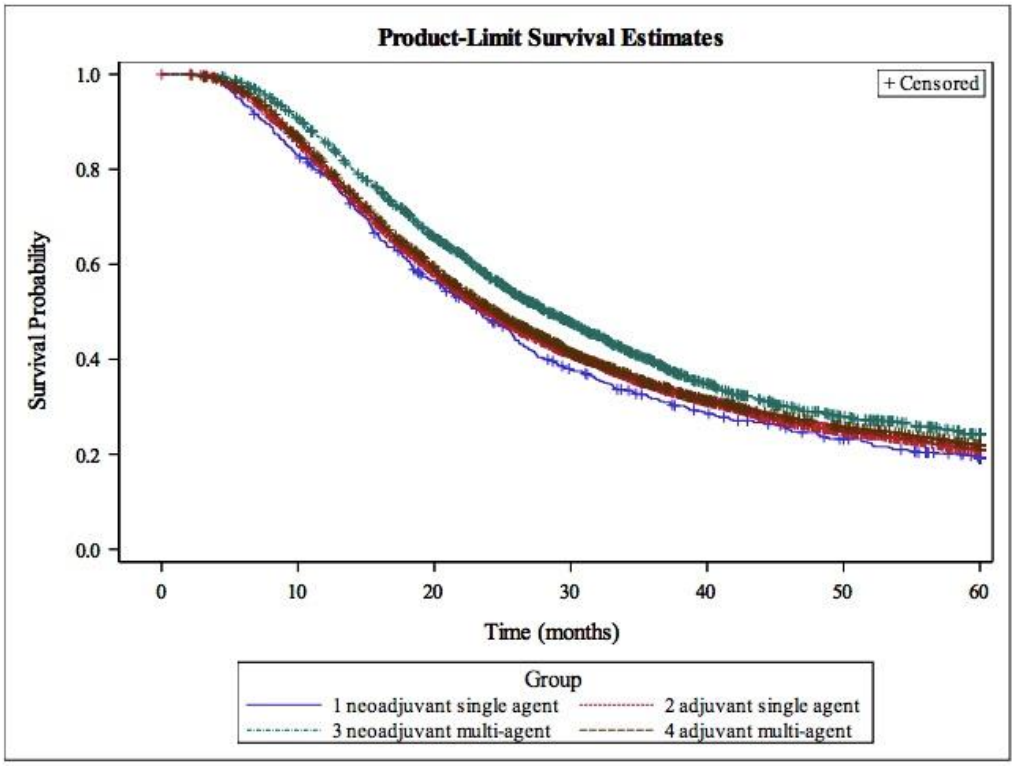
NCDB was queried from 2006-17 for patients with non-metastatic PDAC who underwent surgical resection and received MC or single-agent chemotherapy (SC) pre- or post-resection. Predictors of receiving MC were determined using multivariable logistic regression. Five-year OS was evaluated using Kaplan-Meier 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

Conclusion

Use and timing of MC contribute to overall survival in PDAC with an improved 5-year OS compared to SC. The greatest survival benefit was the NA MC subgroup with the greatest predictor of receiving MC being NA therapy. Randomized studies evaluating timing of effective MC in PDAC are needed.



Cost Analysis and Financial Implications of Cytoreductive Surgery and HIPEC: a US Single Center Experience

Andres Abreu MD
University of Texas Southwestern Medical Center

Introduction/Background
Cytoreductive surgery and hyperthermic peritoneal chemotherapy (CRS/HIPEC) has been shown to improve survival in select patients. This procedure is considered costly and potentially well-reimbursed. Yet, its financial implications have not been extensively explored in the US. This study aims to describe the financial factors impacting hospital costs/collections of CRS/HIPEC at a single academic institution.

Methods:
We performed a retrospective cost analysis of all CRS/HIPEC procedures carried out at our NCI-Designated cancer center from Jan-2014 to Jun-2022. Reports of direct and indirect costs, charges, and collections were obtained from the institutional administrative datasets. Payer mix and reimbursed amounts were assessed. High total cost (HTC) was defined as a total cost above the 75th percentile. Bivariate logistic regression was used to analyze factors associated with HTC.

Results:
90 CRS/HIPEC procedures were performed on 88 patients with a median age of 56.5 years (IQR: 48 – 66). The median operative time (OT) was 505 minutes (IQR: 405 – 615), estimated blood loss (EBL) 450 mL (IQR: 187.5 - 700), peritoneal carcinomatosis index (PCI) 17 (IQR: 12 – 24), and length of stay (LOS) 9 days (IQR: 7 – 14). 54 patients (60%) had postoperative complications and 25 (28%) had severe complications (Clavien-Dindo 3-4). No 30-day mortality occurred, and the 90-day mortality was 2%. 90-day readmission rate was 23%. The median total cost per procedure was $51,067 (IQR: 41,891 – 69,568), of which $38,431 (IQR: 31,273 – 51,725) was direct cost and $12,636 was indirect cost. Median hospital collections were $38,220 (IQR: 23,097 – 67,480) and professional reimbursement was $7,505 (IQR: 5,189 – 12,831) providing a median total reimbursement of $45,725/procedure (IQR: 30,984 – 77,400) accounting for 90% of cost coverage. Payer mix was 57 private and 33 Medicare/Medicaid. Increased LOS, number of organ resections, PCI > 17, EBL > 450 mL, OT > 505 minutes and the presence of major complications were independent predictors of higher odds of HTC.

Conclusion
CRS/HIPEC is an expensive operation, and the presence of major postoperative complications has the greatest impact on the total cost of the procedure. These findings reaffirm that high-quality care in CRS/HIPEC is not only crucial to improve patient outcomes, but also to maintain the economic sustainability of the procedure.

Figure 1. Factors Associated with High Total Cost after CRS/HIPEC

Legend	Reference
Age	< 65 years
Sex	Male
BMI	Normal
Years	⩽2019
Operative Time	⩽505 min
EBL	⩽450 cc
PCI	⩽17
Complication	No Complication