MO 1
EXTERNAL VALIDATION OF THE FISTULA RISK SCORE AS A PREDICTOR OF FISTULA OCCURRENCE AND SEVERITY AFTER PANCREATODUODENECTOMY

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Objective: The 10-point Fistula Risk Score (FRS) has been shown to predict the development of pancreatic fistula (PF) after pancreaticoduodenectomy (PD). However, its ability to predict PF severity is incompletely defined. This study aimed to provide external validation of the FRS and assess its role in predicting PF severity after PD.

Methods: Patients who underwent PD at a single academic tertiary care center were included. Clinicopathological, demographic and perioperative data were collected. The FRS was calculated for each patient and PF severity was graded according to the International Study Group on Pancreatic Fistula standards as A, B, or C. Grades B and C were considered clinically relevant (CR-PF).

Results: Data from 280 patients (mean age 64.4 years) were analyzed. PF occurred after 96 PDs (34.3%), and 68 were CR-PF (24.6%). The FRS correlated closely with the development of PF (for each 1 point increase, PF Odds Ratio 1.47, 95% Confidence Interval CI 1.28—1.70, p < 0.001). PF developed in 11.3% of patients scoring 0—1 (9.3% CR-PF), 40.6% of patients scoring 2-3 (23.4% CR-PF), and 53.6% of patients scoring 4 or more (43.9% CR-PF) (p < 0.001). However, the score did not correlate with the severity of the fistula, with similar distributions of severity grades for each individual FRS score (p = 0.46).

Conclusion: These findings externally validate the FRS as a useful tool in predicting PF after PD. The inability of FRS to predict PF severity suggests that other factors may determine the ultimate clinical sequelae of a PF.

MO 2
WORLDWIDE SURVEY ON CURRENT USE, VALUE AND SAFE IMPLEMENTATION OF MINIMALLY INVASIVE PANCREATIC RESECTION

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Objective: The introduction of minimally invasive pancreatic resection (MIPR) into surgical practice has been slow and randomized trials in this field are lacking. Furthermore, the worldwide utilization of MIPR and attitudes towards MIPR remain unknown.

Methods: We developed a worldwide survey consisting of 61 questions in order to gain knowledge on opinions and use of both, laparoscopic and robot-assisted pancreatic resections. The anonymous online survey was sent to all surgeon members of the 6 largest hepatopancreatobiliary associations.

Results: In total, 435 surgeons from 50 countries completed the survey. Responders performed a median of 22 (IQR: 0—450) pancreatic resections as primary surgeon annually. Minimally invasive distal pancreatectomy (MIDP) was performed by 345 (79%) surgeons with a total personal experience of median 20 (IQR: 10—50) MIDPs. Of surgeons performing MIDP, 338 (98%) surgeons considered the overall value of MIDP superior or equivalent to the open approach. Minimally invasive Whipple (MIW) was performed by 124 (29%) surgeons with a total personal experience of median 12 (IQR: 4—40) MIWs. Of surgeons performing MIW 96 (77%) surgeons considered the overall value of MIW superior or equivalent compared to the open approach. The most important reason for not performing MIPR was a lack of specific training. 392 (90%) would consider participation in an international registry.

Conclusion: This worldwide survey on MIPR showed that the current median annual number of MIPRs performed per surgeon is low. Whereas most surgeons considered MIDP superior or equivalent to open distal pancreatectomy, this was less clear for MIW. Specific training in MIPR, and an international registry seem required.

MO 3
ENHANCED RECOVERY PATHWAYS FOR PANCREATIC RESECTIONS

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Objective: Enhanced recovery pathways (ERP) focus on decreasing surgical stress and improving perioperative experience for patients undergoing major surgical procedures. The aim of this study was to determine the impact on length of hospital stay (LOS), readmissions, morbidity and mortality on patients undergoing pancreatic resections with and without an ERP. A perioperative pathway was developed for total pancreatectomy (TP) and pancreatectoduodenectomy (PD) and another for distal pancreatectomy (DP).

Methods: A retrospective review was performed to determine LOS, readmission, morbidity and mortality rate of pancreatic resections from January 01, 2008 to March 31, 2015. Data was collected on patients from April 1, 2015 to March 31, 2016 after implementation of the perioperative ERP.

Results: 503 pancreatic resections occurred 2008 to March 31, 2015 (261 PD, 49 TP, and 193 DP) prior to ERP implementation. 94 patients received ERP from April 1, 2015 to March 31, 2016 (57 PD, 8 TP, and 29 DP). PD median LOS decreased by 1 day (p value = 0.003) and DP and TP decreased by 2 days (p values = <0.001 and 0.070 respectively). No difference was found in readmission rate. 90-day complication rates and mortality were lower or unchanged in the ERP group compared to the non-ERP group. Clavien-Dindo grade III—V morbidity occurred 25% of the time for PD and was unchanged. A decrease
was noted in DPs (13% to 6.25%) and TPs (24% to 18%) for major morbidity.

**Conclusion:** Implementation of an ERP for PD, TP, and DP appears safe and effective while decreasing LOS and a tendency to decrease complications.

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**MO 4**

**SIMULATED TRAINING FOR THE ACQUISITION OF SKILLS IN THE LAPAROSCOPIC PANCREATICOJEJUNOSTOMY**


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**Objective:** The learning curve of laparoscopic pancreateoduodenectomy (LPD) is long and is associated to high morbidity mainly because of the technical difficulty of the pancreaticojejunostomy (PJ). Simulation has demonstrated to shorten the learning curves of advanced laparoscopy.

The objective is to present the results of a PJ simulated training programme.

**Methods:** A simulated model using ex-vivo tissue to perform a laparoscopic PJ programme was designed, based on three difficulty levels depending on the Wirsung’s duct dilatation (8 mm-5 mm-2 mm). The time, OSATS (5–25 points) and filtration through the anastomosis were registered in each session. Each surgeon must perform a permeable anastomosis in less than 40 minutes, without filtration and OSATS > 20 to continue to the next level. Initial and final evaluation of the 2 mm level was performed.

Finally surgeons performed the procedure in patients.

**Results:** Two expert surgeons without experience in LPD completed the training programme. During the initial evaluation operatory time was 48/52 minutes, OSATS 14/15 points and both had filtrations in the anastomosis. In the final evaluation operatory time was 25/33 minutes, OSATS 24/23 point, without filtration and good permeability. An average of three sessions was required to complete each level and a total of ten sessions.

After the simulated training programme the surgeons performed 7 LPD in real patients. Six patients evolved without complications in the pancreatic anastomosis and only one patient developed a type B fistulae.

**Conclusion:** Simulated training reduces learning curves of the laparoscopic pancreaticojejunostomy. The skills learned in the laboratory are transferred satisfactorily to the operation room.

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**MO 5**

**ENCELATION DOES NOT COMPROMISE ONCOLOGIC OUTCOMES IN PATIENTS WITH SMALL PANCREATIC NEUROENDOCRINE TUMORS**

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**Objective:** To compare perioperative and long-term oncologic outcomes among patients with small pancreatic neuroendocrine tumors (pNET) treated with resection versus enucleation.

**Methods:** Patients undergoing surgery for pNET <3 cm were identified from an institutional pancreatectomy database. Patients with R2 resections, distant metastases, and grade 3 pNETs were excluded. Clinical, pathologic and outcome variables were compared using standard statistical methods.

**Results:** From 2000–2015, 130 patients met inclusion criteria: 33 (25%) underwent enucleation and 97 (75%) formal pancreatectomy. Lymph nodes were sampled in 39% of enucleations and 88% of pancreatectomies (P < 0.001). Enucleated tumors had lower rates of lymph node involvement (0% vs. 13%, P < 0.001), but higher rates of R1 margin (24% vs. 9%, p = 0.038). The incidence of grade 2 tumors (9% vs. 19%, p = 0.57) and MEN-1 (3% vs. 11%, p = 0.29) were similar in the two groups (9% vs. 19%, p = 0.57). Ninety-day mortality was zero in both groups. There were no differences in postoperative complications (36% vs. 29%, p = 0.513), major complications (6% vs. 11%, P = 0.514), or readmission (12% vs. 11%, P = 1.0). At a median follow up of 20 months, there were no differences in overall (5-yr 100% vs. 97%, P = 0.2) or recurrence-free survival (5-yr 86% vs. 90%, p = 0.95). On multivariation analysis, grade (P = 0.004), and the presence of MEN-1 (P = 0.011), but not size (P = 0.29) were independent predictors of recurrence-free survival.

**Conclusion:** Morbidity and mortality following enucleation of small pNET is comparable to formal resection. Although enucleation is associated with higher rates of R1 margins and reduced nodal sampling, survival and disease recurrence is not different from that observed with formal pancreatectomy.

In select patients with small pNET enucleation is safe and does not compromise oncologic outcome.

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**MO 7**

**CYSTIC PANCREATIC NEUROENDOCRINE TUMORS: A MORE FAVORABLE LESION?**


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**Objective:** Pancreatic neuroendocrine tumors (PNET) are predominantly solid lesions with malignant potential. Cystic PNETs are a small subset in which data are scarce. We aim to compare clinical/pathologic features and prognostic implications of cystic versus solid PNET.
Methods: Patients with PNET undergoing pancreatectomy between 1988 and 2016 at a high-volume center were retrospectively reviewed. Demographic, clinical, and histopathologic data were collected and analyzed. PNET lesions were defined cystic if at least partially cystic on preoperative imaging or pathology.

Results: 347 patients with PNET were identified; 27% (n = 94) were cystic. Patients with cystic PNET were older (59 vs. 55 years, p = 0.05) and more likely to be men (64% vs. 51%, p = 0.04). Cystic PNET were more commonly non-functional (95% vs. 82%, p = 0.004), asymptomatic (44% vs. 28%, p = 0.009), and located in the pancreatic body/tail (81% vs. 60%, p < 0.001) than solid PNET. On multivariate analysis, tumor location alone remained significant. When available (n = 149), Ki-67 proliferation index, a negative prognostic indicator, was significantly lower in patients with cystic PNET (Ki-67 ≤ 2%: 83% vs. 63%; p = 0.02). Nevertheless, cystic and solid PNET had similar sizes, histologic grade, pathologic stage, presence of nodal (21% vs. 31%, p = 0.08) and hypothesized that this variability existed in a multi-center institutional setting.

Conclusion: This study found a higher than previously published incidence of cystic PNET (27%). Cystic PNET were less symptomatic and located in the distal pancreas. The disparity in Ki-67 index may suggest an improved prognosis. Distinguishing cystic PNET from solid preoperatively may assist in surgical decision-making; further attention is warranted for long-term follow-up.

MO 8 PATHOLOGIC ASSESSMENT OF VASCULAR INVOLVEMENT IN PANCREATECTOMY WITH VASCULAR RESECTION: ROOM FOR IMPROVEMENT

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Objective: Pancreatectomy with vein resection is currently performed. No standard in pathologic reporting currently exists with respect to vascular involvement. We have observed wide variability in pathologic interpretation of pancreatectomy specimens that include vein resection, and hypothesized that this variability existed in a multi-institutional setting.

Methods: A retrospective review of pancreatectomy/venous resection patients treated within a multi-center pancreas surgery consortium. Pathology reports were reviewed for documentation of vascular margins. For this study’s purpose, complete pathologic assessment of vascular margin was defined to include presence/absence of invasion, depth of invasion, radial involvement and longitudinal involvement.

Results: Among 1341 pancreatectomies performed for malignancy, 136 (10.1%) included venous resection. Operations included pancreatoduodenectomy (n = 105, 77%), total pancreatectomy (n = 21, 22%), and distal pancreatectomy (n = 10, 7%). Veins resected were: portal vein (n = 70, 51%), superior mesenteric vein (n = 41, 30%), and portomesenteric confluence (n = 13, 10%). Twenty-three of the pathology reports (17%) made no mention of any vascular segment in the specimen. Nearly half of the reports (n = 60, 44%) contained no comment on the vascular radial margin. Ninety-nine reports (72% of total) commented on vascular invasion; complete pathologic assessment of the vascular margin was described in only 17%. Discrete histologic depth of invasion was described in 32% of the reports.

Conclusion: Complete pathologic evaluation of vascular margins in pancreatectomy with vascular resection specimens is poor, even at high-volume pancreatic surgery centers. Improving communication between surgeons and pathologists and developing a standardized pathology reporting system will permit more complete understanding of the natural history of this patient population.

MO 9 ROBOTIC PANCREATECDOUODENECTOMY IMPROVES OUTCOMES FOR PATIENTS WITH HIGH RISK MORPHOMETRIC FEATURES

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Objective: Body morphometry has been shown to predict adverse outcomes in patients undergoing open pancreato-duodenectomy (OPD). We hypothesized that robotic pancreatectoduodenectomy (RPD) may mitigate adverse outcomes in sarcopenic patients compared to OPD.

Methods: An institutional database was queried for all patients undergoing RPD or OPD from 2011 to 2015. Morphometric parameters including total psoas index (TPI = total psoas area normalized for height)), visceral-subcutaneous fat ratio (VSR) and average psoas attenuation (APA) were derived from segmentation of CT imaging at L3. Quantile regression was used to evaluate the effect of morphometric parameters on morbidity, pancreatic fistula, LOS, readmission, and discharge disposition.

Results: Of 426 PDs, 221 patients had imaging acceptable for morphometric analysis. RPD (n = 100) and OPD (n = 121) groups were comparable in age, sex, CCI, and pre-operative serum albumin (all P > 0.05). Mean morphometric parameters (TPI, VSR, and APA) were similar between OPD and RPDs (all p > 0.05). VSR was associated with serious complications (Clavien III+) in the OPD cohort (OR 2.06, p = 0.05) but not the RPD cohort (OR 1.30, p = 0.29). Using quantile regression, low APA (defined as bottom 25%) was not associated with risk of increased LOS at the 25th, 50th, or 75th percentiles (p = 1.00) in RPD patients, whereas In the OPD group, low APA was associated with 2, 1 and 3 additional hospital days at the 25th, 50th and 75th percentile LOS respectively(P = 0.046).
Conclusion: RPD may be associated with shorter LOS and improved outcomes in patients with high risk morphometric features.

MO 10
ENDOSCOPIC VERSUS PERCUTANEOUS DRAINAGE OF POST-OPERATIVE FLUID COLLECTION FOLLOWING PANCREATIC RESECTION

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Objective: Postoperative peri-pancreatic fluid collection (PFC) is a common complication following pancreatic resection. The aim of this study was to compare the success rate, complication rate, and outcomes between endoscopic and percutaneous drainage procedures.

Methods: A match-controlled retrospective study of patients who underwent endoscopic drainage of PFC compared to those who underwent percutaneous drainage was performed. Both were matched to post-operative timing of the drainage procedure, type of surgery, and presence of a surgical drain. Technical success was defined as placement of at least one drainage stent/catheter. Clinical success was defined as durable resolution of both the PFC and symptoms. Differences between the two groups were tested using McNemar’s and Wilcoxon signed rank tests.

Results: There were 39 matched patients in each group with a median age of 62 years. For the initial drainage, technical success was achieved in almost all patients in both endoscopic and percutaneous groups (100% and 97%, p = NS), while clinical success was achieved in 67% and 59% (p = 0.63). At least one “salvage” drainage procedure was required in 13 endoscopic patients versus 16 in the percutaneous group. Clinical success was achieved following the first salvage procedure in 93% of the failed endoscopic patients and 88% of the percutaneous patients. Stent/drain duration (59 vs 33 days, p < 0.001) and number of post-procedural CT studies (2 vs 1, p = 0.02) were significantly higher in the endoscopic group. There was no difference in length of stay, complications rate, and readmissions.

Conclusion: Endoscopic drainage of PFC is safe and effective with comparable success rate and outcomes to percutaneous drainage.

MO 11
PATTERNS OF MUSCLE LOSS IN PATIENTS WITH PANCREAS CANCER

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Objective: Pancreas cancer patients often need multimodality treatment for best chance of cure. The rate-limiting step is cancer cachexia, as any therapy is poorly tolerated. The objective of this study is to identify patterns of muscle loss, so that appropriate interventions may be carried out at the right time.

Methods: Between January 2001 and July 2012, patients with histopathologically confirmed pancreas cancer and sequential CT scans in the MUHC database were included for total muscle mass (TMM) surface area/weight trajectory analysis.

Results: Out of 230 patients identified in the database, 176 patients met criteria and were included in the analysis. Out of 176 patients, 85 were females. There were no significant differences in baseline characteristics between both genders. Average number of scans per patient was 7. At diagnosis, TMM surface area per weight for females and males were 19.2 and 27.5 cm²/g respectively (p = 0.00). Four different trajectories of TMM were identified. Patients were grouped as gaining (T1), losing (T2), or stable (T3-4) TMM over time. Significantly higher proportion of men maintained stable TMM over time. Gender and age differences between all groups were statistically significant (p = 0.05 and 0.00 respectively), with more female patients loosing muscle mass. In addition, treatment differences affected the TMM between groups (p = 0.03).

Conclusion: Our study shows that gender influences TMM patterns in patients with pancreas cancer. Trajectory analysis information could be used to identify and provide timely intervention in patients who succumb to cachexia rather than cancer, therein help prolong overall survival.

MO 12
THE BIOLOGY OF MIXED-TYPE INTRADUCTAL PAPILLARY MUCINOUS NEOPLASMS (IPMN): ARE CURRENT GUIDELINES FOR THE CLASSIFICATION ACCURATE?

University of Cincinnati, Cincinnati, OH, USA

Objective: Controversy remains regarding the management of patients with IPMN. Traditionally, main-duct and mixed forms of IPMN have been considered similar entities and managed with a similar algorithm. We aim to assess
whether current guidelines appropriately characterize the clinical and pathologic characteristics of main-duct, mixed-type, and branch-duct IPMN.

**Methods:** The medical records of seven-institutions were reviewed for patients that underwent surgical management of IPMN between 2000 and 2015.

**Results:** 244 patients (50% male) were included in the analysis. 39.8% of patients had main-duct, 20.9% had mixed-type, and 39.3% had branch-duct IPMN. No significant differences in age, gender, race, co-morbidities, or presentation were found between all groups. Main-duct and mixed-type had a statistically higher pre-operative CA 19-9 level than branch-duct IPMN (248.7 vs. 216.7 vs. 45.6; p = 0.019). The average number of high risk features (0.22 vs. 0.24 vs. 0.09; p = 0.05) and worrisome features (0.923 vs. 1.24 vs. 0.70; p = 0.018) were similar between main-duct and mixed-type, which were both significantly higher than branch-duct IPMN. Additionally, main-duct and mixed-type had a significantly higher rate of high grade dysplasia (26.3% vs. 29.4% vs. 12.5%; p = 0.02) or invasive carcinoma (38.1% vs. 23.5% vs. 15.6%; p = 0.002). There was no statistical difference in 5-year overall survival (p = 0.983) between all three groups.

**Conclusion:** Current consensus guidelines for classification of IPMN are appropriate. Given that main-duct and mixed-type IPMN appear to be similar entities, the threshold to operate on mixed-type should remain consistent with standard surgical management of main-duct IPMN.

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**MO 13**

**EARLY DRAIN REMOVAL FOLLOWING PANCREATEODUODENECTOMY IS A BEST PRACTICE**

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**Objective:** Intraoperatively placed drains during pancreatic resection are a common strategy to mitigate the development of and morbidity associated with postoperative pancreatic fistula (POPF) in high risk patients. Recent data suggest that early removal, when guided by postoperative day one drain fluid amylase (DFA-1), is a best practice.

**Methods**: We reviewed our institutional experience with early drain removal following pancreaticoduodenectomy. Patients undergoing pancreaticoduodenectomy between January 2011 and January 2016 who had intraoperative drains placed for prevention of POPF were included. Drains were removed when DFA-1 was <20 units/mL. Patients with POPF were identified as those requiring reoperation or who had a pancreatic fistula as defined by the International Study Group on Pancreatic Fistula (ISGP) criteria. Populations were compared using chi-square tests and t-tests as appropriate.

**Results**: 334 patients underwent pancreaticoduodenectomy during the study period. Of these, 209 (62.8%) had intraoperative drains placed for POPF prophylaxis. Despite being a high risk population, there were no cases of POPF in the early drain removal group. Two patients (1.0%) in the early drain removal group were reoperated for postoperative complications, compared to seven (3.4%) in the standard drain management group (p = 0.002). The average hospital stay was 6 days shorter in the early drain removal group (17.4 vs. 23.4 days; p < 0.001).

**Conclusion:** Early drain removal following pancreaticoduodenectomy is a best practice as it is associated with decreased POPF rate and hospital stay.
associated with reduced rates of clinically relevant (CR)-POPF and lower rates of abdominal complications. Our aim is to compare outcomes in patients with early versus delayed removal of intraoperatively placed drains following pancreatoduodenectomy in a large, multi-center cohort.

**Methods:** The American College of Surgeons-National Surgical Quality Improvement Program (ACS-NSQIP) Participant Use File for 2014 was queried to identify patients having undergone pancreatoduodenectomy (n = 3069). Patients with intraoperatively placed drains (n = 2698) and postoperative day one drain fluid amylase (DFA-1) of ≤5000 U/L were stratified according to day of drain removal (early, ≤3 days vs delayed, >3 days). A propensity score analysis was performed in order to generate patient cohorts.

**Results:** Patients were similar with respect to age, gender, ASA class, BMI, weight loss, neoadjuvant therapy, operative approach (open versus MIS), vascular resection, pancreatic duct size, gland texture, and pathology. Postoperative outcomes are shown in the table.

**Conclusion:** Outcomes are best when operatively placed drains are removed prior to day three if day one drain fluid amylase levels are ≤5000 U/L. Failure to remove pancreatic drains in this setting is associated with increased overall morbidity, clinically relevant postoperative pancreatic fistula, and length of stay.

<table>
<thead>
<tr>
<th>Overall morbidity (%)</th>
<th>Organ space infection (%)</th>
<th>POPF (%)</th>
<th>CR-POPF (%)</th>
<th>DGE (%)</th>
<th>Percutaneous drain (%)</th>
<th>30-Day mortality (n, %)</th>
<th>Length of stay (days)</th>
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</thead>
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<tr>
<td>Early removal (n = 120)</td>
<td>15.8*</td>
<td>3.3</td>
<td>0.8*</td>
<td>0*</td>
<td>9.2</td>
<td>3, 2.5</td>
<td>6.9*</td>
</tr>
<tr>
<td>Delayed removal (n = 118)</td>
<td>30.0</td>
<td>7.6</td>
<td>6.8</td>
<td>5.0</td>
<td>11.9</td>
<td>8.5</td>
<td>2, 1.7</td>
</tr>
</tbody>
</table>

**MO 14**

**AMERICAN COLLEGE OF SURGEONS NATIONAL SURGICAL QUALITY IMPROVEMENT PROGRAM RISK CALCULATOR ANALYSIS DEMONSTRATES INFERIORITY OF RETROSPECTIVE COMPLICATIONS DATA FOR PATIENTS UNDERGOING DISTAL PANCREATECTOMY**


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**Objective:** To assess the accuracy of the ACS NSQIP calculator for estimating risk of complications after distal pancreatectomy for benign and malignant disease.

**Methods:** Data regarding postoperative complications after pancreatectomy were collected from a prospectively maintained pancreas surgery consortium database at three academic medical centers. The ability of the NSQIP calculator to estimate risk of postoperative complications was assessed using the c-statistic (0.7 or above for reasonable models).

**Results:** 254 adult patients who underwent distal pancreatectomy with or without splenectomy were included. Numbers and rates of complications were as follows: pneumonia 14, 5.6% (median predicted risk, c-statistic: 2.6%, 0.652); cardiac complications 14, 5.6% (0.70%, 0.543); surgical site infections 11, 4.4% (11.2%, 0.613); urinary tract infection 13, 5.2% (3.8%, 0.630); venous thromboembolism 11, 4.4% (0.450.3%); renal failure 14, 5.6% (0.6%, 0.590); readmission 58, 23.1% (0.602, 15.1%); return to the OR 12, 4.8% (2.7%, 0.558); death 1, 0.04% (0.5%, 0.555). Median length of stay was 5.0 (Range: 0–40) and predicted median length of stay was 7.0 (Range: 511).

**Conclusion:** The ACS NSQIP Risk Calculator estimates the risk of pneumonia (c-statistic 0.652) reasonably well for patients undergoing distal pancreatectomy but generally underestimates risk of other postoperative complications. Retrospective collection of complication data (used to model the calculator) may not accurately reflect the true volume of complications after distal pancreatectomy.
MO 15
LAPAROSCOPIC & ROBOTIC CYSTGASTROSTOMY VERSUS ENDOSCOPIC CYSTGASTROSTOMY IN THE MANAGEMENT OF WALLED OFF PANCREATIC NECROSIS (WOPN)
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Objective: Severe pancreatitis can lead to walled off pancreatic necrosis (WOPN). This has been traditionally managed by open surgery. Recently, endoscopic and minimally invasive techniques (MIS) (laparoscopy and robotics) are being used to perform these complex procedures. We hypothesize that MIS has improved outcomes as compared to endoscopy in the management of WOPN.

Methods: We performed a retrospective analysis of patients who underwent cystgastrostomy for WOPN from 2009 to 2015 using minimally invasive surgery (laparoscopic and robotic) and endoscopy. We compared demographics, etiology, preoperative cyst characteristics and time to drainage. We also looked at outcomes including failure rates, complications, length of stay, necessity of repeat procedures and cross over to alternative modality.

Results: There were 39 and 42 patients in the surgical and endoscopic groups respectively. Demographics, ASA, comorbidities and size of WOPN were similar. In the endoscopy arm, 35% had true pseudocysts. Median time to intervention was similar (72 days) as well as post-operative (Clavien III and IV) complications were similar (5.6 vs 4.2%). Median length of stay was greater in the surgical arm (Vv. endoscopic arm (p < 0.05). Treatment failure was 2.5% vs. 11.9% (p = 0.2) and recurrence was 2.5% vs. 9.5% respectively (p = 0.3) (surgery vs. endoscopy). Secondary procedures were required in 5.1% in surgical arm vs. 16.6% in the endoscopic arm (p = 0.08).

Conclusion: Minimally invasive cystgastrostomy as compared to endoscopic approach in the management of WOPN has fewer failures and recurrences and repeat interventions.

MO 17
SARCOPENIA IS ASSOCIATED WITH HOSPITAL EXPENDITURE IN PATIENTS UNDERGOING CANCER SURGERY OF THE ALIMENTARY TRACT
Erasmus MC University Medical Center, Rotterdam, Netherlands

Objective: Low skeletal muscle mass (sarcopenia) is correlated with poor postoperative outcomes and survival in surgical cancer patients. Furthermore, it is associated with increased health-care costs in the USA. We sought to determine its effect on hospital expenditure in a Western-European health-care system, with equal access for all patients.

Methods: Skeletal muscle mass was measured on abdominal CT in cancer patients who underwent abdominal cancer surgery between 2005 and 2015. Patients were classified as (non-)sarcopenic based on established cut-offs and divided in sex-specific quartiles. The relationship between sarcopenia and hospital costs was assessed using linear regression analysis and Mann—Whitney U-tests.

Results: In total, 524 patients were included with a median age of 65 (IQR 58–72). The majority of patients had an ASA-classification of 1–2 (80.2%). Most patients underwent a resection for colorectal cancer (35.3%) or colorectal liver metastases (30%), while 126 (24.0%) patients underwent surgery for primary liver and 56 (10.7%) for pancreatic/periampullary cancer. Almost half of the patients (44.7%) had sarcopenia. Total costs for these patients were significantly higher compared with patients without sarcopenia (€17,843 versus €15,015; p < 0.001). Costs decreased per sex-specific quartile of skeletal muscle mass. Significantly higher costs were observed in patients without postoperative complications or prolonged hospital stay (figure) and in patients undergoing hepatopancreatobiliary complications. Patients were classified into non-frail (MFI = 0) or frail (MFI > 0), in which they were sub-classified into mildly frail (MFI 1 or 2), or severely frail (MFI = 3).

Results: A total of 1038 DP were included in the analysis, of which 387 were minimally invasive DP (MIDP: laparoscopic: 285, robotic: 102), 558 open DP (ODP) and 93 MIDP converted to open (MIDPcODP: laparoscopic: 80, robotic: 13). More than 90% of patients had a MFI of 0 or 1 (MFI: 0, 1, 2, 3 in 473 (45.6%), 466 (44.9%), 94 (9.1%), and 5 (0.5%) respectively). Overall, 4.6% of patients experienced grade 4 Clavien complications and a 1.1% mortality. Worsening frailty correlated with increase in complications (non-frail: 2.5%; mildly frail: 6.3%; severely frail: 20%; p = 0.005). Non-frail patients experienced a similar rate of complications with MIDP vs ODP vs MIDPcOP (2.3 vs 2.3 vs 4.9%; p = 0.6), whereas frail patients (MFI > 0) had a lower rate of complications with MIDP (2.4 vs 8.3 vs 11.5; p = 0.007).

Conclusion: Minimally invasive distal pancreatectomy is associated with a lower risk of grade 4 Clavien complications compared to open for frail patients. The minimally invasive approach may modify the risk of the procedure, particularly in frail patients.

MO 16
MINIMALLY INVASIVE DISTAL PANCREATECTOMY: GREATEST BENEFIT FOR THE FRAIL
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Objective: The benefits of minimally invasive distal pancreatectomy (DP) over open surgery continue to be elucidated. Frailty is being recognized as a powerful predictor of postoperative outcome. We hypothesized that the benefit of minimally invasive distal pancreatectomy is greatest for the frailest of patients.

Methods: Data from the pancreas-targeted National Surgical Quality Improvement Program (NSQIP) database for 2014 were reviewed. A modified frailty index (MFI) with 11 pre-operative variables previously validated for use in NSQIP was used to determine the correlation between frailty and postoperative outcomes, including grade 4 Clavien complications. Patients were classified into non-frail (MFI = 0) or frail (MFI > 0), in which they were sub-classified into mildly frail (MFI 1 or 2), or severely frail (MFI = 3).

Results: A total of 1038 DP were included in the analysis, of which 387 were minimally invasive DP (MIDP: laparoscopic: 285, robotic: 102), 558 open DP (ODP) and 93 MIDP converted to open (MIDPcODP: laparoscopic: 80, robotic: 13). More than 90% of patients had a MFI of 0 or 1 (MFI: 0, 1, 2, 3 in 473 (45.6%), 466 (44.9%), 94 (9.1%), and 5 (0.5%) respectively). Overall, 4.6% of patients experienced grade 4 Clavien complications and a 1.1% mortality. Worsening frailty correlated with increase in complications (non-frail: 2.5%; mildly frail: 6.3%; severely frail: 20%; p = 0.005). Non-frail patients experienced a similar rate of complications with MIDP vs ODP vs MIDPcOP (2.3 vs 2.3 vs 4.9%; p = 0.6), whereas frail patients (MFI > 0) had a lower rate of complications with MIDP (2.4 vs 8.3 vs 11.5; p = 0.007).

Conclusion: Minimally invasive distal pancreatectomy is associated with a lower risk of grade 4 Clavien complications compared to open for frail patients. The minimally invasive approach may modify the risk of the procedure, particularly in frail patients.
cancer surgery in particular. In linear regression analysis, presence of sarcopenia was associated with a cost increase of €5,255 (p = 0.001).

**Conclusion:** Sarcopenia was independently associated with increased costs. Reduction of sarcopenia might reduce hospital costs in an era of incremental health-care costs and an increasingly ageing population.

**MO 18**

**FINDING THE BALANCE: RESIDENT VERSUS FELLOW EXPOSURE AND TRAINING IN HEPATOBILIARY AND PANCREATIC SURGERY**

R. Groeschl and M. Truty

*Mayo Clinic, Rochester, MN, USA*

**Objective:** Institutions training both residents and hepatopancreatobiliary (HPB) fellows must strive for adequate case volumes, with the ideal fraction of distributed cases currently unknown. We sought to determine the impact of a dedicated HPB service to trainee exposure over time.

**Methods:** Five-year ACGME resident and HPB Fellowship Council case logs (7/2011-6/2016) were examined alongside administrative case data at a single high-volume center.

**Results:** During study period, 3387 HPB operations were performed including 1523 liver, 1285 pancreas, and 579 complex biliary, with volumes increasing annually. Resident and fellow trainees logged 2884 (85%) of cases, with a ratiometric workforce of 4.5 chief residents per HPB fellow. Chief residents graduated with a mean of 20 liver/16 pancreas operations (ACGME minimum = 4 liver/3 pancreas). HPB fellows graduated with a mean of 168 liver/70 pancreas operations (AHPBA minimum = 25 liver/25 pancreas). Residents/fellows performed 953 (53%)/840 (47%) of all trainee-performed liver operations and 742 (68%)/349 (32%) of trainee-performed pancreas operations respectively, with significantly different HPB case mix (liver versus pancreas, p < 0.0001). The overall relative proportion of HPB cases performed by residents versus fellows was 59%/41%, respectively, and this was stable over time (p = NS).

**Conclusion:** Our experience suggests that a 60/40 resident/fellow HPB case mix allows for more than adequate exposure for both groups of trainees. Liver operations appear to be more fellow-specific than pancreas operations. This relationship should be examined by all HPB fellowships that are incorporated into general surgical training programs, and could be useful as programs need to establish an expected balance between various trainee needs.

**MO 19**

**THE PROGNOSTIC VALUE OF HEPATIC ARTERIAL AND PORTAL VENOUS INVOLVEMENT IN PATIENTS WITH PERIHILAR CHOLANGIOCARCINOMA**

M. Gaspersz, J. van Vugt, R. Coelen, J. Vugts, T. Labeur, J. de Jonge, M. Besselink, O. Busch, W. Polak, J IJzermans, C. Nio, T. van Gulik, F. Willemssen and B. Groot Koerkamp

*Erasmus MC University Medical Center, Rotterdam, Netherlands*

**Objective:** Vascular involvement is part of staging systems and prognostic models for patients with perihilar cholangiocarcinoma (PHC). For instance, the AJCC and DeOliveira/Clavien classification require detailed evaluation of both unilateral and main hepatic artery (HA) and PV-involvement. We investigated the prognostic value of vascular involvement on imaging in patients with PHC.

**Methods:** All patients with suspected PHC in two tertiary referral centers between 2002 and 2014 were identified. Vascular involvement was defined as apparent tumor contact of ≥180 degrees to the PV or HA. The Kaplan–Meier method with log-rank test was used to compare overall survival (OS) between groups. Cox regression-analysis was used to identify independent prognostic factors.

**Results:** In total, 674 patients were included with a median OS (95% CI) of 12.3 months (10.7–13.9). Patients with main/bilateral PV-involvement (19.8%) had a median OS of 8.1 (5.4–10.9) months, inferior to patients with unilateral or no PV-involvement (p < 0.001). Median OS for patients with unilateral HA-involvement (41.9%) was 10.9 (9.5–12.2) months compared with 16.9 (13.1–20.6) months in patients without HA-involvement (p < 0.001). Patients with main/bilateral HA-involvement (13.3%) had a median OS of 6.9 (3.3–10.5) months, inferior to 10.9 (9.5–12.2) months for patients with unilateral or no HA-involvement (p < 0.001, figure). Independent prognostic factors included main/bilateral HA-involvement (HR 1.83, 95% CI 1.37–2.47) as well as unilateral HA-involvement (HR 1.34, 95% CI 1.11–1.61). PV-involvement was not an independent prognostic factor.

**Conclusion:** This study demonstrated that both unilateral and main HA-involvement are independent poor prognostic factor for OS in patients presenting with PHC, whereas PV-involvement is not.
MO 20
PREOPERATIVE PREDICTION OF MICROVASCULAR INVASION IN HEPATOCELLULAR CARCINOMA USING QUANTITATIVE IMAGE ANALYSIS

Memorial Sloan Kettering Cancer Center, New York, NY, USA

Objective: Microvascular invasion (MVI) is a significant risk factor for early recurrence after resection of hepatocellular carcinoma (HCC). Knowledge of MVI status preoperatively would optimize patient selection for resection or transplant. This study proposes quantitative imaging predictors of MVI.

Methods: 121 patients who underwent resection of HCC at 2 institutions from 2003 to 2015 were included in this retrospective study. Patients were included based on the availability of contrast-enhanced CT imaging within 3 months preoperatively. We employed quantitative imaging analysis, including local binary patterns, which utilized regional pixel variations in CT image of tumors to automatically categorize tumor morphology and detect MVI. The analysis was performed on the index tumor, which is the largest tumor, and the analysis was repeated with 10-fold cross-validation.

Results: Given the diverse morphology of HCC tumors, tumors were first categorized into uniform (n = 40) or heterogeneous (n = 81) groups by two blinded radiologists, and it was validated by quantitative image analysis with area under curve (AUC) 0.94 and accuracy 86%. Thirteen tumors (33%) in the uniform group had MVI whereas 41 (51%) in the heterogeneous group had MVI. Within each group, imaging features measured by local binary patterns were most predictive of MVI by univariate analysis. Local binary patterns predicted MVI with AUC 0.78 and accuracy 75% among uniform tumors and with AUC 0.76 and accuracy 74% among heterogeneous tumors (Figure).

Conclusion: Quantitative image analysis is a promising preoperative predictor of MVI. Validation in an external dataset is needed to elucidate the utility of this novel imaging marker.

<table>
<thead>
<tr>
<th></th>
<th>Uniform</th>
<th>Heterogeneous</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUC</td>
<td>0.78</td>
<td>0.76</td>
</tr>
<tr>
<td>Accuracy</td>
<td>75%</td>
<td>74%</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>81%</td>
<td>76%</td>
</tr>
<tr>
<td>Specificity</td>
<td>73%</td>
<td>71%</td>
</tr>
<tr>
<td>PPV</td>
<td>60%</td>
<td>74%</td>
</tr>
<tr>
<td>NPV</td>
<td>88%</td>
<td>74%</td>
</tr>
</tbody>
</table>

MO 21
MULTIINSTITUTIONAL ANALYSIS OF FREQUENCY, RISK FACTORS AND OUTCOMES FOR 537 SIMULTANEOUS PANCREATECTOMY/HEPATECTOMY PROCEDURES

B. Kim, T. Vreeland and T. Aloia
University of Texas, MD Anderson Cancer Center, Houston, TX, USA

Objective: As HPB surgery has become safer, a larger number of combined liver/pancreas resections are being attempted. This project assessed the frequency, clinical features, and outcomes in a large multi-institutional cohort of these radical operations.

Methods: All elective operations with both a hepatectomy (partial lobectomy (PL), left lobectomy (LL), right lobectomy (RL), or trisectionectomy (TS)) and a simultaneous pancreatectomy (pancreatoduodenectomy (PD), distal (DP), or total pancreatectomy (TP)) were identified in the 2005–2014 American College of Surgeons National Surgical Quality Improvement Project (ACS-NSQIP) database. Operations were categorized based on combined magnitude of resection as major (PL + DP), super major (RL/LL/TS + DP or PL + PD/TP), and extreme (RL/LL/TS + PD/TP). Risk factors and outcomes were assessed with standard statistical methods.

Results: During the study period, 537 patients underwent combined liver/pancreas operations with 225 Major (M), 285 Super Major (SM) and 27 Extreme (E). The number of operations reported has increased from 103 (2005–2009) to 434 (2010–2014). Median age was 61 years (range 21–90) and 45.6% were male. Increasing magnitude of resection was associated with longer median operative time (M: 282 minutes/SM: 369/E: 483 minutes), median length of stay (M: 7 days/SM: 9 days/E: 14 days), severe complication (SC) rates (M: 21.3%/SM: 36.5%/E: 51.9%, p<0.001) and 30-day mortality rates (M: 1.3%/SM 6.0%/E: 7.7%, p = 0.022). Multivariate analysis demonstrated that E/SM vs. M was predictive of both serious complications and mortality, with other factors individually contributing to each endpoint [Table 1].

Conclusion: Simultaneous liver/pancreas resection is an increasingly frequent procedure associated with significant morbidity and mortality when complex liver resection is combined with complex pancreas resection.

Table 1 Predictors of serious complications and 30-day mortality.

<table>
<thead>
<tr>
<th></th>
<th>Multivariate for serious complications</th>
<th>OR (CI interval)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>E/SM vs. M</td>
<td>1.77 (1.15–2.69)</td>
<td>0.008</td>
<td></td>
</tr>
<tr>
<td>OP Time &gt;300 minutes</td>
<td>2.106 (1.354–3.277)</td>
<td>0.001</td>
<td></td>
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<tr>
<td>LOS &gt; 8 days</td>
<td>3.206 (1.697–6.057)</td>
<td>&lt;0.001</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Multivariate for 30-day mortality</th>
<th>OR (CI interval)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>E/SM vs. M</td>
<td>2.95 (0.80 – 10.81)</td>
<td>0.103</td>
<td></td>
</tr>
<tr>
<td>Albumin &lt;3.5 mg/dL</td>
<td>3.04 (1.17 - 7.84)</td>
<td>0.022</td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>3.37 (1.28 - 8.87)</td>
<td>0.014</td>
<td></td>
</tr>
<tr>
<td>Age ≥ 75 years</td>
<td>3.68 (1.23 – 11.05)</td>
<td>0.020</td>
<td></td>
</tr>
</tbody>
</table>

Abbreviations: E, Extreme; SM, Super Major; M, Major; OP Time, Operative Time; LOS, Length of Stay
MO 22
REPRODUCIBILITY OF HEPATOBILIARY SCINTIGRAPHY WITH GALLBLADDER EJECTION FRACTION FOR DIAGNOSIS OF BILIARY DYSKINESIA: DIAGNOSIS IS BETTER THE SECOND TIME AROUND?
J. B. Rose and S. M. Strasberg
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Objective: Twenty percent of cholecystectomies in the United States are performed for a diagnosis of biliary dyskinesia (BD) but this is an uncommon event in European countries. The diagnosis of BD is made by measuring gallbladder ejection fraction (EF) using hepatobiliary scintigraphy. The purpose of this study was to evaluate the reproducibility of EF measurement using this technique.

Methods: From 2010 to 2016 all patients who were referred to a single surgeon with a diagnosis of biliary dyskinesia based on EF of <35% were re-tested. Tests were performed using Tc-99m and slow injection of sancaline at 0.02 mcg/Kg and taking serial images.

Results: Repeat testing was performed on all 28 referred patients at a median of 38 days after the index office visit. 14 of 28 patients (50%) had a reduced ejection fraction, which confirmed the diagnosis of BD. However, the same number of patients had had a normal EF of >35% on repeat testing, i.e. the test result was not reproducible in them. The age, gender, days between testing, and initial EF did not differ between groups. Patients with confirmed BD were advised to have a cholecystectomy and the other patients were advised against the procedure.

Conclusion: Hepatobiliary scintigraphy with gallbladder EF is a poorly reproducible test. Re-testing resulted in a change of management in 50% of patients who then avoided an unnecessary cholecystectomy. Strong consideration should be given to repeating hepatobiliary scintigraphy with gallbladder EF prior to cholecystectomy in patients with an initial positive test.

MO 23
INCIDENTAL GALLBLADDER CANCER: HOW RESIDUAL DISEASE AFFECTS OUTCOME IN TWO DIFFERENT SOUTH AMERICAN REFERRAL CENTERS
L. Gil, X. de Aretxabala, J. Lendoire, J. Hepp and O. Inventarza
Hospital Cosme Argerich, Buenos Aires, Argentina

Objective: The purpose of this study was to analyze the patterns of residual disease and influencing factors in patients undergoing re-resection for incidental gallbladder cancer.

Methods: Consecutive patients with IGC undergoing re-exploration between 1990 and 2014 were identified in two centers from different South-American countries. Those patients submitted to a radical definitive resection were analyzed. Demographics and tumor-treated related variables were correlated with RD and survival. Cancer specific survival correlated with the site of RD, local (gallbladder bed) or regional (lymph nodes & bile duct).

Results: Of 265 patients with incidental gallbladder cancer, re-resection was performed in 168, RD was found in 58 (34.5%). Comparison of demographic, clinical and surgical variables between both centers showed differences in T stage and disease stage (<0.0001). Site of RD was regional in 34 (20.2%). The T stage (p=0.002), positive lymph nodes (p=0.008) and stage of the gallbladder specimen (p<0.0001) were independent predictors of RD. The presence of RD at any site reduced the disease specific survival (DSS) (19.6 month vs 62.7 month p<0.001) in comparison with non RD patients. There was no difference in DSS according the location of RD, with all anatomic sites been equally poor (p=0.27). RD at any site predicted DSS (p<0.001), independent of all other tumor related variables.

Conclusion: Residual disease is the most critical prognostic factor in patients with incidental gallbladder cancer treated by radical resection. Outcome was poor in the presence of RD regardless of the anatomic location.

MO 24
DEMOGRAPHIC CLINICAL CHARACTERISTICS AND LONG-TERM SURVIVAL ANALYSIS OF PRIMARY BILIARY CARCINOID: A UNITED STATES POPULATION BASED STUDY (SEER 1973–2013)
S. Patil, J. Parikh and M. Jacobs
Ascension Providence Hospital, Troy, MI, USA

Objective: Carcinoids are slow growing tumors of neuroendocrine origin with a high metastatic potential. Primary biliary carcinoids (PBC) are poorly because of their rarity. The aim of this study was to analyze the demographics, clinical characteristics, and long-term cancer specific survival of patients with PBC.

Methods: Data on PBC patients was abstracted from the Surveillance Epidemiology and End Result (1973–2013) database. PBC arising from liver, gallbladder, extrahepatic bile duct (EHD), and ampulla of Vater were compared. Kaplan –Meier Survival Curves were constructed.

Results: 531 patients with PBC were identified with mean age 62.5 ± 14.5 years. PBC were more common in males, except for ampullary carcinoids, p = 0.01. Liver PBC were common in Caucasians, whereas ampullary carcinoids were more common among African Americans compared to the other sites, p = 0.51. Localized disease at presentation was lowest in the liver (36.8%) and ampullary carcinoids (41.8%), p < 0.001. 56.1% of patients with PBC received cancer-directed surgery, lowest in the liver carcinoid group (19.7%), p < 0.001. Overall mortality (75.2%) and cancer specific mortality (41.9%) were highest for liver carcinoids, p < 0.001. Cancer specific survival lowest for liver carcinoids (47.7 ± 52.1 months), p < 0.01. On Kaplan–Meier survival analysis, the cancer specific mortality plateaued after 5 years for all the PBC, except for liver carcinoids (Fig. 1).

Conclusion: PBC are common in the 6th decade of life, males and Caucasians. Liver PBC are aggressive tumors with the highest mortality and have poor long-term survival. The results of this study will help clinicians to risk stratify patients with PBC and tailor the treatment approach accordingly.
MO 26
A MULTI-INSTITUTIONAL ANALYSIS ON NEUROENDOCRINE LIVER METASTASIS FROM PANCREATIC NEUROENDOCRINE TUMORS
The Ohio State University, Columbus, OH, USA

Objective: Neuroendocrine tumors typically arise from pancreatic (PNET) vs. gastrointestinal or thoracic origins (non-PNET). The impact of primary tumor site on long-term prognosis following resection of neuroendocrine liver metastasis (NELM) remains poorly defined. The objective of the study was to define the association of primary tumor location on prognosis of patients undergoing hepatic resection for NELM.

Methods: Between 1990 and 2014, 421 patients who underwent resection of NELM were identified from a multi-institutional database. Clinicopathological characteristics, operative details, and outcomes were stratified by location of the primary tumor (PNETs vs non-PNET). A propensity score matched analysis was utilized to assess the impact of primary tumor location on long-term survival.

Results: Overall, 197 (46.8%) patients had NELM from a PNET primary while 224 (53.2%) had a non-PNET primary (small bowel, n = 145; rectal, n = 10; bronchial, n = 22; other, n = 47). The extent of liver involvement was comparable among PNET vs. non-PNET patients (>50%: 70.6% vs. 76.3%, respectively; \(P = 0.19\)). Patients with PNET and NELM were, however, more likely to have extrahepatic disease (5.6%) compared with non-PNET patients (12.9%) (\(P = 0.01\)). At the time of surgery, most patients underwent a minor resection (<3 segments) (PNET, 63.8% vs. non-PNET, 60.3%; \(P = 0.46\)). On final pathology, patients with a primary PNET were more likely to have NELM characterized as moderate- or poorly-differentiated (\(P = 0.005\)). Post-operatively, patients with a history of primary PNET were less likely to receive somatostatin-analog/targeted adjuvant therapy than non-PNET patients (15.2% vs. 29.9%, respectively; \(P < 0.001\)). Patients with PNET + NELM had a worse disease-free (DFS) and overall survival (OS) compared with patients who had non-PNET + NELM (DFS: PNET, 36.2% vs. non-PNET 55.2%; OS: PNET, 69.5% vs. non-PNET 83.4%; both \(P < 0.01\)). However, after propensity score matching, while the presence of extrahepatic disease and tumor grade were associated with DFS (extrahepatic disease: HR 2.12; 95% CI, 1.19–3.75; \(P = 0.010\); tumor grade: HR 1.91; 95% CI, 1.43–2.55; \(p < 0.001\)) and OS (extrahepatic disease: HR 3.09; 95% CI, 1.65–5.79; \(P < 0.001\); tumor grade: HR 1.76; 95% CI, 1.25–2.48; \(P = 0.001\)), primary tumor location was not associated with long-term outcomes (DFS: HR 0.92, 95% CI, 0.60–1.42; OS: HR 0.93, 95% CI, 0.58–1.49; both \(P > 0.05\)).

Conclusion: PNET patients present with NELM with extra-hepatic disease and worse tumor grade. On propensity matched analysis factors such as extra-hepatic disease and tumor grade, but not primary tumor location, were associated with prognosis.

Figure 1 Kaplan–Meier cancer specific survival analysis of 531 patients with primary biliary carcinoids (SEER 1973–2013).
LONG TERM SURVIVAL AND SURGICAL OUTCOMES OF MINIMALLY INVASIVE LIVER SURGERY FOR PRIMARY AND METASTATIC LIVER TUMORS. A 15-YEAR EXPERIENCE

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University of Pittsburgh Medical Center, Pittsburgh, PA, USA

Objective: Application of minimally invasive technique in liver surgery is expanding, even for cirrhotic patients with multiple comorbidities. We started a minimally-invasive-liver-resection program in 2001. We sought to review our current experience of laparoscopic liver surgery (LLS). To our knowledge, this is the largest single-center series worldwide.

Methods: A review of consecutive patients between 2001 and 2016 was performed.

Results: A total of 831 patients underwent LLS with mean age of 58 years-old (range: 17–92), 63% female, BMI of 28.3 kg/m² (range: 16–61), and ASA score of 2.7. Pure laparoscopic technique was performed in 550 (66.2%) patients, hand-assisted in 130 (15.6%) patients, hybrid in 99 (12%) patients, and robotic-assisted in 52 (6.3%) patients. Leading pathologies included liver cystic mass (n = 234), hepatocellular carcinoma (HCC) (n = 130), metastatic colorectal cancer (CRC) (n = 110), hemangioma (n = 65), FNH (n = 63), hepatic adenoma (n = 44), intrahepatic cholangiocarcinoma (n = 18), gallbladder cancer (n = 13), and metastatic neuroendocrine tumor (NET) (n = 15). Mean operative time was 201 minutes with blood loss of 128 ml. Blood transfusion was needed in 15 (2%) patients. Unplanned open-conversion occurred in 10 (2%) patients in the pure laparoscopic group and 1 (2%) patient in the robotic-assisted group. ICU admission was needed in 17 (2.1%) patients. Sixty four (7.7%) patients developed 90-day total complications (cardiopulmonary 21, bile leak 6, bleeding 6, intra-abdominal infection 5, thromboembolism 5). Average hospital-stay was 2.7 days. Follow-up information was available in 92.4% of patients. Median overall survival for HCC and CRC were 34 and 39.5 months, respectively.

Conclusion: Our experience confirms that LLS for primary and metastatic liver tumors results in good surgical/survival outcomes and minimal operative complications.

### Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pure laparoscopic (n = 550 (66.2%))</th>
<th>Hand-assisted (n = 130 (15.6%))</th>
<th>Hybrid (n = 99 (12%))</th>
<th>Robotic-assisted (n = 52 (6.3%))</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year)</td>
<td>59 (17–92)</td>
<td>56 (18–92)</td>
<td>55.3 (26–84)</td>
<td>60.4 (33–87)</td>
</tr>
<tr>
<td>Body mass index BMI (kg/m²)</td>
<td>28.4 (17–46.3)</td>
<td>27.9 (17.4–44.7)</td>
<td>29.3 (19–50.7)</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Female</td>
<td>340 (61.8%)</td>
<td>90 (69.2%)</td>
<td>59 (59.6%)</td>
<td>34 (65.4%)</td>
</tr>
<tr>
<td>b. Male</td>
<td>210 (38.2%)</td>
<td>40 (30.8%)</td>
<td>40 (40.4%)</td>
<td>18 (34.6%)</td>
</tr>
<tr>
<td>ASA score</td>
<td>2.7</td>
<td>2.7</td>
<td>2.8</td>
<td>2.7</td>
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<tr>
<td>Background liver cirrhosis</td>
<td>33%</td>
<td>11%</td>
<td>36%</td>
<td>38%</td>
</tr>
<tr>
<td>MELD score</td>
<td>8.8</td>
<td>7.2</td>
<td>6.7</td>
<td>10</td>
</tr>
<tr>
<td>Child Pugh score</td>
<td>5.7</td>
<td>5.2</td>
<td>5</td>
<td>6.3</td>
</tr>
<tr>
<td>Liver pathology</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Hepatocellular carcinoma</td>
<td>87 (15.8%)</td>
<td>21 (16.2%)</td>
<td>16 (16.2%)</td>
<td>6 (11.5%)</td>
</tr>
<tr>
<td>b. Colorectal cancer</td>
<td>42 (7.6%)</td>
<td>27 (20.8%)</td>
<td>29 (29.3%)</td>
<td>12 (23.1%)</td>
</tr>
<tr>
<td>c. Intrahepatic cholangiocarcinoma</td>
<td>11 (2%)</td>
<td>0</td>
<td>6 (6.1%)</td>
<td>1 (1.9%)</td>
</tr>
<tr>
<td>d. Gallbladder cancer</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6 (11.5%)</td>
</tr>
<tr>
<td>e. Neuroendocrine tumor</td>
<td>9 (1.6%)</td>
<td>2 (1.5%)</td>
<td>4 (4%)</td>
<td>0</td>
</tr>
<tr>
<td>f. Breast cancer</td>
<td>18 (3.3%)</td>
<td>6 (4.6%)</td>
<td>6 (6.1%)</td>
<td>0</td>
</tr>
<tr>
<td>g. Hepatic adenoma</td>
<td>24 (4.4%)</td>
<td>10 (7.7%)</td>
<td>8 (8.1%)</td>
<td>2 (3.8%)</td>
</tr>
<tr>
<td>h. Focal nodular hyperplasia</td>
<td>25 (4.5%)</td>
<td>23 (17.7%)</td>
<td>13 (13.1%)</td>
<td>2 (3.8%)</td>
</tr>
<tr>
<td>i. Liver cystic mass</td>
<td>202 (36.7%)</td>
<td>21 (16.2%)</td>
<td>3 (3%)</td>
<td>8 (15.4%)</td>
</tr>
<tr>
<td>j. Hemangioma</td>
<td>31 (5.6%)</td>
<td>18 (13.8%)</td>
<td>12 (12.1%)</td>
<td>4 (7.7%)</td>
</tr>
<tr>
<td>k. Benign fibrotic nodule</td>
<td>36 (6.5%)</td>
<td>0</td>
<td>0</td>
<td>5 (9.6%)</td>
</tr>
<tr>
<td>k. Others</td>
<td>65 (11.8%)</td>
<td>2 (1.5%)</td>
<td>2 (2%)</td>
<td>6 (11.5%)</td>
</tr>
<tr>
<td>Major hepatectomy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Left lateral sectionectomy</td>
<td>43 (7.8%)</td>
<td>66 (50.8%)</td>
<td>22 (22.2%)</td>
<td>10 (19.2%)</td>
</tr>
<tr>
<td>b. Central hepatectomy</td>
<td>39 (7.1%)</td>
<td>0</td>
<td>0</td>
<td>8 (15.4%)</td>
</tr>
<tr>
<td>c. Nonanatomic ≥ 2 segments</td>
<td>16 (2.9%)</td>
<td>22 (17%)</td>
<td>46 (46.5%)</td>
<td>0</td>
</tr>
<tr>
<td>d. Right hepatectomy</td>
<td>3 (0.5%)</td>
<td>4 (0.3%)</td>
<td>9 (9.1%)</td>
<td>6 (11.5%)</td>
</tr>
<tr>
<td>e. Left hepatectomy</td>
<td>4 (0.7%)</td>
<td>13 (10%)</td>
<td>20 (20.2%)</td>
<td>2 (3.8%)</td>
</tr>
</tbody>
</table>
MO 29

**DRAINS SHOULD NOT BE USED ROUTINELY AFTER MAJOR HEPATECTOMY**

A. Karachristos, S. Jayarajan, V. Thompson, B. Hall and H. Pitt
Temple University, Philadelphia, PA, USA

**Objective:** Many liver surgeons continue to routinely insert drains after uncomplicated hepatic resections. However, small randomized trials and a Cochran Systematic Review do not support this practice. The aim of this analysis was to use a multi-institution database to compare matched patients undergoing a major hepatic resection who did and did not have drains placed at surgery.

**Methods:** The 2014 Procedure Targeted Hepatectomy National Surgical Quality Improvement Program (NSQIP) Participant Use File was queried for right, left or extended hepatectomies. Liver resections with a concomitant colectomy or hepaticojejunostomy were excluded. Patients with and without drains were matched for age, gender, ASA class, BMI, multiple comorbidities, liver function, wound class, operative approach, resection type and pathology.

Both univariate comparisons and multivariable logistic regression models were performed to access outcomes.

**Results:** Of 3084 hepatectomies, 787 (26%) were major resections. Propensity score matching resulted in 544 patients with (n = 272) or without (n = 272) drains. Drain and No Drain patients did not differ with respect to overall morbidity, mortality, reoperations or length of stay. Outcomes which were better in the No Drain patients are presented in the Table.

**Conclusion:** Drain placement after major hepatectomy results in more surgical site infections, bile leaks, interventions for leaks and readmissions. Bile leaks are associated with multiple post hepatectomy adverse outcomes. Routine drain placement is not warranted after major hepatectomy.

### Table: Comparison of outcomes between drain and no drain patients

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pure laparoscopic</th>
<th>Hand-assisted</th>
<th>Hybrid</th>
<th>Robotic-assisted</th>
</tr>
</thead>
<tbody>
<tr>
<td>n = 550 (62.2%)</td>
<td>n = 130 (15.6%)</td>
<td>n = 99 (12%)</td>
<td>n = 52 (6.3%)</td>
<td></td>
</tr>
<tr>
<td>Minor hepatectomy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Liver cystic mass fenestration</td>
<td>177 (32.2%)</td>
<td>19 (14.6%)</td>
<td>2 (2%)</td>
<td>4 (7.7%)</td>
</tr>
<tr>
<td>b. Nonanatomic &lt; 2 segments</td>
<td>268 (48.7%)</td>
<td>6 (4.6%)</td>
<td>0</td>
<td>22 (42.3%)</td>
</tr>
<tr>
<td>Operative time (minute)</td>
<td>131.6</td>
<td>281.7</td>
<td>200.4</td>
<td>208.7</td>
</tr>
<tr>
<td>Estimated blood loss (ml)</td>
<td>111.4</td>
<td>308.2</td>
<td>194.3</td>
<td>252.7</td>
</tr>
<tr>
<td>Unplanned open conversion</td>
<td>10 (1.8%)</td>
<td>0</td>
<td>0</td>
<td>1 (1.9%)</td>
</tr>
<tr>
<td>Blood transfusion</td>
<td>10 (1.8%)</td>
<td>7 (5.4%)</td>
<td>7 (7.1%)</td>
<td>0</td>
</tr>
<tr>
<td>Intensive care unit admission</td>
<td>8 (1.5%)</td>
<td>8 (6.1%)</td>
<td>2 (2%)</td>
<td>0</td>
</tr>
<tr>
<td>Overall complications</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Clavien–Dindo grade I</td>
<td>4 (0.7%)</td>
<td>10 (7.7%)</td>
<td>4 (4%)</td>
<td>0</td>
</tr>
<tr>
<td>b. Clavien–Dindo grade II</td>
<td>12 (2.2%)</td>
<td>5 (3.8%)</td>
<td>2 (2%)</td>
<td>1 (1.9%)</td>
</tr>
<tr>
<td>c. Clavien–Dindo grade III</td>
<td>8 (1.5%)</td>
<td>6 (4.6%)</td>
<td>0</td>
<td>1 (1.9%)</td>
</tr>
<tr>
<td>d. Clavien–Dindo grade IV</td>
<td>6 (1.1%)</td>
<td>3 (2.3%)</td>
<td>2 (2%)</td>
<td>0</td>
</tr>
<tr>
<td>Minor complications</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Superficial wound infection</td>
<td>2 (0.2%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>b. Intestinal ileus</td>
<td>1 (0.2%)</td>
<td>4 (3.1%)</td>
<td>2 (2%)</td>
<td>0</td>
</tr>
<tr>
<td>c. Delirium</td>
<td>3 (0.5%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Major complications</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Bleeding</td>
<td>3 (0.5%)</td>
<td>2 (1.5%)</td>
<td>1 (1%)</td>
<td>0</td>
</tr>
<tr>
<td>b. Small bowel obstruction</td>
<td>1 (0.2%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>c. Bile leak</td>
<td>1 (0.2%)</td>
<td>3 (2.3%)</td>
<td>2 (2%)</td>
<td>0</td>
</tr>
<tr>
<td>d. Cardiac complications</td>
<td>3 (0.5%)</td>
<td>2 (1.5%)</td>
<td>1 (1%)</td>
<td>0</td>
</tr>
<tr>
<td>e. Respiratory complications</td>
<td>9 (1.6%)</td>
<td>3 (2.3%)</td>
<td>3 (3%)</td>
<td>0</td>
</tr>
<tr>
<td>f. DVT/PE**</td>
<td>4 (0.7%)</td>
<td>0</td>
<td>0</td>
<td>1 (1.9%)</td>
</tr>
<tr>
<td>g. Intra-abdominal infection</td>
<td>0</td>
<td>2 (1.5%)</td>
<td>2 (2%)</td>
<td>1 (1.9%)</td>
</tr>
<tr>
<td>h. Hernia</td>
<td>3 (0.5%)</td>
<td>3 (2.3%)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>i. Narcotic related complications</td>
<td>1 (0.2%)</td>
<td>3 (2.3%)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>j. Others</td>
<td>0</td>
<td>2 (1.5%)</td>
<td>1 (1%)</td>
<td>0</td>
</tr>
<tr>
<td>Length of hospital stay (day)</td>
<td>2</td>
<td>4.2</td>
<td>5.7</td>
<td>3.9</td>
</tr>
<tr>
<td>90-day mortality</td>
<td>10 (1.8%)</td>
<td>0</td>
<td>1 (1%)</td>
<td>0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drain</th>
<th>Any SSI (%)</th>
<th>Bile leak (%)</th>
<th>Leak intervention (%)</th>
<th>Re-admission (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>7.7*</td>
<td>5.2</td>
<td>2.3</td>
<td>4.8</td>
</tr>
<tr>
<td>Yes</td>
<td>15.4*</td>
<td>16.2*</td>
<td>6.4†</td>
<td>16.2*</td>
</tr>
</tbody>
</table>

*p<0.001, †p < 0.001 vs No Drain
MO 30
HEPATIC INTRA-ARTERIAL THERAPIES FOR UNRESECTABLE AND CHEMO-REFRACTORY COLORECTAL CANCER LIVER METASTASES: SYSTEMATIC REVIEW AND POOLED ANALYSIS
McGill University, Toronto, Canada

Objective: Most patients with colorectal cancer liver metastases (CRCLM) become unresectable during the course of their disease requiring palliative treatments. This meta-analysis aims to compare the survival benefit of three hepatic intra-arterial therapies in unresectable and chemoradiation refractory CRCLM: conventional trans-arterial chemoembolization (cTACE), drug-eluting bead trans-arterial chemoembolization (DEB-TACE) and Yttrium-90 radioembolization (Y-90).

Methods: A systematic literature search was conducted and prospective studies were selected according to pre-determined criteria. Study data was extracted from studies that reported on survival outcomes. Median survivals and tumor responses according to RECIST were pooled and compared indirectly. Studies were qualitatively appraised using Downs and Black’s tool.

Results: Twenty of the 3498 studies identified were included and analyzed: 5 cTACE (n = 746), 4 DEB-TACE (n = 202) and 11 Y-90 (n = 569) studies. Most patients had failed at least one therapy in addition to systemic chemotherapy. Extrahepatic disease was rare in the cTACE patients (2%) but present in approximately one third of patients in the DEB-TACE and Y-90 studies. The pooled median survival was superior in the cTACE and DEB-TACE studies (15.7 and 17.6 months) compared to Y-90 (10.4 months). Radiological responses following index therapies were strongest in the cTACE studies (40.6%) as compared to the DEB-TACE (30.1%) or the Y90 (23.1%) studies.

Conclusion: While limited by methodological and statistical heterogeneity, it appears that DEB-TACE and cTACE provide superior survival benefits compared to Y-90 radioembolization. Given the common use of radioembolization in this setting and the significant cost differences between the various treatments, a more robust prospective comparative trial is warranted.

MO 31
LYSOPHOSPHATIDIC ACID RECEPTOR 6 INHIBITS HEPATOCYTE FUNCTION FOLLOWING REPOPULATION AFTER PARTIAL HEPATECTOMY
Carolina Medical Center, Charlotte, NC, USA

Objective: In addition to coordinated mitogenesis following partial-hepatectomy (PHx), hepatocytes must regain cell orientation-functionality. LPAR6 is the most abundant hepatic LPAR subtype, and is transiently increased following PHx and chronically elevated in human HCC. In this study we developed a LPAR6 knockout mouse (LPAR6−/−) to study LPAR6 function during hepatic regeneration.

Methods: A 2/3 PHx was performed on LPAR6−/− and wild-type C57BL/6 (WT) mice. Tissue and serum were collected and analyzed for markers of hepatic regeneration and liver function.

Results: No phenotypic differences were observed between LPAR6−/− and WT prior to PHx. Both groups exhibited normal hepatic histology and metabolic parameters, and no compensatory change in hepatic LPAR1-5 expression was detected in LPAR6−/−. In male LPAR6−/−, PHx induced jaundice in 66% of animals within 96 hrs. In females, 32% of mice died within 72Hrs of PHx. In animals survived to 7d, no significant difference in regenerated liver weight occurred for male or female LPAR6−/− vs WT. Metabolic analysis revealed significantly elevated bilirubin, ALT/AST, GGT, alkaline phosphatase, creatinine, and cholesterol in male mice 72-96 hrs post-PHx compared to WT. No significant differences in corresponding parameters were detected between female LPAR6−/− and WT. Histology revealed slower rate of portal triad formation in LPAR6−/− mice post-PHx.

Conclusion: LPAR6 deletion does not affect normal liver development-architecture, or rate of hepatocyte repopulation post-PHx. However, LPAR6−/− profoundly impacts hepatic function after PHx, suggesting LPAR6 may be involved in regulating hepatocyte orientation and/or bile production. Overall, male mice appear better adapted to overcome LPAR6 deletion following PHx than females.

MO 32
A NOVEL 3-DIMENSIONAL ELECTROMAGNETIC GUIDANCE SYSTEM INCREASES ACCURACY OF MICROWAVE ANTENNA PLACEMENT
D. Iannitti, A. Sastry, J. Swet, E. Baker, J. Martinie, D. Vrochides and I. McKillop
Carolina Medical Center, Charlotte, NC, USA

Objective: Failure to accurately locate lesions and place antenna, and unpredictable ablation volumes, can lead to incomplete tumor ablation. Medtronic ( Minneapolis, MN)
is developing a microwave ablation system that displays real-time, 3D-electromagnetic spatial antenna tracking (SAT) with predictable ablation zones prior to activation. We sought to determine whether SAT affected time and accuracy of antenna placement using an ex-vivo laparoscopic model.

Methods: Phantom targets (7–10 mm) were placed in agar (3–7 cm depth) inside a laparoscopic trainer. Four novices (no surgical experience), intermediates (residents), and experts (HPB-surgeons) located and targeted phantoms (10-US only, 10-SAT). Time to locate target, number of attempts to hit target, and time from initiating antenna advance to hitting target were measured. >10 attempts for hit-rate were considered a fail.

Results: Participants located 100% of targets using US, experts taking significantly less time (16 ± 2 s) than novices (28 ± 3 s) and intermediates (23 ± 2 s). Using US only, successful hit-rates were 70% (28/40) [novices], 90% (36/40) [intermediates], and 90% (36/40) [experts], experts taking significantly less time to hit targets than novices/intermediates. Using SAT, hit-rate for all 3-groups was 100% and significantly fewer attempts were required (1.18 ± 0.07 vs 4.00 ± 0.51 [novice], 1.25 ± 0.10 vs 4.19 ± 0.44 [intermediate], 1.05 ± 0.03 vs 3.64 ± 0.37 [expert]). Time to hit targets was also significantly reduced for all groups using SAT, the biggest differences being for novices (93 ± 17 s vs 19 ± 3 s) and intermediates (71 ± 13 s vs 19 ± 5 s).

Conclusion: SAT significantly improves accuracy and speed of antenna placement independent of prior experience, and is particularly beneficial for those inexperienced at performing laparoscopic targeting for ablation.

MO 33
SYNERGISTIC EFFECT OF SORAFENIB AND FH535 COMBINATION ON HEPATOCELLULAR CARCINOMA BY TARGETING CELL BIOENERGETICS AND MITOCHONDRIAL INTEGRITY

L. Turcioa, V. Vilchez, P. Poyil, D. Butterfield, M. Mitov, F. Marti and R. Gedaly
University of Kentucky, Lexington, KY, USA

Objective: In the present study, we aim to evaluate the impact of the Î²-catenin inhibitor, FH535, alone or in combination with the RAS/RAF/MAPK inhibitor sorafenib, on the bioenergetics profiles of the HCC cell lines Huh7 and PLC/PRF/5.

Methods: We studied HCC cell proliferation and Mitochondrial respiration and glycolysis were determined by measuring the Oxygen consumption rate (OCR) using the XF Cell MitoStress test kit and the extracellular acidification rate (ECAR) using a XF Glycolysis Stress test kit. We also study mitochondrial transmembrane potential, Mitochondrial Mass and Mitochondrial DNA copy number.

Results: Consistent with the Warburg effect, both cell lines showed a high glycolytic rate. Single low-dose treatments with FH535 or sorafenib promoted different effects on mitochondrial respiration and glycolysis in a cell type specific manner. However, the combination of these drugs significantly reduced both mitochondrial respiration and glycolytic rates regardless of the HCC cells. The combination of FH535 and sorafenib reduced the expression of the anti-apoptotic factor Bcl-2 and Survivin and increased levels of cleaved PARP and Caspase-3. Overall, our results demonstrated that Sorafenib-FH535 drug combination induce the disruption of the bioenergetics of HCC cells. This effect was mediated by simultaneously targeting of mitochondrial respiration and glycolytic flux and resulted in enhanced HCC cell apoptosis.

Conclusion: These results might explain the synergism observed on the inhibition of cell proliferation of HCC cell lines by the drug combination. It also open alternative therapy for treatment of a heterogeneous disease by targeting different molecular pathways.

MO 34
EFFECT OF PORTAL VEIN EMBOLIZATION ON TUMOUR GROWTH AND SURGICAL PLAN PRIOR TO MAJOR HEPATECTOMY FOR HEPATOCELLULAR CARCINOMA

B. Loveday, A. Jaberi, C. Moulton, A. Wei, S. Gallinger, A. Ghanekar, I. McGilvray, G. Sapisochin, P. Greig, K. Tan and S. Cleary
Toronto General Hospital, Toronto, Canada

Objective: Portal vein embolization (PVE) may be used prior to liver resection for hepatocellular carcinoma (HCC) to increase the future liver remnant (FLR) volume. However, this may also increase the tumour growth rate, which could lead to disease progression or mandate more extensive resection. The aim of this study was to determine the effect of PVE on the surgical plan.

Methods: A retrospective cohort study was conducted on patients treated from 2008 to 2015 at Toronto General Hospital with PVE prior to hepatectomy for HCC. Calculation of liver and tumour volumes was performed on pre- and post-PVE CT scans. Planned and actual procedures performed were compared. Outcomes included overall and recurrence free survival using standard statistical methods.

Results: Thirty-three patients received PVE, and volumes could be calculated for 31 patients. Total healthy liver volume decreased (median 1440 to −1394 cc; p = 0.031), while there was an increase in tumour (median 161 to −240 cc; p < 0.001) and FLR volumes (median 430 to −574 cc; p < 0.001). Pre-PVE surgical plan and procedure performed changed in 17/33 patients: did not receive upfront liver resection (n = 10), more extensive resection (n = 6), less extensive resection (n = 1). Twenty-five patients ultimately underwent resection. One-, three- and five-year overall survival post-PVE was 71.9%, 56.2%, and 56.2% respectively. Median recurrence free survival was 27.8 months.

Conclusion: Following PVE there is an increase in HCC volume, resulting in a change in surgical plan for half of patients, who either do not undergo a liver resection (30%) or undergo a more extensive resection (20%) than originally planned.
MO 35
IDENTIFICATION OF PATIENTS AT INCREASED RISK OF SUICIDE IN HEPATOBILIARY AND PANCREATIC CANCER: AN ANALYSIS OF EPIDEMIOLOGIC AND CLINICAL RISK FACTORS

P. Martinez Quinones, A. Talukder, N. Walsh, A. Lawson, A. Jones and E. Kruse
Medical College of Georgia at Augusta University, Augusta, GA, USA

Objective: We present an epidemiologic study of suicide rates and risk factors in hepatobiliary and pancreatic malignancy.

Methods: The Surveillance, Epidemiology, and End Results (SEER) Database of the National Cancer Institute was queried to identify patients diagnosed with hepatobiliary and pancreatic malignancies from 1973 to 2013; demographic and mortality data was collected. Comparison data with the general US population was derived from the CDC National Center for Injury Prevention and Control using the Web-based Injury Statistics Query and Reporting System. Standardized mortality ratios (SMRs) and 95% confidence intervals (95% CIs) were calculated for the identification of risk factors associated with suicide.

Results: For liver malignancies among 94,722 patient deaths 76 were due to suicide. For gallbladder and other biliary malignancies 14/19,425 and 156/185,592 suicides respectively, and 172/192,395 for pancreatic malignancy. Males with hepatobiliary and pancreatic cancer have a higher suicide rate (p < 0.001). Whites diagnosed with biliary and pancreatic cancer have increased suicide rate (p < 0.01), while marital status is also a risk factor (p < 0.01), with the highest frequency being married patients. In hepatobiliary and pancreatic cancers, there was no difference in suicide rate with respect to treatment modality, surgical intervention, histopathology, income, stage and age at diagnosis. Patients with liver (SMR 2.79, CI 2.21–3.47), biliary (SMR 2.10, CI 1.20–3.44) and pancreatic (SMR 5.39, CI 4.63–6.24) cancer had at least twice the risk of suicide when compared to general population.

Conclusion: These results coupled with further studies will be used to formulate a comprehensive suicide risk factor scoring system for screening all cancer patients.

MO 36
THE CURRENT SCOPE OF PRACTICE OF TODAY’S HPB SURGEONS

G. Rana, J. Bhullar and V. Mittal
Providence Hospital, Southfield, MI, USA

Objective: To determine the current scope of practice of today’s HPB surgeons.

Methods: An online survey was sent to all the Americas Hepato-Pancreato-Biliary Association (AHPBA) members. Data collection involved demographic information, educational background, the type of practice, complexity of the cases, etc.

Results: A total of 172 responses were obtained. 72.9% of the responses were from HPB surgeons practicing in the USA. When subdivided into regions within the US, HPB surgeons represent evenly throughout the country. 48.2% are HPB fellowship trained. About 2/3 of the current HPB surgeons have been out in practice for less than 10 years. Approximately 70% of these surgeons are practicing in academic centers, with 56.6% of them being in university institutions. Only 7.32% of the surveyors have a “HPB only” practice; majority of the surgeons have combined practices with HPB & general surgery, HPB & surgical oncology or HPB & transplant. 32% take trauma call, and majority of them (59.3%) take general surgery call. Only about 1/3 of the surgeons perform >30 pancreatic cases a year, and about 1/2 of them perform >30 liver resections a year. 64.9% responded to doing less than 25% of the cases laparoscopically; 96.1% responded to doing less than 25% of the cases robotically. 68.4% of the surgeons did not have any credentialing requirements from their institutions in regards to pancreas and liver cases, beyond general surgery training.

Conclusion: The responses highlight the challenge to practice solely as a HPB surgeon. Most HPB surgeons need a second subspecialty to supplement their practice.

MO 37
BRAF MUTATION IS NOT A CONTRAINDICATION TO RESECTION OF COLORECTAL LIVER METASTASES

The University of Texas, MD Anderson Cancer Center, Houston, TX, USA

Objective: BRAF mutations occur in 2–6% of patients undergoing resection of colorectal liver metastases (CLM) and are associated with a poor prognosis. The objective of this study was to determine the survival benefit of CLM resection among patients with BRAF mutations.

Methods: BRAF mutational status was determined by sequencing of DNA extracted from tumor blocks of colorectal cancer primary tumors or metastases. Overall survival was compared between patients undergoing CLM resection and medical patients treated with chemotherapy alone for isolated hepatic metastases.

Results: Among 578 consecutive patients undergoing resection of CLM and BRAF mutational analysis, 20 patients (3%) had BRAF-mutated tumors. Median overall survival after resection of BRAF-mutated CLM was 46
Among 105 medical patients treated with chemotherapy for isolated hepatic metastases, 9 patients (9%) harbored BRAF mutations. Median overall survival rates after chemotherapy alone, with and without BRAF mutations, were 19 and 33 months, respectively. Surgical resection of BRAF-mutated CLM was associated with significantly longer overall survival than chemotherapy alone for both BRAF-mutated (hazard ratio [HR], 0.27; 95% CI, 0.088–0.82; p = 0.021) and BRAF wild-type tumors (HR, 0.45; 95% CI, 0.24–0.86; p = 0.016, Figure). **Conclusion:** Patients with BRAF-mutated tumors who undergo surgical resection of CLM have significantly longer survival than patients with BRAF wild-type or mutated tumors treated with chemotherapy alone. Thus, BRAF mutations do not represent a contraindication to CLM resection.

**MO 38**

**THE CLEVELAND CLINIC SCORE FOR LIVER TRANSPLANTATION FOR HEPATOCELLULAR CARCINOMA: CONTINUOUS PROGNOSTIC SCORE USING TUMOR MORPHOLOGY AND BIOLOGY**


*Cleveland Clinic Foundation, Cleveland, OH, USA*

**Objective:** In liver transplantation (LT) for (HCC), methodological approaches to understanding the impact of tumor morphology and tumor biology remain overly simplistic and many prognostic models rely on binary variables. Analysis of continuous or ordinal data using arbitrary categorical cut-off values can limit statistical power and lead to inaccurate causal inferences. This study sought to develop a new, simple, predictive tool incorporating tumor morphology and tumor biology to predict outcomes using continuous measures.

**Methods:** We developed a model to assess liver morphology using distance from the origin on a Cartesian plane with two axes: maximum tumor size (x-axis) and number of liver lesions (y-axis) obtained by pathology report, termed: tumor burden score (TBS). Logistic regression analysis generated a predictive model for recurrence using two continuous variables, TBS as tumor morphology factor and preoperative AFP level, as tumor biology factor: termed Cleveland Clinic Score (CCS).

**Results:** CCS was calculated for 422 patients as follows: CCS = (0.146aTBS) + (0.001aAFP). AUC of CCS for recurrence and overall survival were 0.753 and 0.648, respectively (both P < 0.001). A prognostic discrimination model using CCS was created to segregate low/high risk (divided by lower 75% and higher 25% of CCS). Cumulative recurrence rate and overall survival rate were significantly different between low/high CCS groups (both P < 0.001); results were consistent with and robust to inclusion of Milan criteria (all P < 0.05).

**Conclusion:** CCS offers a simple, continuous value to assess prognosis in LT for HCC that can discriminate among both patients who met current gold standard criteria and who did not.
MO 39
APPLYING THE BORDEAUX CLASSIFICATION FOR GENOTYPE-PHENOTYPE RECLASSIFICATION OF RESECTED HEPATOCELLULAR ADENOMAS IN THE GREATER BRISBANE REGION FROM 2000 TO 2015

B. Manoharan, G. Miller, B. McKay, C. Campbell, R. Bryant, A. Clouston and N. O’Rourke
Royal Brisbane and Women’s Hospital, McDowall, Australia

Objective: Hepatocellular adenomas (HCAs) present a diagnostic challenge due to ambiguous histological and radiological profiles, potential for malignant transformation and bleeding. The Bordeaux classification recently established that there are at least four main HCA subtypes with different genotypic characteristics. This paper applied the new classification methodology to previously resected adenomas in the Brisbane region to understand their phenotypes, clinical manifestation and malignancy risk.

Methods: Patients with HCA diagnosis and stored tissue were identified via the Brisbane HPB database of both public and private patients between 2000 and 2016. Pathological techniques for identifying LFABP inactivation, nuclear beta-catenin activation & Glutamine Synthetase, Serum Amyloid A & C-Reactive Protein were applied to surgically resected specimens. Operative data and clinical correlation data was obtained from patient records and follow-up surveys.

Results: 118 patients (93% Female; Median Age 39 yrs), were identified with resected tissue available for reanalysis. Multiple subtypes verified the presence of a heterogeneous adenoma group; Inflammatory (47%; Type C), HNF-1 Alpha (28%; Type A) and beta-catenin (13%; Type B) and un-classifiable (13%; Type D). 18 HCAs were haemorrhagic, with 73% Type C, representing 32% of Type C lesions which was a significantly greater proportion than others (p < 0.05).

Seven patients had adenomatosis, but none were Type B.

Conclusion: Literature suggests beta-catenin mutants predispose to malignant change (10–15% of HCAs transform) and our data verifies the presence of these mutations in HCAs, showing a heterogeneous group of tumours, however further validation required to assess HCA transformation to HCC and if a new diagnostic and management approach is warranted.

MO 40
SURGEON PERFORMED TRANSVERSUS ABDOMINIS PLANE BLOCK (TAP) WITH LIPOSOMAL BUPIVACAINE (LP) IS AN EFFECTIVE ADJUNCT FOR PERIOPERATIVE ANALGESIA AFTER OPEN LIVER SURGERY

Mayo Clinic, Rochester, MN, USA

Objective: To evaluate perioperative pain management in a retrospective, single-institution series of 230 hepatectomies (≥3 segments) performed between Jan-2014 and Jun-2016.

Methods: Results: Most frequent diagnosis was CRLM (84/230), midline incisions prevailed (108/230), 51.8% were female, and median age was 55.6 yrs. Fifty-seven percent (131/230) received a TAP, alone or in combination with neuroaxial techniques. Median Pain Scores (PS) on a 0–10 scale, were 0.88 points less at 24 hrs and 2.45 less at 48 hrs in patients who received TAP (P < 0.001). Mean opioid use was significantly reduced by 139 oral morphine equivalents (OME) on postoperative day 1. Subgroups included: G-1: spinal block alone (n = 64, 27.8%), G-2: spinal block and TAP (n = 91, 39.5%), G-3: epidural and TAP (n = 23, 10.0%), G-4: TAP alone (n = 17, 7.3%), and G-5: oral and iv pain medication alone (n = 35, 15.2%). All groups that received regional anesthesia had significantly reduced PS compared to G-5: 24 hrs (median, ≤4 vs 6) and 48 hrs (median, ≤4 vs 6), whereas groups with TAP (2, 3, 4) had significantly lower PS at 48 hrs when compared to G-1 and G-5. Groups 2 and 3 required significantly less OME’s in the first 24 hrs. Length of stay was significantly greater in G-5.

Conclusion: Regional anesthesia reduced pain scores, opioid use and length of stay after open hepatectomy. TAP blocks in conjunction with neuraxial techniques provided superior analgesia during the early postoperative period. TAP block had a more profound effect on pain control on postoperative day 2 while analgesic efficacy following spinal block alone diminished beyond 24 hours.

MO 41
PREDICTORS AND IMPLICATIONS OF UNPLANNED CONVERSION DURING MINIMALLY INVASIVE HEPATECTOMY: AN ANALYSIS OF THE ACS-NSQIP DATABASE

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University of Tennessee Health Science Center, Memphis, TN, USA

Objective: We investigated short-term outcomes of patients requiring unplanned conversion to an open procedure during minimally invasive hepatectomy (MIH) using a national database and evaluated factors predictive of an unsuccessful minimally invasive approach.

Methods: The 2014 American College of Surgeons National Surgical Quality Improvement Program (ACS-
NSQIP) database and hepatectomy data-file were analyzed. MIH performed without planned conversion was compared to those requiring unplanned conversion.

**Results:** Among 3064 hepatectomy patients, MIH was performed in 549 (17.9%); 520 (94.7%) laparoscopic and 29 (5.3%) robotic. Resection was performed for metastases in 225 (41%), benign lesions in 178 (32%), primary hepatic malignancy in 130 (24%) and unknown diagnosis in 16 (3%) patients. Major hepatectomy (≥3 segments) was performed in 91 (16.6%). Unplanned conversion was required in 115 (20.9%). On multivariate analysis, hypertension (OR 2.27, p = 0.0004), concurrent ablation (OR 2.79, p = 0.0028), cirrhotic liver texture (OR 1.97, p = 0.0306), Pringle maneuver (OR 3.47, p < 0.0001), and major hepatectomy (OR 2.61, p = 0.0009) were significantly associated with unplanned conversion. Patients with unplanned conversion experienced higher rates of bile leak (8.7% vs 2.5%, p = 0.0049), wound dehiscence (1.7% vs 0.0%, p = 0.0436), UTI (6.1% vs 0.9%, p = 0.0023) and perioperative transfusion (25.2% vs 6.7%, p < 0.0001). Unplanned conversion was also associated with greater LOS (7.2 ± 6.9 vs 4.0 ± 5.1 days, p < 0.0001) and 30-day mortality (3.5% vs 0.7%, p = 0.0381).

**Conclusion:** Analysis of this large national database revealed unplanned conversion during MIH is associated with significantly higher morbidity and mortality. Furthermore, this investigation identified several factors that should be carefully considered when selecting patients for MIH.

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**MO 44**

**WHAT IS THE CLINICAL VALUE OF A MARGIN NEGATIVE RESECTION IN LYMPH NODE POSITIVE EXTRAHEPATIC CHOLANGIOCARCINOMA?**

North Shore University Health System, Evanston, IL, USA

**Objective:** Achieving free surgical margins in extrahepatic cholangiocarcinoma (EHCCA) often requires an operation more morbid than bile duct resection alone. There is little data examining the value of a margin negative resection in patients who have lymph node positive disease and thus high risk for distant disease recurrence.

**Methods:** We queried the National Cancer Database to identify patients undergoing resection for lymph node positive EHCCA between 2004 and 2012. Patients receiving neoadjuvant chemoradiotherapy and those with gross residual (R2) disease were excluded. Multivariable and Cox Regression Models adjusted for age, facility type, Charlson index, margin status, tumor grade, T-stage, number of nodes examined, procedure type and receipt of adjuvant chemoradiotherapy.

**Results:** 879 (77.2%) patients had free microscopic margins on final pathology (R0); 260 (22.8%) had microscopic positive margins (R1). Multivariable regression identified Charlson score ≥2 (OR 1.980, 95% CI [1.101, 3.559]) and limited (<5 nodes examined) lymphadenectomy (OR 2.368, 95% CI [1.596, 3.512]) as independently associated with R1 resection. Cox analysis identified high histologic grade (HR 1.529, 95% CI [1.145, 2.042]), T4 pathology (HR 1.875, 95% CI [1.435, 2.449]), limited lymphadenectomy (HR 1.239, 95% CI [1.011, 1.518]) and R1 resection (HR 1.665, 95% CI [1.390, 1.994]) as independently associated with poor overall survival and adjuvant chemotherapy (HR 0.598, 95% CI [0.494, 0.724]) with improved survival. Patients undergoing R0 resection had a median survival of 20.9 months compared to 13.6 months for those undergoing R1 resection (p < 0.0001).

**Conclusion:** For patients with node positive EHCCA, operations that carry risk of major morbidity but achieve negative surgical margins are justifiable.
MO 45
THE HISTOLOGICAL GROWTH PATTERNS OF COLORECTAL CANCER LIVER METASTASIS ARE ASSOCIATED WITH DISEASE PROGRESSION POST PORTAL VEIN EMBOLIZATION

McGill University, Montreal, Canada

Objective: We have recently reported that colorectal cancer liver metastases have three different histological growth patterns (HGPs) (desmoplastic, replacement and pushing) and that patients with predominantly desmoplastic lesions have a better prognosis after resection than replacement HGPs. It is also known that a portion of metastases progress after portal vein embolization (PVE) and may decrease the resectability rate. Our aim was to determine if a particular HGP was associated with progression seen after PVE.

Methods: Between 2008 and 2015, patients who underwent PVE and resection and had the appropriate imaging available were included. CT-Scan tumor volumes were measured for lesions before and after PVE and pathologists blinded to the clinical data performed HGP scoring on the H&E stained slides derived from the resected specimens.

Results: Forty-eight patients with 178 lesions were included. Ninety-eight lesions progressed (PD) and 80 were stable (SD), the predominant pattern was desmoplastic in both patients with two-stage resections with PD, the predominant pattern was replacement in both patients with two-stage resections with PD, the predominant pattern was desmoplastic in both patients with two-stage resections with SD, the predominant pattern was replacement (95.0% (47.5–96.3) and 90.0% (82.7–95.0) respectively), whereas in patients with two-stage resections with SD, the predominant pattern was desmoplastic in both the first and second stage surgeries (97.5% (20.0–100.0) and 97.5% (50.0–100.0) respectively).

Conclusion: HGP of liver metastases are associated with disease progression post PVE. Non-invasive methods that could identify growth patterns are needed to optimize patient stratification.

MO 46
EFFECT OF PASIREOTIDE ON PREVENTION OF SEVERE PANCREATIC FISTULAE: A PRACTICE BASED STUDY

Washington University School of Medicine, Mexico City, MO, USA

Objective: In a recent randomized controlled trial, pasireotide prophylaxis reduced high-grade pancreatic leak after pancreatic surgery. The aim of this work is to describe our experience implementing pasireotide into our clinical practice.

Methods: We altered our clinical practice plan to include 7 days of pasireotide beginning in the OR after pancreatectomy. A retrospective review of our prospectively maintained database was performed comparing our initial 100 cases with pasireotide to historic controls. High-grade leak was considered as any pancreatic leak according to the international definition (ISGPF) with a severity grade 3 or higher based on the Accordion system. The latter includes leaks requiring an invasive procedure or with any organ system failure.

Results: From January 2013 to December 2015, 363 patients were included: 100 received pasireotide prophylaxis. Pancreatecoduodenectomy was performed in 277 patients and 86 underwent distal pancreatectomy. The overall rate of high-grade leak was 9.6% with no significant difference between pasireotide 11/100 (11%) vs. no pasireotide prophylaxis 24/263 (9.1%), p = 0.5. In multivariate analysis, pancreatic duct dilation [OR 0.2 (0.06–0.7), p = 0.01], female gender [OR 0.1 (0.04–0.6), p = 0.008] and greater surgeon experience [OR 0.2 (0.08–0.9), p = 0.045] were significant protective factors of high-grade pancreatic leak.

Conclusion: In our practice, pasireotide prophylaxis was not associated with a decrease in the rate of high-grade leak following pancreatic resection. This may be due to a low overall leak rate. Further study is warranted prior to widespread implementation.

MO 47
SEQUENTIAL DRAIN AMYLASE TO GUIDE DRAIN REMOVAL FOLLOWING PANCREATECTOMY

Baylor College of Medicine, Houston, TX, USA

Objective: Although used as criteria for early drain removal, POD1 drain fluid amylase (DFA) < 5000 IU/L has a low negative predictive value for clinically relevant 

Figure 1 Cox survival analysis adjusted for age, chemotherapy, radiation, Charlson score, tumor grade, margin status, pathologic T stage, procedure type, number of lymph nodes examined, and facility type.
postoperative pancreatic fistula (CR-POPF). We hypothesized that POD3 DFA $\leq 350$ could provide further information to guide safe early drain removal. **Methods:** We retrospectively analyzed a prospectively maintained pancreas surgery consortium database for patients who had a pancreatectoduodenectomy or distal pancreatectomy. Patients without drains and without POD 1 and 3 DFA were excluded. Patients with POD1 DFA < 5000 were divided into two groups based on POD3 DFA: low risk ($\leq 350$) and higher risk ($> 350$). Demographics, co-morbidities, operative characteristics, and 60-day outcomes were compared in the two groups using Chi square.

**Results:** Among 662 patients in the database, all drain-related data was available in 316. An additional 44 patients were excluded because POD1 DFA was $\geq 5000$. Of the remaining 272 that met all inclusion criteria, 214 (79%) were in the low risk group and 58 (21%) were in the higher risk group. There were no differences in demographics or co-morbidities.

**Conclusion:** In patients with POD1 DFA $< 5000$ following pancreatectomy, POD3 DFA $\leq 350$ may be a practical clinical test to guide safe early drain removal. Further prospective testing, particularly following pancreatectoduodenectomy, may be useful.

**Table 1** Comparison of low and higher risk groups.

<table>
<thead>
<tr>
<th></th>
<th>Overall (n = 272)</th>
<th>Pancreatectoduodenectomy (n = 208)</th>
<th>Distal pancreatectomy (n = 64)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Low risk</strong></td>
<td><strong>Higher risk</strong></td>
<td><strong>p-Value</strong></td>
<td><strong>Low risk</strong></td>
</tr>
<tr>
<td>(n = 214)</td>
<td>(n = 58)</td>
<td></td>
<td>(n = 164)</td>
</tr>
<tr>
<td>Patients with any</td>
<td>99 (46%)</td>
<td>55 (95%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>complications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CR-POPF</td>
<td>10 (5%)</td>
<td>9 (16%)</td>
<td>0.008</td>
</tr>
<tr>
<td>Pancreatic duct</td>
<td>47 (22%)</td>
<td>21 (36%)</td>
<td>0.02</td>
</tr>
<tr>
<td>$\leq 2$ mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soft gland texture</td>
<td>95 (44%)</td>
<td>45 (82%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Pancreatic</td>
<td>115 (54%)</td>
<td>12 (21%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>adenocarcinoma/pancreatitis</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**MO 48**

Note: This abstract can be found at the end of the section.

**MO 49**

**LOW VOLUME INSTITUTIONS ARE ASSOCIATED WITH DELAY AND OMISSION OF ADJUVANT CHEMOTHERAPY FOR RESECTED PANCREATIC ADENOCARCINOMA INDEPENDENT OF SURGICAL APPROACH**


**University of Texas, MD Anderson Cancer Center, Houston, TX, USA**

**Objective:** Adjuvant chemotherapy (AC) in resected pancreatic adenocarcinoma (PDAC) can lead to doubled 5-year survival rates. To date, the impact of institutional volume on “rate of” and “time to” adjuvant chemotherapy (AC) for pancreatectoduodenectomy (PD), partial/distal pancreatectomy (PP) and total pancreatectomy (TP) for PDAC has not been investigated. **Methods:** NCDB was queried for resected PDAC between 2010 and 2012. Patients with M1 and T1 N0 with negative margins were excluded. After correcting for confounders (age, sex, size, margins, T-N-stage, comorbidities and hospital stay), the odds ratio (OR) of receiving and delay past 90 days of AC following PD, PP, TP for each volume quartile institution was compared to highest quartile. Factors were analyzed by multivariable regression analysis for the entire cohort and each procedure.

**Results:** 8797 patients met inclusion criteria, 56.8% received AC with 9.5% receiving it after 90 days. AC rates for Quartile (Q) 1, Q2, Q3, and Q4 were as follows: 55.7%, 60.4%, 57.6%, 59.6%, 58.6% ($p = 0.016$). After correcting for confounders, compared to the top quartile, Q1 and Q2 had lower odds of receiving AC. For all quartiles and procedures, time to discharge was associated with omission or delay of AC ($p = 0.003$). Laparoscopic compared to open approach for PP in the highest 2 quartiles had higher odds of receiving AC. Only Q4 showed higher rates and lower odds of delay of AC for laparoscopic PD.

**Conclusion:** PAC patients who have pancreatectomy at lower-volume institutions are less likely to receive AC. These data support centralization of treatment, including surgery independent of approach, for patients with PAC.

**Graph 1** Comparison of odds of receiving adjuvant chemotherapy by quartiles after correcting for confounding factors.
MO 50  
STAGING LAPAROSCOPY NOT ONLY SAVES PATIENTS AN INCISION, BUT MAY ALSO HELP THEM LIVE LONGER  
N. M. Sell, Z. V. Fong, C. Fernandez del Castillo, A. L. Warshaw, D. Chang, K. D. Lillemoe and C. R. Ferrone  
Massachusetts General Hospital, Boston, MA, USA  
Objective: Approximately 17% of patients with pancreatic adenocarcinoma (PDAC) “resectable” by imaging criteria have metastatic disease on exploration. Our aim was to assess the potential impact of staging laparoscopy versus upfront laparotomy in patients with metastatic PDAC.  
Methods: Clinicopathologic data was retrospectively collected for all patients with PDAC undergoing an operation with curative intent between 2001 and -2015 at a single institution.  
Results: Of the 1,001 patients undergoing surgical evaluation, 160 had unsuspected metastatic PDAC. Staging laparoscopy was performed in 60% (96/160) of patients, while 40% (64/160) underwent an exploratory laparotomy with or without prophylactic bypass. There were no differences in patient demographics and preoperative CA 19-9 levels between the staging laparoscopy and exploratory laparotomy groups. However, staging laparoscopy was more often performed for pancreatic body/tail lesions (80.0% vs 50.5% for pancreatic head lesions, p < 0.001). Patients who only underwent laparoscopy started palliative chemotherapy more quickly (19.5 days vs 43.2 days in the laparotomy group, p < 0.001). No difference was appreciated in patients requiring post-operative procedures (38.5% vs 26.6% laparotomy group, p = 0.116). The median overall survival for the staging laparoscopy group (12.2 months) was significantly longer than the laparotomy group (8.3 months, p = 0.002). In a cox regression analysis adjusting for clinicopathologic variables, staging laparoscopy was associated with significantly improved overall survival when compared to the laparotomy group (HR 0.596, 95% C.I. 0.400–0.887, p = 0.009; Figure).  
Conclusion: For patients diagnosed with metastatic PDAC at the time of surgical exploration, staging laparoscopy was associated with a shorter time to chemotherapy and improved survival duration when compared to those explored without laparoscopy.

MO 51  
NEOADJUVANT THERAPY AFFECTS MARGINS AND MARGINS AFFECT ALL: PERIOPERATIVE AND SURVIVAL OUTCOMES IN RESECTED Pancreatic adenocarcinoma  
S. de Geus, G. Kasumova, M. Eskander, S. Ng, T. Kent, A. Moser, M. Callery, A. Vahrmeijer and J. Tseng  
Beth Israel Deaconess Medical Center, Boston, MA, USA  
Objective: Resection margin status is an important prognostic factor in pancreatic cancer; however, previous studies suggested that neoadjuvant therapy may abrogate R1/R0 margin effect. We investigated the predictive value of neoadjuvant therapy for margin status and subsequently, its survival benefit after pancreaticoduodenectomy for pancreatic adenocarcinoma.  
Methods: Patients who underwent pancreaticoduodenectomy for pancreatic adenocarcinoma between 2006 and 2012 were identified from the National Cancer Database (NCDB). Multivariate logic regression analysis was utilized to examine the predictive value of neoadjuvant chemotherapy (with or without radiation) for resection margin status, prolonged hospital stay and 90-day mortality. Propensity-score matching was performed for the probability of negative margins to equalize baseline characteristics after neoadjuvant therapy. Long-term outcomes were compared using the Kaplan—Meier method.  
Results: 7189 patients were identified in total; 911 (12.7%) and 6278 (87.3%) patients received neoadjuvant therapy and upfront surgery, respectively. Neoadjuvant therapy was independently predictive for R0 margin (81.2% vs. 74.9%; OR, 1.53; p < 0.001); however, neoadjuvant therapy did not correlate with prolonged hospital stay (18.4% vs. 22.0%; OR, 1.15; p = 0.128) or 90-day mortality (6.4% vs. 7.3%; OR, 1.149; p = 0.335). R0 margin was associated with survival benefit in both upfront surgery (median survival, 19.8.0 vs. 14.3 months; p < 0.001) and neoadjuvant therapy groups (median survival, 25.0 vs. 17.8 months; p < 0.001). This survival advantage remained robust after matching.  
Conclusion: Neoadjuvant therapy is associated with increased R0-resection rates after pancreaticoduodenectomy for pancreatic adenocarcinoma. Moreover, R0 margin status was associated with increased survival in both upfront surgery and neoadjuvant cohorts.
MO 52

INTRAOPERATIVE AUTONOMY IN HEPATO-PANCREATO-BILIARY SURGERY TRAINING: DIFFERENCES IN PERCEPTIONS AMONG HPB FELLOWS AND HPB FELLOWSHIP SENIOR SURGEONS

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Oregon Health and Science University, Portland, OR, USA

Objective: Hepato-Pancreato-Biliary (HPB) fellowship programs have developed standardized training requirements for certification. Operative readiness is largely assessed through case-volume thresholds. The goal of this study was to evaluate perceptual differences, if any, of intraoperative autonomy between trainees and trainees during a complex pancreatic surgical procedure among Fellowship Council/AHPBA accredited HPB fellowships.

Methods: Two similar surveys were distributed. One survey targeted senior surgeons from Fellowship Council/AHPBA accredited HPB surgery training programs. A second survey targeted current and recently graduated (since 2011) HPB surgery fellows. Data related to experiences during a pancreaticoduodenectomy (PD) performed at the beginning and end of fellowship were collected. Analysis of perceived intraoperative autonomy was completed.

Results: Responses from 13 fellows and 13 senior surgeons were collected. There was overall congruence between fellow and senior surgeon perceptions on intraoperative autonomy while performing a PD. Notable differences were seen when evaluating complete intraoperative independence at the end of fellowship. Consistently more fellows (47.5%) perceived they were completing key steps of a PD independently than perceived by senior surgeons (29.2%). Notably, the majority of fellows (77.8%) and senior surgeons (85.6%) believe that a senior surgeon should be available to assist a graduating fellow who is performing a PD early upon entering practice.

Conclusion: The study provides insight and comparison of intraoperative autonomy and surgical readiness as perceived by fellows and senior surgeons during the course of an HPB fellowship. Future studies evaluating common HPB fellowship index cases would continue to provide insight on training progression and readiness upon completion.

MO 53

BACTERIOLOGICAL PROFILES OF SURGICAL SITE INFECTIONS FOLLOWING PANCREATOUDENECTOMY DO WE NEED TO CHANGE THE PROPHYLACTIC ANTIBIOTIC REGIMEN?

Cleveland Clinic Foundation, Cleveland, OH, USA

Objective: The aim of the current study was to analyse the use of prophylactic antibiotics prior to pancreaticoduodenectomy (PD) and assess the results of a change in prescribing policy on SSI rates.

Methods: A prospectively maintained departmental database was used to identify all patients undergoing PD between January 2010 and December 2015. Patient data relating to SSIs was obtained from the NSQIP data set and the details of culture results and organism sensitivity extracted from the electronic medical record. For the purpose of the study it was hypothesized that an appropriate choice of prophylactic antibiotic would reduce the prevalence of SSIs.

Results: During the 6-year period of the study 500 PDs were performed. Microbiologically-proven SSIs were observed within the first 30 post-operative days in 107 (21.4%) patients. There was no standard antibiotic policy, though the majority received Cefazolin as their sole prophylaxis, the main exception being those with a penicillin allergy. In only 35 cases were organisms identified as the cause of SSI sensitive to the prophylactic antibiotic prescribed prior to surgery. From May 2015 onwards 56 PDs were performed of which 34 received Cefotaxime and Metronidazole. Only 2/34 (5.9%) patients developed an SSI whilst 5/22 (22.7%) not receiving the new regimen had a culture-positive SSI.

Conclusion: A detailed analysis of the microflora responsible for SSIs in our patient cohort identified that the existing prophylaxis was inadequate. Following internal audit, change of prescribing policy, and closure of the audit cycle the SSI rate improved significantly.

MO 54

THE COST OF COMPLICATIONS AFTER PANCREATICODUODENECTOMY: A POPULATION-BASED ANALYSIS

N. Goyert, D. J. Kagedan, M. E. Dixon, Q. Li, N. Mittmann, C. Earle, A. Kiss, L. Paszat, A. Wei, P. Karanicolas and N. Coburn
Sunnybrook Health Sciences Centre, Toronto, Canada

Objective: Pancreatecoduodenectomy (PD) is associated with significant morbidity and cost. High-volume centers have improved outcomes with PD, but the relationship with cost is unknown. We examined the financial burden of postoperative complications and relationship between hospital volume and costs.

Methods: A retrospective population-based observational cohort study was performed. Patients undergoing PD for malignancy from 2005 to 2013 were identified and linked to administrative healthcare databases which cover all medical services (population 13.5 million) within a single payer system. 90 day postoperative complications were identified through billing and administrative data and grouped according to the Clavien—Dindo classification. Mean costs were derived and reported in US$(2016). High-cost patients were defined as those within the highest 20th percentile. HPB centers were grouped into high-(>40 PD/year), medium-(20–39 PD/year) and low-(<10–19 PD/year) volume centers.

Results: 2686 patients underwent PD. Mean patient costs according to Clavien-Dindo grade are summarized in Table 1. Multivariable analysis showed increasing Clavien—Dindo grade, age and comorbidities score >9 were significant independent predictors of high-cost. Abdominal

HPB 2017, 1–69
MO 55
DOES THE STATUS OF THE RETROPERITONEAL MARGIN AFFECT SURVIVAL FOR PATIENTS WITH RESECTABLE PANCREATIC CANCER?

University of Cincinnati, Cincinnati, OH, USA

Objective: The significance of a positive pancreatic margin during pancreaticoduodenectomy remains controversial. Various studies have demonstrated that the uncinate or retroperitoneal margin (RP) is at highest risk for positive margin status. We sought to determine if tumor biology is predictive of obtaining a negative margin, and if the extent of RP margin clearance is of prognostic importance.

Methods: A single institution, retrospective analysis was performed, identifying 176 patients who underwent a pancreaticoduodenectomy for pancreatic cancer between 2005 and 2015. Involvement of the RP margin (R1 resection) was defined as cancer within 1 mm of the surgical margin. Statistical analysis was performed using regression analyses and the Kaplan–Meier method.

Results: The majority of R1 resections (n = 42, 75%) involved the RP margin, with a median overall survival (OS) of 13.7 months, in comparison to 28.9 months for patients without RP margin involvement (P = 0.018). A positive RP margin was associated with nodal involvement, perineural and vascular invasion, and larger tumor size (all P < 0.05). Among patients with a negative RP margin, obtaining ≥2 mm clearance proffered a survival advantage compared to the traditional definition of 1 mm clearance (OS, 28.9 vs 18.5 months, P = 0.038). On multivariate analysis, perineural invasion, margin status, and nodal involvement persisted as independent prognosticators of OS.

Conclusion: Our data indicates that a positive RP margin is related to both biological and technical factors. The ability to achieve a greater than 2 mm margin from periadventitial dissection is reflective of good tumor biology and improved outcomes.

Table 1 Patients undergoing pancreaticoduodenectomy grouped by Clavien–Dindo complication grade at 90 days post-operatively and patient costs associated with each complication grade. Cost reported in 2016 US$.

<table>
<thead>
<tr>
<th>Clavien–Dindo grade</th>
<th>n (%)</th>
<th>Mean cost (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 or 1</td>
<td>1228 (48.1)</td>
<td>24,407 (8,264)</td>
</tr>
<tr>
<td>2</td>
<td>208 (8.2)</td>
<td>36,433 (14,001)</td>
</tr>
<tr>
<td>3a</td>
<td>501 (19.6)</td>
<td>38,710 (19,292)</td>
</tr>
<tr>
<td>3b</td>
<td>143 (5.6)</td>
<td>47,230 (23,652)</td>
</tr>
<tr>
<td>4</td>
<td>472 (18.5)</td>
<td>61,235 (48,537)</td>
</tr>
</tbody>
</table>

MO 56
IRREVERSIBLE ELECTROPORATION OF THE PANCREAS USING PARALLEL PLATE ELECTRODES IN A PORCINERNMODEL: A FEASIBILITY STUDY

S. Rombouts, M. Nijkamp, W. van Dijck, L. Brosens, M. Konings, I. Borel Rinkes, J. Hagendoorn, F. Wittkampf and I. Molenaar
University Medical Center Cancer Center Utrecht, Utrecht, Netherlands

Objective: Irreversible electroporation (IRE) is being explored as treatment option in locally advanced unresectable pancreatic cancer. Several studies have shown promising results with IRE needles. Disadvantages are the technical difficulties for needle placement, the time needed to achieve tumor ablation and possible occurrence of postoperative pancreatic fistula via the needle tracks. The aim of this experimental study is to evaluate the feasibility of newly developed IRE-technique using two parallel metal paddles, in a porcine model.

Methods: Twelve healthy pigs underwent laparotomy. Three parts of the pancreas were treated, each with a single application of either 50 or 100 joules (J) or a series of 4 applications of 50 J using a standard monophasic external cardiac defibrillator. After 6 hours, pancreatectomy was performed for histology and pigs were terminated.

Results: Histology showed necrosis of pancreatic parenchyma with influx of neutrophils in 5/12, 11/12 and 12/12 of the ablated areas at 50, 100, and 4x 50 J respectively. The electric current density threshold to achieve necrosis was 4.3, 5.1 and 3.4 A/cm² respectively. The ablation threshold was significantly lower for 4x 50 J compared to a single application of 50 or 100 J; (p = 0.003).

Conclusion: Pancreatic tissue can successfully be ablated using two parallel paddles around the tissue. In the present study, a series of 4 applications of 50 J was most effective in creating a homogeneous necrotic lesions.
MO 57
ASSOCIATION OF PANCREATIC INSUFFICIENCY WITH INTRADUCTAL PAPILLARY MUCINOUS NEOPLASM DYSPLASIA
R. Carr, B. Kiel, A. Roch, E. Ceppa, M. House, N. Zyromski, A. Nakeeb and C. M. Schmidt
Indiana University School of Medicine, Indianapolis, IN, USA

Objective: Intraductal papillary mucinous neoplasm (IPMN) of the pancreas is a well-established precursor to pancreatic adenocarcinoma. Pancreatic insufficiency is commonly associated with pancreatic adenocarcinoma but has yet to be associated with IPMN dysplastic progression. We aim to evaluate the association between pancreatic insufficiency and IPMN dysplastic progression.

Methods: Patients undergoing resection of IPMN from 1992 to 2015 were retrospectively reviewed using a prospectively collected database. Preoperative pancreatic endocrine (insulin or oral hypoglycemic dependent) and exocrine (pancreatic enzyme dependent) insufficiency data were collected and analyzed.

Results: Of 486 patients identified, 428 had complete data. IPMN dysplastic grade was low/moderate in 292 (68.2%), high in 57 (13.3%), and invasive in 80 (18.8%). Preoperative prevalence of exocrine insufficiency was 25.2%. Patients with invasive IPMN preoperatively had lower BMI (invasive: 25.7, non-invasive: 27.9; p = 0.003) and increased weight loss (69.2% vs 33.5%; p < 0.001). Exocrine insufficiency did not correlate with the degree of IPMN dysplasia. Prevalence of preoperative endocrine insufficiency was 24.9%. Endocrine insufficiency was present in 32.5% and 23.3% of patients with invasive and non-invasive IPMN, respectively (p = 0.06). In patients main duct involved (mixed, main types) IPMN (n = 155), invasive lesions were associated with a higher HbA1c level (invasive: 7.4, non-invasive: 6.3; p = 0.01).

Conclusion: Pancreatic insufficiency is common among patients with IPMN. Overall insufficiency rates do not vary according to degree of dysplasia. HbA1c, however, is associated with invasive, main duct IPMN. In this select group, HbA1c may serve as a marker of IPMN dysplastic progression.

MO 58
OUTCOMES OF SPORADIC PANCREATIC DUCTAL ADENOCARCINOMA AND PANCREATIC ADENOCARCINOMA ASSOCIATED WITH CYSTIC MUCINOUS NEOPLASMS: A NATIONAL CANCER DATABASE ANALYSIS
O. Picado, A. Nguyen, S. Rodgers, H. Stuart, V. Dudeja, D. Franceschi, A. Livingstone, N. Merchant and D. Yakoub
University of Miami, Miami, FL, USA

Objective: It remains unclear if outcomes of patients with pancreatic adenocarcinoma associated with cystic mucinous neoplasms (PMAC) differ from those of patients with pancreatic ductal adenocarcinoma (PDAC). The differential role of adjuvant chemoradiation in both groups is also not well defined.

Methods: PMAC and PDAC diagnosed between 1998 and 2011 in the National Cancer Database were analyzed. The association between treatment and hazard of death was assessed using Kaplan—Meier Cox proportional hazards modeling.

Results: We identified 1479 patients with PMAC and 6157 patients with PDAC. Head of the pancreas tumors (80.6%) were most common, as were moderately differentiated tumors (49.2%), stage II disease (49.5%), and Whipple procedure (58.7%). There was a significantly increased median overall survival (OS) in patients with PMAC (21.2 months) compared to patients with PDAC (16.3 months, p < 0.0001). In stratified analysis, stage I, II, and III PMAC patients had improved survival with adjuvant chemoradiation therapy (ACRT) (69.5, 32.1, and 37.9 months, respectively) compared to PDAC patients (29.5, 20.2, and 23 months, respectively all stages p < 0.01). In PMAC patients, ACRT increased OS compared to surgery alone only in stage IIB and III (12, 13 months respectively). In PDAC the survival advantage with ACRT was seen across all stages I, IIA, IIB, III (8.5, 10.7, 8.3 and 7 months, respectively).

Conclusion: OS in PMAC patients is significantly higher than PDAC patients. Adjuvant chemoradiation therapy is associated with improved survival in all stages of PDAC, whereas only in stages IIB and III PMAC patients, suggesting that early stage PMAC patients may be managed by surgery alone.
THE ROLE OF METASTASTECTOMY FOR OLIGOMETASTATIC PANCREATIC CANCER

Y. Hong, D. Sharma, J. Rostas and R. Martin
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Objective: To evaluate the role of metastastectomy in select patients with oligometastatic pancreatic cancer utilizing combination of systemic chemotherapy along with local therapy in order to determine the impact on overall survival and disease free progression.

Methods: Retrospective analysis of prospective database from 2010 to 2016 was utilized to identify patients with oligometastatic pancreatic cancer. Patients received systemic chemotherapy followed by resection or ablative therapy of the distant metastatic lesions. These patients were then followed by resection of the primary pancreatic cancer lesion in conjunction with Irreversible Electroporation (IRE) after perioperative systemic chemotherapy.

Results: Fifteen patients were identified with distant metastatic disease of their pancreatic cancer. There were 80% (12/15) single metastatic lesion with 53% (8/15) localized in the liver. Treatment modalities for distant metastatic lesions included 60% (9/15) resection and 40% (6/15) ablative therapy. Systemic chemotherapy received by patients includes FOLFOX 33% (5/15), FOLFIRI 20% (3/15), Avastin 13% (2/15), and FOLFIRINOX 13% (2/15). Primary resection with IRE after systemic chemotherapy was utilized in 93% (14/15) of the lesions along with metastasectomy of additional remaining lesions. The median survival in our study group was 16 months with 20% (3/15) patients who remain NED (range 16–41 mo).

Conclusion: Combination of systemic chemotherapy and metastastectomy with adjunctive IRE therapy is a novel treatment strategy that may have survival benefit in select patients with oligometastatic pancreatic cancer.

Table 1 Description of disease and treatment of oligometastatic pancreatic cancer.

<table>
<thead>
<tr>
<th>Patients (n = 15)</th>
<th>Location of metastases</th>
<th>Irreversible electroporation (IRE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pancreatic cancer</td>
<td>In Situ</td>
<td>Resection with margin</td>
</tr>
<tr>
<td>Liver</td>
<td></td>
<td>Additional procedure</td>
</tr>
<tr>
<td>Omentum</td>
<td></td>
<td>Cholecystectomy</td>
</tr>
<tr>
<td>Peritoneum</td>
<td></td>
<td>J-tube</td>
</tr>
<tr>
<td>Pancreas</td>
<td></td>
<td>Gastrojejunostomy</td>
</tr>
<tr>
<td>Number of lesions</td>
<td></td>
<td>Subtotal pancreatectomy</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>Spleenectomy</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Hepatectomy</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>Duodenotomy</td>
</tr>
<tr>
<td>Chemotherapy</td>
<td></td>
<td>Colectomy</td>
</tr>
<tr>
<td>FOLFOX</td>
<td>5</td>
<td>Other*</td>
</tr>
<tr>
<td>6 cycles</td>
<td>3</td>
<td>Metastatic lesion therapy</td>
</tr>
<tr>
<td>9 cycles</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>12 cycles</td>
<td>1</td>
<td>Liver resection</td>
</tr>
<tr>
<td>FOLFIRI</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>3 cycles</td>
<td>1</td>
<td>Radiofrequency (RFA)</td>
</tr>
<tr>
<td>6 cycles</td>
<td>2</td>
<td>13</td>
</tr>
<tr>
<td>Avastin</td>
<td>2</td>
<td>3D Conformai Therapy</td>
</tr>
<tr>
<td>3 cycles</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>12 cycles</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>FOLFIRINOX</td>
<td>2</td>
<td>Y-90</td>
</tr>
<tr>
<td>12 cycles</td>
<td>2</td>
<td>Resection</td>
</tr>
<tr>
<td>Other*</td>
<td>9</td>
<td>60</td>
</tr>
</tbody>
</table>

MO 60

ELEMENTAL DIET AS EARLY ENTERAL NUTRITION AFTER PANCREATODUODENECTOMY

M. Matsumura, Y. Mise, T. Ishizawa, Y. Inoue, H. Ito, Y. Takahashi, N. Takemura and A. Saiura
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Objective: Early enteral nutrition carries advantages over parenteral nutritional support in patients undergoing abdominal surgery. However, early enteral nutrition after pancreateoduodenectomy (PD) is controversial because of high incidence of chylous ascites. The aim of this study was to prospectively assess the safety of elemental diet (ED) as early nutrition in patients undergoing PD.

Methods: A single institute phase II study was conducted from June 2012 to September 2014. ED was administered...
to 104 patients after PD from 2nd postoperative day. Incidence of chylous ascites and other perioperative findings were compared with those of 73 patients undergoing PD to whom low residue diet (LRD) were administered before the study period.

**Results:** No chylous ascites was occurred in patients with ED (0% in patients of ED vs. 49.3% in LRD, p < 0.01). Discontinuation rates of enteral nutrition were significantly lower in patients with ED (5.8% in ED vs. 38.4% in LRD, p < 0.01). Incidence of intolerable diarrhea (2.9% in ED vs. 8.2% in LRD), abdominal distention (1.9% in ED vs. 2.7% in LRD) and hyperglycemia (0% in ED vs. 5.5% in LRD) were lower in patients with ED. Multivariate analyses revealed not using elemental diet (p < 0.01) and lymph node dissection (p = 0.04) were independent risk factors of postoperative chylous ascites.

**Conclusion:** Early postoperative enteral nutrition with ED does not increase chylous ascites in patients undergoing PD.

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**MO 61**

**VALIDATION OF CLINICAL RISK SCORE FOR COLORECTAL LIVER METASTASES RESECTED IN A CONTEMPORARY MULTICENTER COHORT**


**Sunnybrook Health Sciences Centre, Toronto, Canada**

**Objective:** Recent advances in care for colorectal liver metastases (CRLM) have lengthened 5-year survival. In this new era, prognostic tools such as the clinical risk score (CRS) for colorectal liver metastases require reevaluation to determine their retained relevance and to assess for improvements.

**Methods:** Records from patients undergoing resection for CRLM between 2008 and 2012 were collected from 4 specialty hepatobiliary centers in Canada (N = 740). Patients were stratified by their CRS and analyzed in Kaplan—Meier survival curves with the primary outcome of overall survival (OS) and the secondary outcome of recurrence-free survival (RFS). Multivariate Cox regression analysis was used to compare CRS to relevant patient factors.

**Results:** Median OS was >60 months and median RFS was 16.2 months. The original CRS strata was a significant (p < 0.0001) predictor of both OS (5-year OS: 0; 75.1%, 1; 71.1%, 2; 57.3%, 3; 56.7%, 4; 46.3%) and RFS (5-year RFS: 0; 39.2%, 1; 33.2%, 2; 20.5%, 3; 21.1%, 4; 8.3%). Other patient factors, such as the presence of extrahepatic colorectal metastatic disease (RFS hazard ratio of 1.318) and the use of intraoperative portal pedicle clamping (OS hazard ratio of 0.618, RFS hazard ratio of 0.740) were found significant alongside the CRS.

**Conclusion:** The CRS remains a relevant tool for predicting long-term outcomes for patients undergoing resection of CRLM, and outcomes in CRLM patients seem to have improved since its introduction. Additional factors such as the presence of extrahepatic colorectal metastatic disease and the use of intraoperative portal pedicle clamping may improve the prognostic power of the CRS further.

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**MO 62**

**DOES ACCELERATED LIVER HYPERPOTROPHY CAUSED BY THE ALPPS PROCEDURE LEAD TO CIRCULATING TUMOUR CELL DISSEMINATION IN PATIENTS WITH COLORECTAL LIVER METASTASES?**


**Western University, London, Canada**

**Objective:** Early presence of circulating tumour cells (CTCs) in the serum blood after oncological surgery predicts disease progression in patients with colorectal liver metastases (CRLM). Associating liver partition with portal vein ligation for staged-hepatectomy (ALPPS) is a technique for inducing accelerated hypertrophy in patients with insufficient future liver remnant. It remains unknown whether this hypertrophy may lead to rapid cancer cell dissemination. The main aim of this study was to evaluate whether ALPPS results in CTCs dissemination and disease progression in patients with CRLM.

**Methods:** This prospective, observational, 2-arm study enumerated CTCs as a marker for assessing disease dissemination in patients with CRLM undergoing ALPPS (Arm-1) or single-stage liver resection (Arm-2) from July 2015-June 2016. All patients received and responded to standard neoadjuvant therapy. CTCs were collected at multiple time-points by the FDA-approved CellSearch® system. CTC positivity was defined as 1 CTCs per 7.5 ml blood.

**Results:** Of 24 pre-screened patients, 17 met the eligibility criteria for and underwent curative hepatic resection: 7 in Arm-1 and 10 in Arm-2. Demographics were comparable between groups. At stage-1 ALPPS, CTCs were present in two patients (28.6%), one of whom continued to be positive after completion of both stages, and four patients (44.4%) were found positive in Arm-2 (p = 0.289). Both patients with positive CTCs at follow up developed early recurrence and died (p = 0.0083) (Figure-1).
Conclusion: Accelerated and extensive hypertrophy during ALPPS was not associated with CTCs dissemination. Persistence of and positivity for CTCs at follow-up was significantly associated with disease progression.

Figure-1 ARM 1, ALPPS group; ARM 2, Single stage liver resection; CTCs assessment after surgery and follow-up. CTCs status was available in 16 patients after surgery, 6 patients had positive CTCs status (2 in Arm-1 and 4 in Arm-2). Two patients remain positive at follow-up developed recurrence and died. p = 0.0083.

MO 63
SURVIVAL BENEFIT OF TRANSARTERIAL CHEMOEMBOLIZATION FOR THE TREATMENT OF UNRESECTABLE HEPATOCELULAR CARCINOMA: INFLUENCE OF THE MELD SCORE
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Objective: Data supporting the routine use of transarterial chemoembolization (TACE) for unresectable hepatocellular carcinoma (HCC) is equivocal. We sought to examine our institutional TACE experience in order to determine if there is a beneficial treatment effect when compared to systemic therapy or best supportive care (BSC) for unresectable HCC.

Methods: Institutional registry was queried for all HCC cases treated with TACE (Doxorubicin eluting beads), chemotherapy or BSC. Standard demographic variables were included. Inverse probability of treatment weighted propensity scores were created using age, stage, gender, AFP, albumin and MELD score at diagnosis and included in a Cox proportional hazards model to estimate survival. A logistic regression model was created to identify variables associated with survival less than 90 days (<90D).

Results: 746 HCC patients were included in this study. TACE was performed in 171 patients (23%), 209 chemotherapy (28%) and 57 received both (8%). Adjusted for chemotherapy use, the estimated mean survival was 11.8 months (95% CI: 9.8–13.8, p < 0.05) for patients not treated with TACE. Treatment with TACE increased mean survival an additional 9.5 months (95% CI: 2.7–16.2, p < 0.05). In those treated with TACE, variables associated with <90D included MELD (OR 1.16, p < 0.01) and stage III (OR 12.1, p < 0.03). The probability of <90D crossed 50% for HCC stages (I & II) at MELD = 22. Whereas stage III patients treated with TACE demonstrated a 50% probability of <90D at MELD = 15.

Conclusion: TACE significantly improved survival when compared to chemotherapy or BSC. As MELD score increases, the TACE survival benefit diminishes especially for those with advanced stage.

MO 64
LIVER FUNCTION ANALYSIS ACCORDING TO THE SERUM BILIRUBIN DECREASING RATE OF PREOPERATIVE BILIARY DRAINAGE
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Saitama Medical Center, Kawagoe City, Saitama Prefecture, Japan

Objective: To investigate the relationship between liver function and bilirubin decreasing response of preoperative biliary drainage for obstructive jaundice in perihilar biliary tumor patients.

Methods: Twenty-five patients who underwent surgical treatment for perihilar biliary tumor between January 2014 and August 2016 were included. Among them, 11 patients had obstructive jaundice (jaundice group) and remaining 14 patients had no jaundice (no-jaundice group). All patients in jaundice group underwent preoperative biliary drainage. To evaluate the bilirubin decreasing response, we defined bilirubin decreasing rate (BDR) as follow; BDR = (difference of serum bilirubin value between before and after drainage)/drainage duration. Preoperative liver function was investigated using indocyanine green retention rate at 15 minutes (ICGR15), the clearance index (HH15) and hepatic uptake ratio (LHL15) of 99mTc-galactosyl human serum albumin liver scintigraphy.

Results: Among 25 patients, 22 underwent extended hemi-lobeectomy (4 right and 18 left), 2 underwent left trisectionectomy, and 1 underwent limited liver resection with pancreatoduodenectomy. Drainage duration was 9 days (1−59) and BDR was 12.7 μmol/L/day (3.4−37.6). Although preoperative liver function was not significantly different between jaundice group and non-jaundice group, BDR was strongly correlated with preoperative liver function (r = −0.587, 0.775, −0.422 in ICGR15, HH15 and LHL15, respectively), the
patients with lower BDR were tended to be lower liver function.

BDR was also strongly correlated with postoperative bilirubin increasing value \((r = -0.694, P = 0.018)\), the patients with lower BDR were tended to be higher bilirubin increasing value.

**Conclusion:** The patients in jaundice group with lower BDR were suspected to be lower liver function.

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**MO 65**

**LIVER TRANSPLANTATION FOR THE TREATMENT OF COMPLICATED IATROGENIC BILIARY INJURIES: ANALYSIS FROM THE UNOS DATASET**


*University of Kentucky, Lexington, KY, USA*

**Objective:** To study outcomes on patients Transplanted for complicated biliary injuries in the US.

**Methods:** The UNOS database was queried for all liver transplants performed in the US between October 1988 and January 2013. Of the 110,353 transplants performed, 42 were for complicated iatrogenic biliary injuries.

**Results:** The median age for this cohort was 50.6 years \((74)\) with a median MELD score of 21.1. Patients receiving liver transplantation for IBDI were more likely women \((54.8\%, P = 0.01)\), had a higher rate of portal vein thrombosis \((14.3\%, P = 0.01)\), and had less incidence of HCV infection \((78.6\%, P = 0.0001)\). The median BMI was 25.6 in patients transplanted for IBDI. Fifty percent of these cases were performed in UNOS regions 3, 5 and 7. IBDI was found as an independent predictor associated with 5-fold increased risk of early graft loss \((p = 0.002, CI 1.7—9.8, HR 4.9)\). IBDI was also associated with a 2.7 fold increased risk of 30-day mortality after liver transplantation \((p = 0.04, CI 1.0—7.0, HR 2.7)\).

**Conclusion:** IBDI is an uncommon but challenging indication for liver transplantation. IBDI patients undergoing liver transplantation have significant increased rates of early graft loss and re-transplantation. IBDI is also an independent factor related to increased risk of perioperative death after liver transplantation. Further studies are needed to determine the causes of perioperative morbidity and to identify potential modifiable factors to improve outcomes in patients undergoing transplantation for IBDI.

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**MO 66**

**DISPARITIES AND SURVIVAL OUTCOMES IN THE MANAGEMENT OF HEPATOCELLULAR CARCINOMA: A NATIONAL PERSPECTIVE**

D. Pointer, A. Volk, M. Darden, G. Parker, R. Marshall, P. Friedlander and J. Buell

*Tulane University, New Orleans, LA, USA*

**Objective:** Hepatocellular carcinoma is the second leading cause of cancer death worldwide. Current data suggest patients in the United States may not receive equal access to care. Our study attempts to dissect the effect of race and socioeconomics, as measured by community risk, on patient outcomes.

**Methods:** A cross-sectional analysis was performed using adult Surveillance, Epidemiology, and End Results (SEER) data for hepatocellular cancer. Community risk is a surrogate comprised of premature death rate, general health status, low birth weight rate, comorbidities, alcoholism and hospitalization rate, education, unemployment, and household income. Cancer specific mortality was then analyzed based on race, gender, stage, treatment, and community risk score.

**Results:** 32,384 patients were identified with hepatocellular cancer: 26,797 Caucasian and 5487 African American. The majority were male between the age of 45–65 years old. Cancer-specific mortality was significantly increased for African Americans \([HR: 1.04, 95\% CI: (1.00, 1.09), p = 0.05]\) as were patients living in a communities with intermediate \([HR: 1.10, 95\% CI: (1.06, 1.15), p < 0.001]\) and high \([HR: 1.17, 95\% CI: (1.12, 1.23), p < 0.001]\) risk scores. Outcomes for African Americans in intermediate- and high-risk communities were compared to Caucasians living in similar risk communities. African Americans persisted with an increased cancer specific mortality \([HR: 1.10, 95\% CI: (1.04, 1.16), p = 0.001]\).

**Conclusion:** Racial and socioeconomic factors play a prominent role in the management and outcomes of all patients with hepatocellular carcinoma. This includes patients living in higher risk communities as well as African Americans. Unfortunately, African Americans incur the highest cancer specific mortality even matched with equivalent community risk with Caucasians.

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**MO 67**

**CONDITIONAL PROBABILITY OF LONG-TERM SURVIVAL IN PATIENTS WITH LOCALLY ADVANCED AND METASTATIC HILAR CHOLANGIOCARCINOMA**

M. Gasperisz, S. Buettner, J. van Vugt, E. Roos, R. Coelen, J. IJzermans, T. van Gulik and B. Groot Koerkamp

*Erasmus MC University Medical Center, Rotterdam, Netherlands*

**Objective:** In recent years conditional survival (CS) has gained more attention, because it takes into account the amount of years a patient has already survived. CS estimates are especially interesting in patients with non-curative peri hilar cholangiocarcinoma (PHC) because of the limited treatment options and their poor prognosis.
**Methods:** All patients with suspected non-curative PHC who presented between 2002 and 2012 at two academic hospitals in the Netherlands were assessed. Survival was estimated using the Kaplan–Meier-method to evaluate factors associated with overall survival (OS). CS estimates at year “x” after diagnosis were calculated with the formula \( CS = S(x+1)/Sx \).

**Results:** In total, 572 patients were included. Median age was 68 (interquartile range 59–74) and most patients were male (62.8%). Lymph node and distant metastases were frequently observed on imaging (in 48.6% and 12.6%, respectively) and the majority showed vascular invasion on imaging (76.8%). Actuarial survival decreased from 41.8% at 1 year, to 2.3% at 5 years. In contrast, the conditional chance of surviving 5 years, increased from 5.5% at 1 year, to 60.5% at 4 years. Age \( \geq 65 \) years (Hazard Ratio [HR] 1.25; 95% CI 1.04–1.51; \( P = 0.018 \)), tumor size \( \geq 3 \) cm on imaging (HR 1.36; 95% CI 1.13–1.64; \( P = 0.001 \)), receipt of palliative chemotherapy (HR 0.66; 95% CI 0.48–0.91; \( P = 0.010 \)) and treatment group (HR 1.27; 95% CI 1.05–1.55; \( P = 0.015 \)) were identified as independent factors associated with survival. CS for all high risk patients exceeded the actuarial survival.

**Conclusion:** CS can be helpful for patients with PHC and healthcare professionals by facilitating the best indication of OS. The concept of CS may help to personalize treatment and follow-up.

**MO 68**

**ADDITIONAL VALUE OF GADOXETIC ACID-ENHANCED MRI TO GADOLINIUM-ENHANCED MRI FOR THE SURGICAL MANAGEMENT OF COLORECTAL AND NEUROENDOCRINE LIVER METASTASES**


*Chu de Quebec – Laval University, Quebec, Canada*

**Objective:** To assess the impact of preoperative Gadoxetic Acid-Enhanced MRI (Primovist/Eovist) compared to a standard non-hepatospecific Gadolinium-Enhanced MRI on the surgical management of colorectal and neuroendocrine liver metastasis.

**Methods:** A retrospective analysis of 123 patients who underwent both a Gadoxetic Acid-Enhanced MRI and a standard non-hepatospecific Gadolinium-Enhanced MRI for evaluation of liver metastasis, within 30 days, from January 2012 to December 2015 at the CHU de Quebec was performed. The number of lesions identified on each MRI was compared. In cases where the number of lesions differed from one imaging modality to another, the surgeons were asked if their surgical plan was modified by the additional findings of the Gadoxetic Acid-Enhanced MRI.

**Results:** Compared to the non-hepatospecific Gadolinium-Enhanced MRI, the Gadoxetic Acid-Enhanced MRI found new lesions in 24 of the 121 patients (19.8%), excluded lesions in 28 patients (23.1%) and identified the same number of lesions in 69 patients (57.0%). Regardless of the size, 95.8% of the patients with a unique liver metastasis seen on the standard non-hepatospecific Gadolinium-Enhanced MRI had no new lesions on the Gadoxetic Acid-Enhanced MRI. The addition of the Gadoxetic Acid-Enhanced MRI directly altered the surgical management in 28% of the patients.

**Conclusion:** Despite the additional cost associated with a Gadoxetic Acid-Enhanced MRI compared to a standard non-hepatospecific Gadolinium-Enhanced MRI, the use of this contrast agent has a significant impact on the surgical management of patients with liver metastasis more specifically in patients with more than one liver metastasis identified on a standard non-hepatospecific Gadolinium-Enhanced MRI.

**MO 69**

**HO-3867, STAT3 INHIBITOR: EFFECTS ON CELLULAR PROLIFERATION IN HEPATOCELLULAR CARCINOMA**

N. G. Berger, S. Kunnimalaiyaan, K. M. Sokolowski, T. C. Gamblin and M. Kunnimalaiyaan

*Medical College of Wisconsin, Milwaukee, WI, USA*
Objective: Signal transducer and activator of transcription 3 (STAT3) plays an important role in cancer cell proliferation. HO-3867, a STAT3 inhibitor, has shown preclinical efficacy in ovarian cancer, but there is limited data in Hepatocellular carcinoma (HCC), a lethal disease with limited systemic therapy options. This project hypothesizes HO-3867 inhibits HCC cellular proliferation through STAT3 inhibition.

Methods: Effects of increasing concentrations of HO-3867 on three HCC cell lines were assessed via calorimetric assay. Cell lysates were examined via Western blot for cell cycle arrest, pro- and anti-apoptotic markers, and traditional oncogenic pathways Notch, STAT3, and Phosphatidylinositol-3 Kinase (PI3-K)/Akt.

Results: Concentrations of 2 μM HO-3867 led to a significant reduction in cellular proliferation (p = 0.001). Upon Western analysis, HO-3867 was associated with increased expression of cell cycle markers p21 and p27 and reduction in cyclin D1. Furthermore, an increase in pro-apoptotic cleaved poly ADP ribose polymerase (PARP) and reduction in anti-apoptotic Bcl2, BclXL, XIAP, and Survivin was observed. HO-3867 also demonstrated a reduction in pSTAT3 and concomitant inhibition of Notch and PI3-K/AKT pathways as evidenced by reduction in Notch1-3, Hes1, and pAKT. However, higher concentrations of HO-3867 were associated with increased phosphorylation of extracellular signal-regulated kinase 1/2 (ERK1/2), a cell survival protein.

Conclusion: HO-3867, STAT3 inhibitor, mitigates HCC cell proliferation through cell cycle arrest and apoptosis through STAT3 inhibition. HO-3867 also reduces oncogenic targets Notch and Akt but at higher concentration increases phospho ERK1/2. This is the first study demonstrating HO-3867 effectiveness in HCC cells, providing a strong rationale for further preclinical analysis of HO-3867.

MO 70
THE METASTATIC MICROENVIRONMENT OF HUMAN LIVER CHARACTERISED BY INCREASED LEVELS OF INFILAMMATORY CYTOKINES PROMOTES CANCER CELL CHEMOTAXIS RN
St. Vincent’s University Hospital, Dublin, Ireland

Objective: Healthy human liver is immunologically equipped for effective tumour surveillance, with repertoires of potent cytotoxic lymphoid populations. Despite this, hepatic metastases are common with little known of the immune landscape that remains following hepatectomy. How the immune microenvironment of the liver responds in the presence of metastatic disease, and whether this response dictates hepatic metastatic recurrence has yet to be elucidated. We hypothesise the cytokine milieu across metastatic liver can modify the local anti-tumour response and thus influence further tumour growth.

Methods: Biopsies of freshly resected tumour, tumour adjacent liver and liver at the distal resection margin (n = 25) were cultured in vitro to obtain metastatic conditioned media (CM). Using an antibody array, this CM was screened for 102 cytokines, compared to CM from healthy control liver. Differentially expressed cytokines (n = 12) were quantified using Luminex-based multiplex analysis.

Results: IL6, CXCL1(GRO ), CXCL5(ENA 78), GCSF, GMCSF, VEGF, LIF, CCL 3(MIP-1) demonstrated significant variation in distal metastatic liver when compared to healthy donor. When analyzed by chemotaxis assay, all areas of metastatic liver induced migration of metastatic cancer cells. Furthermore, depletion of neutrophils at the distal resection margin significantly correlated with recurrent hepatic metastases.

Conclusion: Healthy human liver has a highly evolved anti-tumour immune repertoire which is maintained by a complex cytokine environment. This immune landscape is perturbed in the presence of metastases, with increased expression of chemotactic cytokines and altered immune cell populations, inducing metastatic cell migration and tumour recurrence.

MO 71
THE TOP TEN MOST TREACHEROUS LAPAROSCOPIC CHOLECYSTECTOMIES I HAVE EVER DONE
University of Pittsburgh Medical Center, Pittsburgh, PA, USA

Objective: Although laparoscopic cholecystectomy (LC) has been commonplace for a quarter century, bile duct injuries during LC remain a serious problem. While surgical technique and failure to obtain the critical view of safety are risk factors, aberrant biliary anatomy is also a consideration. Herein we review our top ten most treacherous laparoscopic cholecystectomy cases.

Methods: Intra-operative cholangiogram (IOC) was done when anatomy was not clear with the critical view of safety, or routinely by a high volume general surgeon.

Results: Difficult cases of LC and hazards of aberrant biliary anatomy with IOC are listed below with #1 being the potentially most dangerous (Figure):

10. Cirrhosis with portal vein thrombosis and cavernous transformation with varices surrounding gallbladder.
9. Cystic duct takeoff at bifurcation of the left and right hepatic ducts.
8. Cystic duct arising from choledochal cyst.
7. Takeoff of accessory right duct near cystic duct.
6. Cystic duct arising from right posterior hepatic duct.
5. Cystic duct arising from accessory right hepatic duct.
4. Double cystic duct.
3. Cystic duct arising from left hepatic duct which gives off right posterior duct.
2. Duplicate gallbladder with two cystic ducts.
1. Double common bile duct.

Each of these hazards were encountered and IOCs will be shown. Fortunately all cases were accomplished laparoscopically without injury.

Conclusion: It is vital for general and HPB surgeons to be aware of anomalous biliary anatomy and rare variants. When the critical view is not crystal clear during LC, IOC can be helpful in confirming anatomy and identifying aberrant ducts.
AN OVERWHELMING MAJORITY OF PUBLIC DOMAIN, SURGICAL VIDEOS OF LAPAROSCOPIC CHOLECYSTECTOMY DO NOT DEMONSTRATE THE CRITICAL VIEW OF SAFETY

S. Deal, D. Stefanidis, L. Brunt and A. Alseidi
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Objective: Using crowd sourcing, we sought to evaluate the frequency of achieving the critical view of safety (CVS) in laparoscopic cholecystectomy (LC) as seen in actual intraoperative video by blinded surgical performers.

Methods: We collected 160 videos of LC from public domain websites. Videos were edited to ≤60 seconds and ended when a structure was cut/clipped. Crowd workers watched a tutorial reviewing how to rate videos using the CVS modified doublet criteria, in which, points were awarded for each of the three components if they were seen in the anterior or posterior view (Table 1). Satisfactory CVS was considered achieving ≥5 points out of 6. Linear mixed effects models derived average CVS ratings. Five experts assessed 40 representative videos to determine the degree of correlation with crowd assessments.

Results: No videos received satisfactory CVS ≥ 5. The percentage of videos receiving scores from 1–4 was: Score of 4: 23%; Score of 3: 21%; Score of 2: 25%; and Score of 1: 21%. Of all videos reviewed, 46% had a score ≤2, reflecting poor demonstration and/or achievement of the CVS in the video.

Conclusion: While a random selection of public domain videos of LC may not represent the true surgical landscape, the incredibly low frequency of CVS, as assessed by crowd sourcing, is alarming and may represent a public safety issue. A national effort to assess use of the CVS approach and surgeon education, as currently underway by the SAGES safe cholecystectomy task force, is needed, and biliary surgeons should be active participants.

### Table 1: Criteria for the Critical View of Safety

<table>
<thead>
<tr>
<th>Criteria</th>
<th>0 points</th>
<th>1 point</th>
<th>2 points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two structures connected to gallbladder</td>
<td>Unable identify 2 structures or only 1 structure seen</td>
<td>2 structures connected but some overlap</td>
<td>2 structures clearly seen connected to GB</td>
</tr>
<tr>
<td>Cystic plate clearance</td>
<td>Not visible</td>
<td>Visible but overlapped by structures or out clearly shown</td>
<td>Bottom 1/3 of gallbladder is clearly demonstrated and cystic plate is shown.</td>
</tr>
<tr>
<td>Hepatocystic triangle clearance</td>
<td>Tissue in triangle obscures view of structures</td>
<td>Some obscurement of triangle</td>
<td>Hepatocystic triangle cleared of all tissue except the cystic duct and cystic artery</td>
</tr>
</tbody>
</table>

Surgical Volume as a Driver for Clinical and Financial Outcomes after Liver Resection: A National Perspective

A. Volk, D. Pointer, Z. Al-Qurayshi, G. Parker, M. Darden and J. Buell
Tulane University, New Orleans, LA, USA

Objective: Analyzed the impact of socioeconomics, patient demographics, and preoperative comorbidities with the volume and location of surgical centers.

Methods: Retrospective analysis of the NIS database for liver cancer patients undergoing liver resections. Patient demographics, insurance status and Charlson comorbidity index were analyzed with extent of resection, region and affiliation of hospitals with hospital and surgeon volume. Cross-sectional analysis was performed to evaluate the impact of these factors on complications, mortality, length of hospital stay, and cost.
Results: 3326 patients were included: 68.2% were males, 58.4% were Caucasian, and 94.3% were over the age of 45 years. Complications were associated with higher Charlson scores (OR 2.0; p = 0.026) and low (OR 1.7; p = 0.015) and intermediate volume surgeons (OR 1.8; p = 0.003). Elective procedures (OR 6.0) and those performed at urban centers (OR 0.5) were protective. Increases in mortality were identified in intermediate Charlson score patients (OR 2.7; p < 0.001), low volume surgeons (OR 2.84; p = 0.022), and low volume centers (OR 2.49; p = 0.029). Regression modeling for length of stay identified commonly observed variables: elective resection (OR 0.3; p < 0.001), extent of resection (OR 3.79; p = 0.030), increased Charlson score (p < 0.030) and center volume (p = 0.032). In a final cost analysis only emergent resection, extent of resection and hospital volume were identified.

Conclusion: More extensive and emergent resections are associated with increased morbidity, complications and expense. Increased complications were associated with low surgical volume but not hospital volume. Significant increases in length of stay, mortality, and costs were always associated with hospital volume. Reviewing volume, surgical pathways, and standardized processes are necessary.

MO 74
DEVELOPMENT OF A NOVEL ANIMAL MODEL FOR INTRAHEPATIC CHOLANGIOCARCINOMA
R. Marcus, W. C. Foo, A. Maitra and S. Gupta
The University of Texas, MD Anderson Cancer Center, Houston, TX, USA

Objective:
Methods: A genetically engineered mouse model incorporating a deletion of BRCA associated protein 1 (BAP1) and Kras activation was developed. Hepatoblast-specific mutations were induced using an Albumin-Cre promoter.

Results: Mutant Kras cooperates with loss of BAP1 resulting in lethal hepatic transformation and dose-dependent survival. Loss of BAP1 or Kras activation alone results in extended disease latency and survival >45 weeks. Heterozygous loss of BAP1 combined with mutant Kras shortens disease latency, with mice surviving 40 weeks on average. A significant reduction in survival is seen with homozygous loss of BAP1 and Kras activation, with mice surviving on average 23 weeks (p ≤ 0.01). These mice develop focal biliary precursor lesions, frank intrahepatic cholangiocarcinoma (ICC), and hepatocellular carcinoma (HCC). Mice with heterozygous deletion of BAP1, loss of BAP1 alone, and Kras activation alone develop HCC only.

Conclusion: Homozygous loss of BAP1 and Kras activation results in the development of ICC and HCC in a mouse model. Heterozygous loss of BAP1 and Kras activation, loss of BAP1 alone, or Kras activation alone produces HCC. Given the bipotential nature of hepatoblasts, the ICC phenotype of our mixed model may be enhanced by inducing biliary tree-specific mutations using adenoviral Cre enzyme (Ad-Cre) to achieve such combinatorial specificity. A novel surgery was developed whereby retrograde biliary tree administration of Ad-Cre is performed. Proof-of-principle was established via multiple methods to confirm appropriate localization of Cre recombinase expression within the biliary tree. Ad-Cre injection in LSL-Kras; BAP1L/L mice to induce cholangiocyte-specific BAP1 deletion and Kras activation is ongoing.

MO 75
DEVELOPING AND VALIDATING CUSTOMIZED PREDICTIVE ALGORITHMS FOR OUTCOMES OF MAJOR HEPATECTOMY AT A HIGH-VOLUME CENTER
M. Fruscione, R. Kirks, A. Cochran, K. Murphy, E. Baker, J. Martinie, D. Iannitti and D. Vrochides
Carolinias Medical Center, Charlotte, NC, USA

Objective: The American College of Surgeons (ACS) NSQIP® Risk Calculator is designed to estimate post-operative risk. Using ACS-predicted complication rates, we identified significant discrepancies in outcomes for patients undergoing major hepatectomy (>3 Couinaud segments) at our high-volume HPB center. The goal of this study was to develop and validate an institution-specific risk calculator for patients undergoing major hepatectomy at our institution.

Methods: Outcomes generated by the ACS calculator were recorded for 136 major hepatectomies performed at our institution (2008–2015). In parallel, novel predictive models for seven postoperative outcomes were constructed and probabilities calculated. Brier score and area under the curve (AUC) were employed to assess predictive accuracy. Internal validation was performed using bootstrap logistic regression. Logistic regression models were constructed using bivariate (p < 0.25) and multivariate (p < 0.05) analyses. Model accuracy was validated using retrospective and prospective data.

Results: Brier scores showed no significant difference in predictive ability of the ACS and institution-specific models. However, significant differences in the discriminative ability of the ACS and institution-specific models were identified at the individual level. The ACS model weakly predicted individual postoperative risk for 6/7 outcomes (AUC: 0.5200.619, p > 0.05) compared to the institution-specific model (AUC: 0.7550.969, p < 0.05). Predictive capacities were similar for 30-day mortality (ACS AUC: 0.858, p < 0.05; institution-specific AUC: 0.815, p < 0.05).

Conclusion: Institution-specific models provide superior outcome predictions for individual perioperative risk following major hepatectomy and, if properly developed/validated, can be used to generate more accurate, patient-specific delivery of care.
MO 76

HEALTH BELIEF MODEL APPLIED TO DECISION MAKING IN Pancreatic CANCER TREATMENT

M. Castillo-Angeles, A. Watkins, A. Garces-Descovich, C. Guetter, J. Tseng, M. Callery, A. Moser and T. Kent
Beth Israel Deaconess Medical Center, Boston, MA, USA

Objective: For pancreatic cancer, surgery remains the only potentially curative treatment. However, less than one-third of resectable patients undergo surgery. The purpose of this study is to identify predictors of intention to undergo surgery as the treatment for pancreatic cancer based on the Health Belief Model (HBM).

Methods: A qualitative study was performed using HBM as a framework to develop a semi-structured interview guide. This questionnaire (31 questions) was developed based on the following HBM domains: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy. Participants were selected using purposive-stratified criterion-based sampling. Data were audio-recorded, transcribed, and coded to allow for thematic analysis.

Results: 16 patients were interviewed (50% male, mean age 65.6 ± 9 y). 75% patients were white and 56% had a college degree. Based on domains, multiple themes emerged (Figure 1): 1) fear of learning about the disease; 2) inefficient communication with surgical team medical language was difficult to understand; 3) confusion caused by online information; 4) uncertainty about being able to handle the surgery and post-operative period. The main determinants of undergoing surgery were family support and a positive relationship with the surgeon.

Conclusion: The intention to undergo surgery, once recommended to the patient, is determined by a complex interaction of multiple factors. Ineffective communication with the surgeon, fear of the disease prognosis and surgery, and apprehension about the post-operative period constituted significant barriers for patients to undergo surgery. These findings suggest a need for improvement of the patient-surgeon communication to improve patients’ decision-making capacity.

MO 77

NATIONAL VARIABILITY IN BLOOD TRANSFUSIONS AFTER PANCREATICODUODENECTOMY

University of Cincinnati, Cincinnati, OH, USA

Objective: To characterize the variability in perioperative blood use for patients undergoing pancreaticoduodenectomy (PD) and determine impact on readmission, mortality, and cost at the national level.

Methods: The University Health Systems Consortium (UHC) database was queried for all PDs performed between 2011 and 2013 (n = 9739). Patients were grouped according to transfusion requirements into none (0 units, n = 6147; 63%), low (1 unit, n = 716; 7%), medium (2–5 units, n = 1947; 20%), and high (6 units, n = 929; 10%) during hospital stay. Logistic regression models were used to determine predictors of increased transfusions, readmission, and cost.

Results: 37% of patients who undergo PD at academic medical centers receive blood perioperatively. Patients undergoing PD with high transfusion requirements were of similar age, race, and gender, however had a significantly
higher severity of illness (SOI) (60.4% extreme vs. 20.3% vs. 12.6% vs. 5.7%; p < 0.01). Having a high transfusion requirement correlated with higher readmission rates (OR 1.19, p = 0.04), higher cost (RR 1.92, p < 0.01), increased length of stay (19 vs. 12 vs. 10 vs. 8 days; p < 0.01) and in-hospital mortality (15% vs. 2% vs. 0.4% vs. 0.4%; p < 0.01). A negative correlation was identified between surgeon volume and transfusion requirements, with higher surgeon volume surgeons demonstrating lower transfusion requirements (OR 0.61, p < 0.01).

**Conclusion:** This is the first report to show that significant variability exists nationally in transfusion practices for patients undergoing PD, which directly influences patient outcomes and resource utilization. Efforts to reduce such variability could lead to improved outcomes and healthcare cost savings.

**Table** Multivariable analysis for predictors of readmission, cost, and high transfusion use in patients undergoing pancreaticoduodenectomy.

<table>
<thead>
<tr>
<th>Transfusion group (Ref = None)</th>
<th>Readmission OR p-value</th>
<th>Cost RR p-value</th>
<th>High transfusion use OR p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>0.95 0.62</td>
<td>1.11 &lt;0.01</td>
<td>1.92 &lt;0.01</td>
</tr>
<tr>
<td>Medium</td>
<td>0.95 0.62</td>
<td>1.11 &lt;0.01</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>1.19 0.04</td>
<td>1.92 &lt;0.01</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>DRG (Ref = No CC)</th>
<th>CC 1.23 0.02 1.10 &lt;0.01 3.07 &lt;0.01</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major CC 1.26 0.03 1.14 0.01 4.59 &lt;0.01</td>
<td></td>
</tr>
<tr>
<td>Other 1.66 &lt;0.01 1.27 &lt;0.01 5.59 &lt;0.01</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SOI (Ref = Minor)</th>
<th>Moderate 1.19 &lt;0.01 2.65 0.32</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major 1.36 &lt;0.01 5.31 0.07</td>
<td></td>
</tr>
<tr>
<td>Extreme 2.49 &lt;0.01 51.8 &lt;0.01</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Center volume (Ref = Low)</th>
<th>Medium 0.85 &lt;0.01</th>
</tr>
</thead>
<tbody>
<tr>
<td>High 0.68 &lt;0.01</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Surgeon volume (Ref = Low)</th>
<th>Medium 0.95 &lt;0.01 0.61 &lt;0.01</th>
</tr>
</thead>
<tbody>
<tr>
<td>High 0.94 0.01 0.61 &lt;0.01</td>
<td></td>
</tr>
</tbody>
</table>

CC = comorbidities/complications, SOI = severity of illness.

**MO 78**

**UNIQUE PREDICTORS OF SUPERFICIAL AND DEEP/ORGAN SPACE SURGICAL SITE INFECTIONS IN PANCREATECTOMY**

A. Fadayomi, G. Kasumova, O. Tabatabaie, S. de Geus, T. Kent, S. Ng, A. Moser, M. Callery, S. Ashley and J. Tseng
Beth Israel Deaconess Medical Center, Boston, MA, USA

**Objective:** Despite differences in etiology of superficial and deep/organ space infections, studies have grouped all SSIs together. We identified unique predictors for each SSI type and evaluated their effects on readmission and length of stay (LOS).

**Methods:** ACS-NSQIP targeted pancreas 2014 database was queried for patients undergoing pancreatectomy. Rates and predictors of superficial and deep/organ SSI and effects of SSI type on readmission and LOS were examined using multivariate logistic and generalized linear models.

**Results:** In 4088 patients, rates of superficial and deep/organ SSI were 9.6% and 15.5%, respectively. Significant predictors for superficial SSI were preoperative biliary stent (OR 2.44) and each additional operative hour (OR 1.10). Predictors for deep/organ SSI: BMI ≥30 (OR 1.76), pancreatic duct <3 mm (OR 1.44), open approach (OR 1.56), soft pancreatic texture (OR 1.93), proximal pancreatectomy (OR 1.60) each additional hour (OR 1.08), contaminated/dirty wound (OR 1.35) and steroids (OR 1.68). Median LOS was significantly longer with superficial and deep/organ space SSI (9 and 13 vs 7 days, p < 0.0001). Of 698 (17.1%) readmissions, 33(4.7%) and 161(23.1%) were due to superficial and deep/organ SSI. On multivariate modelling, superficial and deep/organ SSI remained significant predictors of LOS (RR 1.14 and 1.61) and readmission (OR 2.99 and 6.90).

**Conclusion:** While traditional measures such as biliary stenting and operative time drive superficial SSI, deep/organ SSI are impacted by predictors more specific to anastomotic leak, contaminated field, and immunosuppression/metabolic syndrome. Our data demonstrates that prolonged LOS and readmissions are dominated by deep/organ SSI, suggesting future strategies should focus on preferential prevention of deep/organ space infections.

**MO 79**

**GEOGRAPHIC REGION IS ASSOCIATED WITH TREATMENT AND SURVIVAL OUTCOMES FOR PANCREATIC CANCER**

A. Salami and A. Joshi
Einstein Medical Center, Philadelphia, PA, USA

**Objective:** We sought to assess the impact of geographic region on treatment characteristics and survival for pancreatic adenocarcinoma.

**Methods:** The SEER registry was used to identify patients with potentially resectable pancreatic adenocarcinoma (AJCC I–III) diagnosed between 2004 and 2013. The exposure of interest was geographic region of diagnosis: West (WE), South (SO) or North-East (NE). The endpoints of interest were: (1) recommendation of no surgery by the provider (2) utilization of resection and (3) disease-specific
mortality. Multivariable Logistic and Cox regression models were used to determine associations.

Results: Overall, 12,485 patients were identified [NE = 23.4%, SO = 36.1% and WE = 40.5%]. On univariate analysis, the likelihood of a recommendation of no surgery was lowest in the NE (OR: NE = 0.6, SO = 0.7, WE = Ref; P < 0.05 for all). This association persisted following risk adjustment (OR: NE = 0.5, SO = 0.8, WE = Ref; P < 0.05 for all). Compared to other regions, patients diagnosed in the NE were independently more likely to undergo resection (OR: NE = 2.1, SO = 1.2, WE = Ref; P < 0.05 for all). Furthermore, diagnosis in the NE was an independent predictor of survival (Table 1). Among patients that underwent resection, diagnosis in the SO was independently associated with an increased risk of mortality (HR: 1.2; P < 0.001).

Conclusion: Significant disparities in treatment and survival outcomes for pancreatic cancer exist on the basis of geographic region. Improved adherence to guideline-driven treatment recommendations, standardization of care processes, and regionalization may help stem the existing variability in care and outcomes.

### Table 1 Risk-adjusted association between geographic region and mortality stratified by tumor stage.

<table>
<thead>
<tr>
<th>Geographic region</th>
<th>Hazard ratio*</th>
<th>95% Confidence interval</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>1.19</td>
<td>1.13-1.26</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>South</td>
<td>0.94</td>
<td>0.88-0.99</td>
<td>0.044</td>
</tr>
<tr>
<td>North East</td>
<td>1.11</td>
<td>0.93-1.32</td>
<td>0.241</td>
</tr>
<tr>
<td>AJCC I</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>1.13</td>
<td>0.98-1.30</td>
<td>0.083</td>
</tr>
<tr>
<td>South</td>
<td>0.97</td>
<td>0.90-1.04</td>
<td>0.422</td>
</tr>
<tr>
<td>North East</td>
<td>1.11</td>
<td>0.93-1.32</td>
<td>0.241</td>
</tr>
<tr>
<td>AJCC II</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>1.21</td>
<td>1.13-1.30</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>South</td>
<td>1.15</td>
<td>1.03-1.28</td>
<td>0.013</td>
</tr>
<tr>
<td>North East</td>
<td>0.85</td>
<td>0.76-0.95</td>
<td>0.004</td>
</tr>
<tr>
<td>AJCC III</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>1.15</td>
<td>1.03-1.28</td>
<td>0.013</td>
</tr>
<tr>
<td>South</td>
<td>0.85</td>
<td>0.76-0.95</td>
<td>0.004</td>
</tr>
</tbody>
</table>

**MO 80**

**ROBOTIC APPROACH IS AN INDEPENDENT PREDICTOR OF SHORTER LENGTH OF STAY AND LOWER COST AT AN EXPERIENCED HIGH VOLUME PANCREAS CENTER**


*University of Pittsburgh Medical Center, Pittsburgh, PA, USA*

**Objective:** Recent NSQIP data shows 50% of distal pancreatectomies (DP) are performed minimally invasively (MIS). Clear advantages have been demonstrated for MIS DP, yet comparative cost data is limited. We sought to compare outcomes and cost in patients undergoing open (ODP), laparoscopic (LDP), and robotic (RDP) at a single institution.

**Methods:** A retrospective review was performed on patients undergoing ODP, LDP, and RDP between 1/2010–5/2016. Analyses were intention-to-treat, and cost data was available after 2013.

**Results:** DP was performed in 374 patients: ODP = 85(23%), LDP = 93(25%), and RDP = 196(52%). LPD patients had lower CCI (p = 0.016), ASA (p = 0.0001), and pancreas cancer (0.002) than ODP and RPD. Operating time was lowest in the RPD (211 ± 68) cohort (OPD = 316 ± 140 vs LPD = 318 ± 124; p < 0.0001). ODP had higher EBL (p < 0.0001) and transusions (p < 0.0001) than LPD and RPD. LPD (9%) had greater conversions than RPD (2%; p = 0.06). Postoperative outcomes were similar (Table). LOS was higher in the OPD (p = 0.0001) than LPD and RPD. Overall cost for the ODP ($23,228) was higher than the RPD ($15,440) and LPD ($16,733) group (p = 0.002). Index admission costs for OPD were higher (p = 0.012); however, readmissions costs were similar between groups (p = 0.093). On multivariate analysis, RPD reduced LOS (OPD: Odds = 6.5 [p = 0.0001] and LPD: Odds = 2.1 [p = 0.036]) and total cost (OPD: Odds = 5.7 [p = 0.002] and LPD: Odds = 2.8 [p = 0.042]) independently of all demographics and illness covariates.

**Conclusion:** MIS PD conveys cost advantage over ODP with a decreased LOS. LPD patients are more highly selected than ODP and RPD. Overall, RPD reduces LOS and total cost compared to ODP and LPD.

<table>
<thead>
<tr>
<th></th>
<th>Total n = 374</th>
<th>Open n = 85 (23%)</th>
<th>Laparoscopic n = 93 (25%)</th>
<th>Robotic n = 196 (52%)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pancreatic leak</td>
<td>138 (37)</td>
<td>24 (29)</td>
<td>35 (38)</td>
<td>79 (40)</td>
<td>0.174</td>
</tr>
<tr>
<td>ISGPF</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>73 (20)</td>
<td>11 (13)</td>
<td>16 (17)</td>
<td>46 (24)</td>
<td>0.217</td>
</tr>
<tr>
<td>B</td>
<td>55 (15)</td>
<td>10 (12)</td>
<td>18 (20)</td>
<td>27 (14)</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>10 (3)</td>
<td>3 (4)</td>
<td>1 (1)</td>
<td>6 (3)</td>
<td></td>
</tr>
<tr>
<td>Admitted to ICU initially</td>
<td>108 (29)</td>
<td><strong>48 (57)</strong></td>
<td>24 26</td>
<td>36 (18)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Fluid collection</td>
<td>53 (14)</td>
<td>12 (14)</td>
<td>15 (16)</td>
<td>26 (13)</td>
<td>0.809</td>
</tr>
<tr>
<td>Post Op bleeding</td>
<td>10 (3)</td>
<td>4 (5)</td>
<td>2 (2)</td>
<td>4 (2)</td>
<td>0.390</td>
</tr>
<tr>
<td>Wound infection</td>
<td>18 (5)</td>
<td>6 (7)</td>
<td>6 (7)</td>
<td>6 (3)</td>
<td>0.219</td>
</tr>
<tr>
<td>Reoperation</td>
<td>15 (4)</td>
<td>5 (6)</td>
<td>5 (5)</td>
<td>2 (3)</td>
<td>0.282</td>
</tr>
<tr>
<td>90 day Re-admission</td>
<td>102 (27)</td>
<td>23 (27)</td>
<td>25 (27)</td>
<td>54 (28)</td>
<td>1.000</td>
</tr>
<tr>
<td>90-day mortality</td>
<td>11 (3)</td>
<td>4 (4.7)</td>
<td>4 (4.3)</td>
<td>3 (1.5)</td>
<td>0.209</td>
</tr>
</tbody>
</table>
MO 81
ASSOCIATION OF INTRADUCTAL PAPILLARY MUCINOUS NEOPLASM AND PANCREATIC NEUROENDOCRINE TUMORS: MYTH OR REALITY?
Indiana University School of Medicine, Indianapolis, IN, USA

Objective: Intraductal papillary mucinous neoplasm (IPMN) and pancreatic neuroendocrine tumors (PNET) are distinct pathological entities. Their association, however, has been reported in small series. We seek to validate this association in a larger series.

Methods: A retrospective review of a prospectively collected database (2000–2015) of patients undergoing pancreatectomy at a single academic center was performed. The prevalence of IPMN and PNET was compared to historical autopsy data. Patients with IPMN alone (n = 526) and PNET alone (n = 376) were compared to patients with IPMN and PNET (IPMN-PNET).

Results: Of 526 patients with resected IPMN, 15 (2.8%) had PNET on pathology. Of these, PNET was incidentally discovered on pathology in 12 (80%). Correspondingly, PNET size was smaller (9 vs. 34 mm, p < 0.0001) compared to PNET alone patients, and never associated with positive lymph nodes. Despite this, there was no difference in overall tumor stage, and all PNET in IPMN-PNET patients were non-functional. The prevalence of PNET in IPMN patients was similar to PNET prevalence in historical autopsy data (2.8% vs 0.8–10%). IPMN-PNET were older than PNET alone (66.8 vs. 56.4 years, p = 0.009) patients, whereas IPMN-PNET had demographic characteristics comparable to IPMN alone patients. There was no difference in IPMN subtype or degree of dysplasia between IPMN-PNET and IPMN alone patients.

Conclusion: The association of IPMN and PNET has been described in the literature. Our large series indicates that PNET are not more frequent in IPMN patients and most are incidentalomas on pathology with likely no clinically relevant impact. Additional screening for PNET (e.g., serum Chromogranin A) is not indicated in IPMN patients.

MO 82
COST ANALYSIS OF LAPAROSCOPIC VERSUS OPEN PANCREATICODUODENECTOMY FOR PERIAMPULLARY MALIGNANCY
University of Florida, Gainesville, FL, USA

Objective: We sought to determine if laparoscopic pancreaticoduodenectomy (LPD) is a cost effective alternative to open pancreaticoduodenectomy (OPD).

Methods: Itemized hospital cost data from periampullary cancer patient cohorts of LPD and OPD, previously identified as similar (met NCCN criteria for resectable disease) were compared. This review also included discharge disposition, readmission rates, and readmission costs.

Results: The cohorts consisted of 52 and 50 patients in the LPD and OPD cohorts, respectively. The total OR cost was significantly higher in the LPD group (P < 0.05) as the laparoscopic equipment and regional blocks had increased cost in the LPD group (P < 0.05). Although hospital length of stay was shorter in the LPD group (9 vs 11.9 days), the total hospital cost (average of $36,646 for LPD vs $39,250 for OPD) was not significantly decreased compared to the OPD group. The readmission rates were equal with each group having 23 patients readmitted for a total of 43 readmissions. Readmission costs were not significantly different between groups. More LPD patients were discharged directly home, with or without home health care (P < 0.05), and the number discharged to a rehabilitation facility also trended favorably in the LPD group (P = 0.054).

Conclusion: LPD is cost effective. Total episode-of-care costs may favor LPD via reduced post-hospital needs for skilled nursing and rehabilitation.

<table>
<thead>
<tr>
<th></th>
<th>LPD (n = 52)</th>
<th>OPD (n = 50)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expired</td>
<td>1 (2%)</td>
<td>1 (2%)</td>
<td>1</td>
</tr>
<tr>
<td>To home (with or without HHC)</td>
<td>46 (88%)</td>
<td>36 (72%)</td>
<td>0.046*</td>
</tr>
<tr>
<td>To home with HHC</td>
<td>23 (44%)</td>
<td>23 (46%)</td>
<td>1</td>
</tr>
<tr>
<td>To home without HHC</td>
<td>23 (44%)</td>
<td>13 (26%)</td>
<td>0.064</td>
</tr>
<tr>
<td>To long term acute care</td>
<td>0 (0%)</td>
<td>2 (4%)</td>
<td>0.24</td>
</tr>
<tr>
<td>To rehabilitation center</td>
<td>0 (0%)</td>
<td>4 (8%)</td>
<td>0.054</td>
</tr>
<tr>
<td>To skilled nursing facility</td>
<td>5 (10%)</td>
<td>7 (14%)</td>
<td>0.55</td>
</tr>
<tr>
<td>Laparoscopic equipment (SEM)</td>
<td>$ 450 (31)</td>
<td>$ 46 (17)</td>
<td>&lt;0.01*</td>
</tr>
<tr>
<td>Regional block (SEM)</td>
<td>$ 1,450 (144)</td>
<td>$ 820 (103)</td>
<td>&lt;0.01*</td>
</tr>
<tr>
<td>OR (SEM)</td>
<td>$ 13,173 (254)</td>
<td>$ 11,770 (539)</td>
<td>0.02*</td>
</tr>
<tr>
<td>Total number of readmissions</td>
<td>43</td>
<td>43</td>
<td></td>
</tr>
<tr>
<td>Total hospital days during readmissions</td>
<td>282</td>
<td>408</td>
<td></td>
</tr>
<tr>
<td>Average number of readmissions per patient (SEM)</td>
<td>0.83 (0.20)</td>
<td>0.86 (0.19)</td>
<td>0.9</td>
</tr>
<tr>
<td>Average number of hospital days per patient (SEM)</td>
<td>5.42 (1.57)</td>
<td>8.16 (2.24)</td>
<td>0.28</td>
</tr>
<tr>
<td>Total readmission costs (SEM)</td>
<td>$ 14,722 (2663)</td>
<td>$ 20,096 (5983)</td>
<td>0.42</td>
</tr>
</tbody>
</table>

P values were calculated using Fisher’s exact test and unpaired t test.
HHC home health care, SEM standard error of the mean.
MO 83
A COMPARISON OF OUTCOMES BETWEEN OPEN, LAPAROSCOPIC AND ROBOTIC PANCREATICODUODENECTOMY
A. Zimmerman, D. Roye and K. Charpentier
Brown University, Cranston, RI, USA
Objective: The purpose of this study was to compare post-operative outcomes between open, laparoscopic and robotic pancreaticoduodenectomies using the ACS National Quality Improvement Program (ACS-NSQIP) defined complications.
Methods: Retrospective review of NSQIP targeted data for the year 2014 was performed on patients undergoing pancreaticoduodenectomies. Demographic characteristics, length of stay, operative time, and 30-day postoperative complications were compared between open (OP), laparoscopic (LP) and robotic pancreaticoduodenectomies (RP).
Results: Of the 2949 evaluated patients who underwent pancreaticoduodenectomies, 2760 (94%) were open, 106 (3%) laparoscopic and 83 (3%) were robotic. In comparison with OP, LP had lower rates of SSI (9.5% vs. 2.8%; p = 0.021), higher rates of DVT (2.8% vs. 6.6%; p = 0.034) and longer operative time (371 vs 449 min; p < 0.001). In comparison with OP, RP had lower rates of pneumonia (4.7% vs 0%; p = 0.032) and longer operative time (371 vs 440 min; p < 0.001). When compared to LP, RP had lower rates of delayed gastric emptying (23% vs. 8.5%; p = 0.009), higher rates of SSI (2.8 vs 13.3; p = 0.036) and lower rates of conversion to open (31.1% vs 15.7%; p = 0.014). There was no significant difference between the three groups with regards to post-operative LOS, overall morbidity or mortality.
Conclusion: When comparing outcomes of open, laparoscopic and robotic pancreaticoduodenectomy, there was no difference with regards to LOS, overall morbidity, or mortality. Minimally invasive techniques appear to increase operative time without a significant change in short-term outcomes.

MO 84
PANCREATIC ADENOCARCINOMA: EFFECTS OF NEOADJUVANT THERAPY ON POST-PANCREATECTOMY OUTCOMES — A NATIONAL SURGICAL QUALITY IMPROVEMENT PROGRAM TARGETED VARIABLE REVIEW
N. Czosnyka, A. Borgert and T. Smith
Gundersen Health System, La Crosse, WI, USA
Objective: To evaluate surgical outcomes in pancreatic adenocarcinoma patients undergoing neoadjuvant therapy or surgery first approach.
Methods: The ACS-NSQIP 2014 targeted pancreatectomy database was queried for patients with pancreatic adenocarcinoma who underwent resection based on appropriate CPT and ICD-9 codes. Outcomes for patients receiving neoadjuvant chemotherapy, radiation therapy, or a combined treatment first were compared to those undergoing surgery first.
Results: 1833 patients underwent elective pancreatectomy for pancreatic adenocarcinoma. Of these, 1406 underwent proximal pancreatectomy, 391 underwent distal pancreatectomy, and 36 underwent total pancreatectomy. Of the 1833 patients, 497 (27.1%) received neoadjuvant therapy (251 chemotherapy, 236 chemotherapy + radiation, 10 radiation alone). Group characteristics were similar; the neoadjuvant therapy group was younger (63.3 ± 9.6 vs. 66.9 ± 10.2; P < 0.001), more likely to have insulin-dependent diabetes (19.5% vs. 15.5%; P = 0.033) and require preoperative biliary stenting (53.9% vs. 48.2%; P = 0.031). The neoadjuvant therapy group underwent more open procedures (96.4% vs. 93.6%; P = 0.021) with vascular reconstruction (35.6% vs. 17.9%; P < 0.001). The surgery first group had a higher incidence of hypertension (57.4% vs. 49.1%; P = 0.002). There was no difference in overall morbidity or mortality. Neoadjuvant treatment of any kind was associated lower rates of pancreatic fistulas (9.7% vs. 14.0%; P = 0.014), and higher postoperative bleeding rates (28.0% vs. 22.5%, P = 0.014). Preoperative and intraoperative factors were found to independently predict postoperative morbidity (Table).
Conclusion: Neoadjuvant therapy appears to be safe prior to operative intervention with no difference in overall postoperative complication rates. Although a higher rate of postoperative bleeding was identified in the neoadjuvant therapy group, neoadjuvant therapy appears to have a protective effect against pancreatic fistulas.

<table>
<thead>
<tr>
<th>Multivariate Logistic Regression model to predict postoperative morbidity</th>
<th>Odds ratio</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (per year)</td>
<td>1.02</td>
<td>1.01–1.03</td>
<td>0.002</td>
</tr>
<tr>
<td>Female sex</td>
<td>0.83</td>
<td>0.67–1.02</td>
<td>0.070</td>
</tr>
<tr>
<td>Increasing preoperative albumin (per mg/dL)</td>
<td>0.74</td>
<td>0.61–0.89</td>
<td>0.001</td>
</tr>
<tr>
<td>Increasing preoperative bilirubin (per mg/dL)</td>
<td>0.96</td>
<td>0.92–1.00</td>
<td>0.030</td>
</tr>
<tr>
<td>Body mass index category</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight (BMI &lt; 18.5 kg/m²) vs. normal</td>
<td>0.83</td>
<td>0.45–1.55</td>
<td>0.564</td>
</tr>
<tr>
<td>Overweight (BMI 25–30 kg/m²) vs. normal</td>
<td>1.28</td>
<td>1.0–1.63</td>
<td>0.050</td>
</tr>
<tr>
<td>Obese (BMI ≥ 30 kg/m²) vs. normal</td>
<td>1.25</td>
<td>0.94–1.65</td>
<td>0.125</td>
</tr>
<tr>
<td>History of COPD</td>
<td>1.85</td>
<td>1.12–3.08</td>
<td>0.017</td>
</tr>
<tr>
<td>Bleeding disorder</td>
<td>1.65</td>
<td>0.98–2.77</td>
<td>0.059</td>
</tr>
<tr>
<td>Preoperative biliary stenting</td>
<td>1.34</td>
<td>1.05–1.70</td>
<td>0.018</td>
</tr>
<tr>
<td>Open/partially open surgical approach</td>
<td>2.27</td>
<td>1.39–3.70</td>
<td>0.001</td>
</tr>
<tr>
<td>Pancreatectomy type</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Proximal vs distal</td>
<td>1.27</td>
<td>0.77–2.10</td>
<td>0.360</td>
</tr>
<tr>
<td>Total vs distal</td>
<td>3.39</td>
<td>1.49–7.71</td>
<td>0.004</td>
</tr>
<tr>
<td>Vascular resection</td>
<td>2.17</td>
<td>1.69–2.80</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Conclusion: This data suggests that nab-paclitaxel and gemcitabine demonstrated a survival benefit over gemcitabine alone in metastatic pancreatic cancer. However, there are limited results using this chemotherapy in potentially resectable pancreatic adenocarcinoma. Our aim is to report the oncological results of patients affected by potentially resectable pancreatic adenocarcinoma that underwent surgery after a combination of gemcitabine and nab-paclitaxel.

Methods: A total of 25 patients with pancreatic adenocarcinoma received preoperative gemcitabine plus nab-paclitaxel based chemotherapy. We evaluated the following data:

1. Toxicity related to neoadjuvancy;
2. Tumor response rate (tumoral size at CT scan, SUV of FDG PET-CT scan and CA 19.9);
3. Pattern of the treatment failure during neoadjuvancy, including local recurrence, peritoneal dissemination, and distant metastasis;
4. Resection rate;
5. Rate of R0 resection and histopathological response to neoadjuvant treatment and

Results: Overall treatment was well tolerated. Treatment resulted in significant antitumoral activity by a statistical decrease of tumoral size (p = 0.04), CA19.9 (p = 0.03) and SUV (p = 0.03). The resection rate was 68% (17/25 patients). All specimens were margin free from disease and 13 of 17 specimens had major pathological response. Median survival and median disease free survival of patients that underwent surgery was 30.2 months and 13 of 17 specimens had major pathological response. Grade B-I, and B-II. The LDP and LOS for the patients with B-I POPF were significantly shorter than those with B-II and similar with grade A. The LDP and LOS for the patients with B-I POPF were significantly shorter than those with B-II (Table 1).

Conclusion: This data suggests that nab-paclitaxel and gemcitabine is a safe and effective neoadjuvant treatment for potentially resectable pancreatic adenocarcinoma. This data should be confirmed in larger, randomized studies.

**Table 1** Comparison of clinical courses among Grade A, B-I, and B-II.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Grade B-I (n=51)</th>
<th>Grade A (n=40)</th>
<th>P</th>
<th>Grade B-II (n=35)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall morbidity*</td>
<td>18.4% (9/49)</td>
<td>11.9% (5/42)</td>
<td>0.394</td>
<td>97.1% (34/35)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Length of drain placement (days)</td>
<td>28 (22–59)</td>
<td>19 (7–21)</td>
<td>&lt;0.001</td>
<td>37 (24–171)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Length of stay (days)</td>
<td>32 (23–89)</td>
<td>25 (4–96)</td>
<td>&lt;0.001</td>
<td>44 (27–75)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Data are median (range) or number (%).

*Clavien–Dindo classification ≥2, including postoperative pancreatic fistula.
MO 87
MEASURED VS ESTIMATED BLOOD LOSS DURING PANCREATICODUODENECTOMY AND OTHER MAJOR ABDOMINAL OPERATIONS: INTERIM ANALYSIS
L. Ghee, S. Thomas, G. Kowdley, S. Patel and S. Cunningham
Saint Agnes Hospital and Cancer Institute, Ellicott City, MD, USA
Objective: Estimated blood loss (EBL) is an important factor predicting clinical outcomes, but is frequently under- and over-estimated, which can be dangerous for individual patients, and confounding for scoring systems, relying on EBL.
Methods: We performed direct measurement of hemoglobin (hb) levels of suction-canister volumes after collecting all blood from sponges and the field with dilute heparin-saline. Hgb levels were then used to calculate the measured blood loss (MBL), which was compared to the EBL, as estimated both by surgeons (sEBL) and anesthesiologists (aEBL). Power calculation predicted 83% power to detect a difference of 100 mL with a sample size of 35. An interim analysis was performed midway through the study. A paired t-test was used to compare MBL with EBL.
Results: Of 23 eligible cases at interim analysis, pancreaticoduodenectomy (n = 8) was the most common. Median ASA score was 3 (range 2–4) and 96% of patients had comorbidities (median 3/patient). Median length of stay was 8 days (range 2–34), operative time was 5:14 (range 2:05–9:01), and complications occurred in 48%, and were Clavien grade >2 in 22%. The aEBL overestimated MBL by 192 mL (143%) on average, and was significantly greater than MBL (P = 0.004), while the sEBL was significantly less than MBL (P = 0.009).
Conclusion: Surgeons underestimate and anesthesiologists overestimate EBL. This difference shown here is clinically substantial and statistically significant, and impacts not only immediate patient care but also the interpretation of scoring systems relying on EBL as a variable that may in fact be frequently inaccurate.

MO 88
DO DRAINS CONTRIBUTE TO PANCREATIC FISTULA? ANALYSIS OF OVER 5,000 PANCREATECTOMY PATIENTS IN A SINGLE YEAR
R. Elkhoury, C. Kabir, V. Maker, M. Banulescu, M. Wasserman and A. Maker
University of Illinois, Chicago, IL, USA
Objective: Conflicting evidence exists from randomized controlled trials supporting both increased complications/ fistulae and improved outcomes with drain placement after pancreatectomy. The objective was to determine drain practice patterns in the U.S.A., and to identify if drain placement was a risk for fistula formation.
Methods: Demographic, perioperative, and outcomes data were captured from the NSQIP 2014 database, including components of the fistula risk score. Fistulas were classified based on International Study Group definition. P < 0.05 was used for statistical significance in univariate analysis and entry criteria to adjusted logistic regression models.
Results: Of 5013 pancreatectomy patients, 4343 (87%) underwent drain placement. When controlled for other factors, drain placement was associated with ducts <3 mm, soft glands, and blood transfusion within 72 h of surgery. Age, obesity, neoadjuvant radiation, INR, and malignant histology lost significance in the adjusted model. Drained patients experienced higher readmission rates (17 vs. 14%, p < 0.05); and experienced increased (20 vs. 8%, p < 0.01) and type A/B/C fistulae. Fistula was associated with obesity, no neoadjuvant chemotherapy, drain placement, <3 mm duct, soft gland, and longer operative times. Drain placement remained independently associated with fistula after both distal pancreatectomy (OR = 2.84 [1.70–4.75], p < 0.01) and pancreaticoduodenectomy (OR = 2.29 [1.28–4.11], p < 0.01).
Conclusion: Drains are placed in the vast majority (87%) of pancreatectomy patients from >100 institutions; particularly those with soft glands, small ducts, and associated blood transfusions. When these factors are controlled for, drain placement is independently associated with clinically relevant fistulae in both distal and proximal pancreatectomy, raising questions regarding the utility of drain placement.

MO 89
HOSPITAL-FREE DAYS, A NOVEL COMPOSITE ENDPOINT, IN PATIENTS UNDERGOING PANCREATIC SURGERY
A. Maiga, J. Wright, G. Edwards and K. Idrees
Vanderbilt University Medical Center, Nashville, TN, USA
Objective: Traditional post-operative metrics, i.e., length of stay (LOS) and readmission rates, individually do not fully quantify the totality of deviation from normalcy for patients. In this study, we utilize a novel composite endpoint, termed Hospital-Free Days (HFD), which incorporates post-operative outcomes into number of days patients spend outside of any healthcare facility after pancreatic resection (PR).
Methods: We retrospectively reviewed 409 PR patients. Patient demographics, ASA class, Elixhauser Comorbidity Index (ECI), Surgical Apgar Score (SAS), and post-operative major complications (PMC) during index hospitalization were evaluated. HFD within 90 days from surgery were calculated by subtracting hospital LOS, readmission days, and days spent in rehabilitation/nursing facilities. Multivariable analysis (MVA) was used to examine association with HFD.
Results: The median HFD after PR was 82 days (see Table). Patients with no PMC had a median HFD of 83 days compared to 77 days with a single PMC and 71 days for those with multiple PMC (p < 0.01). By MVA, age (p < 0.01), race (p < 0.01), ECI (p = 0.02), lower SAS (p < 0.01), and PMC (p < 0.01) were predictive of lower HFD. In patients without PMC during index hospitalization, lower SAS (p = 0.01) was the only significant factor associated with HFD.
Conclusion: HFD is a novel, patient-centric, composite metric to quantify the true amount of time patients spend...
away from home in healthcare facilities after surgery. Patients who experience complications after PR have fewer HFD. HFD is an intuitive, single, clinically meaningful endpoint that enables providers to better establish expectations for prospective patients and serves as a surrogate measure of healthcare resource utilization.

### MO 90

**IMPACT OF PERIOPERATIVE CHANGES IN CA19-9 LEVELS IN PATIENTS WITH RESECTABLE AND BORDERLINE RESECTABLE PANCREATIC CANCER**

**Medical College of Wisconsin, Milwaukee, WI, USA**

**Objective:** Changes in CA19-9 values during treatment may have important prognostic implications. We examined the impact of perioperative changes in CA19-9 values in patients with pancreatic cancer (PC).

**Methods:** CA19-9 values were classified as normal or elevated based on a cutoff of 35 U/mL. Patients with localized PC who received neoadjuvant therapy were grouped by the change in CA19-9 status from preop to postop: normal/normal, normal/elevated, elevated/normal, or elevated/elevated.

**Results:** Of the 205 patients, 89 (44%) were normal/normal, 4 (2%) were normal/elevated, 58 (28%) were elevated/normal, and 54 (26%) were elevated/elevated. Median postop CA19-9 for normal/normal, normal/elevated, elevated/normal, and elevated/elevated groups were 10, 68, 19, and 67, respectively. Median overall survival (OS) was 39 months; 48, not reached, 43, and 20 months in the normal/normal, normal/elevated, elevated/normal, and elevated/elevated groups, respectively (p < 0.001). In an adjusted hazards model, patients with elevated/elevated CA19-9 had a 2.82-fold (95% CI: 1.68–4.73) increased risk of death as compared to patients with normal/normal CA19-9.

**Conclusion:** Following neoadjuvant therapy and surgery, the postoperative CA19-9 value is highly prognostic in patients with localized PC. If the preop CA19-9 is normal, it will likely remain normal postop. In contrast, only 50% of patients with elevated preop CA19-9 will normalize after surgery valuable information for investigators exploring alternative treatment sequencing for PC.

### MO 91

**IMPACT OF COMPLICATIONS ON HOSPITAL-FREE DAYS AFTER HEPATIC SURGERY**

J. Wright, A. Maiga, G. Edwards and K. Idrees  
**Vanderbilt University Medical Center, Nashville, TN, USA**

**Objective:** Traditional post-operative metrics, i.e., length of stay (LOS) and readmission rates, individually do not fully quantify the totality of deviation from normalcy for patients. In this study, we utilize a novel measure, termed Hospital-Free Days (HFD), which incorporates post-operative outcomes into number of days patients spend outside of any healthcare facility after hepatic resection (HR).

**Methods:** 463 HR patients over a 7-year period were retrospectively reviewed. Patient demographics, ASA class, Elixhauser Comorbidity Index (ECI), Surgical Appgar Score (SAS), and post-operative major complications (PMC) during index hospitalization were evaluated. HFD in the 90 days from surgery were calculated by subtracting hospital LOS, readmission days, and days spent in rehabilitation/nursing facilities. Multivariable analysis (MVA) was utilized to examine association with HFD.

**Results:** The median HFD after HR was 85 days (see table). Patients without PMC had a median HFD of 83 days compared to 78 days with a single PMC and 72 days for those with multiple PMC (p < 0.01). Age (p = 0.04), lower SAS (p < 0.01), and PMC (p < 0.01) were predictive of the lower HFD on MVA. In patients without PMC during the index hospitalization, SAS (p = 0.0007) and ECI (p = 0.02) were predictive of lower HFD.

**Conclusion:** HFD is an intuitive, singular, and clinically meaningful endpoint to quantify the true amount of time a patient spends away from home in healthcare facilities. Complications have a significant impact on lowering HFD following HR. HFD is a novel, patient-centric metric which allows providers to better establish expectations for prospective patients and serves as a surrogate measure of healthcare resource utilization.
MO 92
ENHANCED RECOVERY AFTER SURGERY PROGRAMS IN PATIENTS UNDERGOING HEPATIC RESECTION: RETROSPECTIVE COHORT STUDY

H. Alamri, M. Charles-Blouin, J. Barkun, G. Zogopoulos, P. Metrakos and P. Chaudhury
McGill University, Montreal, Canada

Objective: Enhanced recovery after surgery (ERAS) pathways have been associated with improved perioperative outcomes and accelerated recovery, it is increasingly replacing conventional approaches in surgical care. In this study we review outcomes of hepatic resection before and after the introduction of two different standardized pathways.

Methods: Retrospective review of 197 patients who underwent hepatic resection were divided into three groups: Group A, all hepatic resections in 2007 who followed conventional postoperative care (61 patients); Group B, all hepatic resections in 2009 who followed a standardized postoperative pathway (71 patients); Group C, all hepatic resections between Aug 2014 and September 2015 who followed an ERAS adapted pathway (65 patients). Data were collected on patient outcome and demographics, length of hospital stay (LOS), readmission rate, and rates of morbidity and mortality.

Results: Of a total of 197 hepatic resections, 131 (66.5%) resections were performed for colorectal liver metastasis. Our series included 100 (50.7%) major hepatic resections. A, all hepatic resections in 2007 who followed conventional postoperative care (61 patients); Group B, all hepatic resections in 2009 who followed a standardized postoperative pathway (71 patients); Group C, all hepatic resections between Aug 2014 and September 2015 who followed an ERAS adapted pathway (65 patients).

Conclusion: An ERAS pathway can be implemented successfully, and can further reduce length of stay without affecting rates of readmission, morbidity or mortality.

MO 93
LEFT HEPATECTOMY IS ASSOCIATED WITH ENHANCED LIVER REGENERATION AFTER RESECTION FOR COLORECTAL LIVER METASTASES

G. A. Margonis, S. Buettner, N. Andreatos, K. Sasaki, M. Zargham Pour, N. Shao, M. Ghasebeh, J. Izermans, J. He, I. Kamel, T. Pawlik, C. Wolfgang and M. Weiss
The Johns Hopkins Hospital, Baltimore, MD, USA

Objective: Hepatectomy remains the only curative treatment for patients with colorectal liver metastases (CRLM). Depending on tumor location, right or left hepatectomy may be indicated. As the implications of resection type on liver regeneration have not been well-studied, we aimed to examine them in the present study.

Methods: Liver regeneration rates of patients who underwent hepatectomy for CRLM between 2003 and 2015 were assessed. The early and late regeneration indexes were defined as the relative increase in liver volume (RLV) within 7 days and 7 months from surgery. The right (RH) and left (LH) hepatectomy (both formal and extended) groups were compared with respect to liver regeneration; multivariable analysis was then performed.

Results: Preoperative chemotheraphy details and volumetric data were available for 69 patients. The RH group consisted of 51 patients (73.9%); the LH group included 18 (26.1%). Baseline characteristics and frequency of middle hepatic vein resection were similar across both groups; however, resected liver volume was significantly greater in the RH group [Right: 52.3% (IQR: 45.3–58.8)% vs. Left: 21.8% (IQR: 16.2–28.0)%, p < 0.001]. On univariable analysis, the RH group exhibited higher early [44.4% (20.7%–64.0%) vs. 7.4% (−3.8%–19.0%); p = 0.001] and late regeneration rates [66.0% (37.6%–92.0%)] vs. 13.0% (−7.0%–23.6%); p < 0.001]. However, after adjusting for potential confounders — portal vein embolization, resected volume, and bevacizumab — the effect reversed for both the early [23.7% increase for LH vs RH; p = 0.062] and late [52.1% increase for LH vs RH; p = 0.001] regeneration indexes. Liver failure occurred exclusively in the RH group (n=6).

Conclusion: Left hepatectomy was associated with greater regeneration than right hepatectomy after adjusting for potential confounders on multivariable analysis. This finding should be confirmed in future studies.

MO 94
THREE POINT TRANSFUSION RISK SCORE IN HEPATECTOMY: AN EXTERNAL VALIDATION FROM THE AMERICAN COLLEGE OF SURGEONS NATIONAL SURGICAL QUALITY IMPROVEMENT PROGRAM (ACS-NSQIP)

Sunnybrook Health Sciences Centre, Toronto, Canada

Objective: To externally validate the Three Point Transfusion Risk Score (TRS) to predict receipt of peri-operative red blood cell transfusions (RBCTs) for hepatectomy.
Methods: TRIPOD guidelines were followed. A validation cohort (VC) was created with the 2014 hepatectomy ACS-NSQIP dataset. Characteristics of the VC and development cohort (DC) were compared. Risk groups for RBCT within 72 hours of surgery were created using anemia (hematocrit ≤36%), major liver resection (≥4 segments) and primary liver malignancy according to the TRS. The association between TRS variables and RBCT was examined with multivariable logistic regression. Area under the receiver operating characteristic curve (AUROC) assessed discrimination. Hosmer–Lemeshow test for goodness of fit assessed calibration.

Results: Of 3064 hepatectomies in VC, 18.9% received RBCT, compared to 23.3% in DC. The TRS stratified patients from low (8.5%) to very high risk (40.6%) of RBCT (Figure 1). All TRS variables were independently associated with RBCT in VC and DC. The final TRS was associated with RBCT in VC (odds ratio OR: 2.23; 95% confidence interval 95% CI: 1.99–2.51) and DC (OR 2.29; 95% CI 1.92–2.73). AUROC was 0.68 (95% CI 0.66–0.70) in VC compared to 0.66 (95% CI 0.63–0.69) in DC. Hosmer–Lemeshow test and calibration curves supported good predictive performance of the model in VC.

Conclusion: The TRS adequately discriminated risk of RBCT in an external sample of patients undergoing hepatectomy. It provides a simple method to identify pre-operatively patients at high transfusion risk. Tailored patient blood management initiatives can be utilized to reduce the use of RBCT.

MO 95
RECTAL AND HEPATIC RESECTION FOR RECTAL CANCER WITH SYNCHRONOUS LIVER METASTASES (RESECT): SIMULTANEOUS VS. STAGED. A SYSTEMATIC REVIEW
A. Giles, M. Valencia, E. Fu, J. Hawkins, L. Ruo, M. Simunovic and P. Serrano
McMaster University, Hamilton, Canada

Objective: Staged surgical resection has been the preferred approach to treat synchronous rectal cancer with liver metastases; however, newer reports suggest that simultaneous resection is feasible and safe. This systematic review seeks to determine differences in overall post-operative complications (primary outcome) between staged and simultaneous resections.

Methods: We searched Medline, Embase, and PubMed for all study designs comparing simultaneous (intervention) versus staged (control) resection of synchronous rectal cancer with liver metastases. Study selection, data abstraction, risk of bias and quality of the evidence assessment were carried out in duplicate. Major complications were a secondary outcome. Risk of bias was assessed using the tool designed by the CLARITY Group. The quality of evidence was assessed using GRADE. Statistical heterogeneity was calculated using chi-squared and I2. Clinical heterogeneity was explored via subgroup analyses. The protocol was published in PROSPERO.

Results: Of the 4456 abstracts retrieved, 17 studies were analyzed and 6 reported the primary outcome (all retrospective cohort studies). There were 288 intervention and 287 control patients in total. The odds ratio (OR) for overall complications (Intervention vs. Control) was 0.93, 95% confidence interval (CI) 0.64–1.35; the OR for major complications was 0.83, 95% CI 0.41–1.65. There was no significant statistical or clinical heterogeneity. Overall, the risk of bias for the included studies was moderate and the quality of the evidence (GRADE) was very low.

Conclusion: Simultaneous resection of synchronous rectal cancer with liver metastases carries a similar risk of overall and major complications compared to the staged approach. Evidence from randomized trials is needed.

MO 96
INFLUENCE OF AGE ON SURGICAL APPROACH FOR HEPATECTOMY: AN ANALYSIS OF THE NATIONAL SURGICAL QUALITY IMPROVEMENT PROGRAM DATABASE
J. Silva, N. Berger, S. Tsai, K. Christians, C. Clarke, H. Mogal and T. C. Gamblin
Medical College of Wisconsin, Milwaukee, WI, USA

Objective: This study sought to analyze the role of age in hepatectomy; specifically focused on the intended surgical approach and perioperative outcomes.

Methods: The National Surgical Quality Improvement Program Database identified patients undergoing hepatectomy between January 1, 2014 and December 31, 2014. Patients were divided into age cohorts of <50 years, 50–74 years, and ≥75 years. Demographic information, intended surgical approach, perioperative characteristics, and short-term postoperative outcomes were compared.

Results: A total of 3,064 patients were included in the study. Hepatectomy was performed most frequently on patients 50–74 years (64.5%, n = 1,975), followed by those...
n = 340). Patients <50 years were more likely to have benign pathology (p < 0.001). Significant differences in gender, race, body mass index, diabetes, hepatitis, hypertension, and American Society of Anesthesia classification were found among age groups. No significant difference in intended surgical approach (minimally invasive vs. open) existed between groups (p = 0.369), and rates of conversion were similar (p = 0.527). Younger patients experienced the longest operative time (249 vs. 227 vs. 206 minutes, p < 0.001), but shorter length of stay (5 vs. 6 days, p < 0.001). Morbidity was lowest in patients <50 years (p = 0.031), but similar in the remaining cohorts. No significant difference existed in 30-day mortality (p = 0.079) or readmission (p = 0.261).

**Conclusion:** Operative approaches for hepatectomy showed no variation between age groups despite differences in underlying tumor pathology, patient demographics, and comorbidities. Hepatectomy is a safe and effective procedure for selective patients regardless of age. Age does not appear to contribute to intended operative approach for hepatectomy.

**MO 97**

**DETERMINANTS OF OUTCOME AND SURVIVAL FOLLOWING TREATMENT OF RECURRENT HEPATOCELLULAR CARCINOMA: A SYSTEMATIC REVIEW & META-ANALYSIS**


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**Objective:** This review aimed to identify the optimum treatment strategies for hepatocellular carcinoma (HCC) recurrence.

**Methods:** A systematic review, up to July 2015, was conducted in accordance with MOOSE guidelines. The primary outcome was the hazard ratio for overall survival of different treatment modalities. Meta-analysis of differing treatment modalities was carried out using a random effects model with further assessment of additional prognostic factors for survival.

**Results:** 18 cohort studies (2662 patients) were included in final data analysis. The median 5-year survival of repeat hepatectomy (RH; n = 481 pts), ablation (n = 389) and transarterial chemoembolization (TACE; n = 878) were 43.0%, 52.7% and 9.0% respectively. Pooled analysis of 10 studies demonstrated no significant difference between overall survival after RH or ablation (HR = 1.03; p = 0.897). Median tumor size across these studies was 23.0 mm (RH) and 20.5 mm (ablation). Pooled analysis of 7 studies comparing TACE with RH showed a non-significant trend to improved survival from RH (HR = 1.61; p = 0.056). Review of prognostic factors identified those negatively associated with overall survival includes: recurrence of HCC within one year (HR 6.8; p < 0.05), presence of more than 3 recurrent tumors (HR 3.78; p < 0.05) and tumors greater than 3 cm in size (HR 4.01; p < 0.05).

**Conclusion:** There was significant heterogeneity in the reporting of these studies preventing the implementation of formal meta-regression. Despite a paucity of available data, these results suggest a non-significant trend to improved survival following RH compared with TACE and identification of important negative prognostic factors, which may influence choice of treatment modality.

**MO 98**

**INTERSTAGE ASSESSMENT OF REMNANT LIVER FUNCTION IN ALPPS USING HEPATOBILIARY SCINTIGRAPHY: PREDICTION OF POSTHEPATECTOMY LIVER FAILURE AND INTRODUCTION OF THE HIBA INDEX**

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**Hospital Italiano de Buenos Aires, Bologna, Italia**

**Objective:** The aim of the present study was to evaluate interstage liver function in associating liver partition and portal vein occlusion for staged hepatectomy (ALPPS) using hepatobiliary scintigraphy and whether this may help to predict clinically significant PHLF.

**Methods:** Between 2011 and 2016, 20 out of 39 patients (51.3%) underwent SPECT-HBS before completion of ALPPS stage 2 for primary (n = 3) or secondary liver tumors (n = 17) at the Hospital Italiano de Buenos Aires (HIBA). PHLF was defined by the International Study Group of Liver Surgery (ISGLS) criteria, 50–50 criteria or peak bilirubin >7 mg/dl. Grade A PHLF was excluded, as it requires no change in clinical management. Receiver operating characteristic curves were used to determine cutoff for HBS parameters.

**Results:** Interstagem, 3 HBS parameters differed significantly between patients with (n = 4) and without PHLF (n = 16) after stage 2. Among these, the HIBA index best predicted PHLF, with a cutoff value of 15%. The risk of PHLF in patients with <15% was 80%, whereas no patient with ≥15% developed PHLF.

**Conclusion:** Interstage HBS could help to predict clinically significant PHLF after ALPPS stage 2. An HIBA index cutoff of 15% seemed to give the best diagnostic performance. Even though further studies are needed to confirm our findings, the routine application of this non-invasive low-cost exam could be useful to facilitate decision-making in every institution willing to safely perform the ALPPS approach.

**MO 99**

**ARE ANTERIOR AND POSTERIOR SECTIONECTOMIES REALLY MINOR LIVER RESECTIONS? RETROSPECTIVE COMPARISON TO RIGHT HEPATECTOMY AND MINOR HEPATIC RESECTION**

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**Objective:** Classically, right anterior and posterior sectionectomies (RAPS) are considered minor resections; however, these operations are technically complex. We
hypothetize that RAPS have similar intraoperative outcomes to right hepatectomy (RH), but have postoperative outcomes similar to minor hepatectomy (MH).

Methods: RAPS were compared to RH and MH (resection of <3 segments) using a tertiary center database (2005–2015). Intra-operative and 90-day postoperative outcomes were the primary outcome measures.

Results: There were 468 hepatectomies: 90 RH (19%), 34 RAPS (7%) and 344 MH (74%). Metastatic cancer (40.7%) was the most common diagnosis. Mortality, serious morbidity for the entire cohort were 2.7%, 22.4% and 52%, respectively. RAPS had comparable operative time (OT), intraoperative blood loss (EBL) and blood transfusion (BT) (P > 0.05) to RH, but longer OT, more EBL and intraoperative BT than MH (P < 0.05). RAPS had lower mortality (0) than RH (7.8%) and MH (1.7%), P = 0.014. Serious morbidity after RAPS was 23.5% – less than RH (38.8%) but greater than MH (18%), P < 0.001. Subjects undergoing RAPS had hospital length of stay similar to RH (p = 0.49), but greater than MH (P = 0.005). Hospital readmission was higher after RH than RAPS and MHR (25.6 vs 17.7 vs 13.9%, P = 0.03). In multivariate analysis, cirrhosis, hepatitis C, INR, albumin, extent of resection, and indication for resection were independent predictors of serious postoperative morbidity.

Conclusion: RAPS have intraoperative outcomes similar to RH, suggesting technical complexity similar to that of RH. However, most observed 90-day postoperative outcomes or RAPS are between those of RH and minor hepatectomy.

MO 100

CLINICAL FACTORS AND POSTOPERATIVE IMPACT OF BILE LEAK AFTER LIVER RESECTION

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Objective: Despite technical advances, bile leak remains a significant complication after hepatectomy. The current study uses a targeted multi-institutional dataset to characterize perioperative factors that are associated with bile leakage after hepatectomy to better understand the impact of bile leak on postoperative recovery.

Methods: Adult patients in the 2014 ACS-NSQIP hepatectomy dataset were linked to the 2014 ACS-NSQIP PUF dataset. Clinical variables included operative diagnosis, extent of resection, operative approach, and concomitant bile duct reconstruction. Bivariable and multivariable regression analyses were used to assess the associations between clinical factors and post-hepatectomy bile leak.

Results: Of 2059 included patients, 159 (7.7%) had a postoperative bile leak. Proportion of bile leaks was significantly higher in patients after major compared to minor hepatectomy (13.1% vs 4.2%, P < 0.001). The proportion of patients with bile leak was significantly higher in patients after major hepatectomy who underwent biliary reconstruction (33% vs 6.4%, P < 0.001). There was no significant difference in the proportion with bile leaks after major hepatectomy for benign vs malignant disease (9.1% vs 10.7%, p = 0.638) or open vs minimally invasive hepatectomy (13.6% vs 9.5%, p = 0.259) in patients without biliary reconstruction. Postoperative mortality was significantly higher in patients with bile leaks (3.8% vs 1.2%, p = 0.009). Bile leak was independently associated with postoperative complications including liver failure, readmission, and occurrence of NSQIP-defined complications (all p < 0.001).

Conclusion: Major hepatectomy and enterohpatic bile reconstruction are associated with significantly higher rates of bile leak after liver resection. Bile leak is independently associated with significant postoperative morbidity. Mitigation of bile leak is important in reducing morbidity after liver resection.

Table 1 Independent association between bile leak and postoperative complications.

<table>
<thead>
<tr>
<th>Odds ratio</th>
<th>95% Confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.39</td>
<td>1.92–5.98</td>
</tr>
<tr>
<td>0.61</td>
<td>0.21–1.74</td>
</tr>
<tr>
<td>1.82</td>
<td>0.86–3.85</td>
</tr>
<tr>
<td>2.98</td>
<td>1.96–4.53</td>
</tr>
<tr>
<td>4.72</td>
<td>3.17–7.03</td>
</tr>
</tbody>
</table>

†C-statistic for model is 0.78.
*p-value less than 0.05 considered significant by multivariable logistic regression.

MO 101

DEVELOPMENT OF LAPAROSCOPIC AND OPEN MODELS FOR TRAINING AND ASSESSING IMAGE-GUIDED LIVER TUMOR ABLATION

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Objective: To create and evaluate a low-cost model and training curriculum for ultrasound-guided liver tumor microwave ablation (MWA) that residents could use to prepare for participation in operative cases.

Methods: We created simulated tumors that were implanted into bovine livers and visualized by ultrasound. A high-fidelity abdominal model for open or laparoscopic surgery was constructed, with a total cost of $30. Physicians with ultrasound and ablation experience performed simulated ablations and evaluated the model’s realism and training utility using a 10-point Likert-type scale.

Expert performance metrics were established and served as targets for our training curriculum. These included time, number of passes, number of repositionings, and percentage of tumor ablated. Next, eight novice trainees completed our deliberate practice curriculum. The participants performed 2 ablations prior to training, and 2 ablations after training to expert performance metrics. Participants’ performances were recorded throughout.

Results: Physicians rated the model’s realism at 8/10 and utility for training at 10/10. Tumors appeared hyperechoic and were clearly visualized on ultrasound. Trainees performed a total of 32 ablations. Prior to training, the time from needle insertion to ablation was 3–9 minutes, with 4–6 needle passes, 7–15 repositionings, and 20–30% of tumor volume ablated. Post-training, the time from needle insertion to ablation was 7–10 minutes, with a total of 24–30 needle passes, 7–10 repositionings, and 30–50% of tumor volume ablated. Post-training, the time from needle insertion to ablation was 7–10 minutes, with a total of 24–30 needle passes, 7–10 repositionings, and 30–50% of tumor volume ablated.
insertion to ablation was 2–5 minutes, with 1–3 needle passes, 3–9 repositionings, and 70–80% of the tumor volumes ablated.

**Conclusion:** We have created a cost-effective, high-fidelity model of MWA, with a deliberate practice curriculum. Trainees can practice to proficiency with clear target metrics prior to participating in clinical cases.

**MO 102**

THE IMPACT OF BODY MASS INDEX ON HEPATECTOMY APPROACH AND OUTCOMES

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**Objective:** This study sought to examine the role of BMI in intended surgical approach for hepatectomy and short-term perioperative outcomes.

**Methods:** The National Surgical Quality Improvement Program Database identified patients undergoing hepatectomy between January 1, 2014 and December 31, 2014. Patients were stratified by BMI as Underweight (BMI < 18.5), Normal (BMI 18.5–24.9), Overweight (BMI 25–29.9), Obese (BMI 30–39.9), or Morbidly Obese (BMI ≥ 40). Demographic information, surgical approach, and short-term postoperative outcomes were compared.

**Results:** A total of 3,027 patients were included in the study. Most patients were Overweight (35.18%, n = 1,065), followed by Normal (30.33%, n = 918), Obese (28.01%, n = 848), Morbidly Obese (4.56%, n = 138), and Underweight (1.92%, n = 58). Patients with lower BMI were more likely to undergo formal lobectomy (p < 0.001). When compared to all other patients, Morbidly Obese patients were more likely to be offered minimally invasive surgery (29.1% vs. 18.5%, p = 0.003), and had a higher rate of conversion to open (7.9% vs. 3.9%, p = 0.007). Wound dehiscence was most common in Morbidly Obese patients (p = 0.011), but overall morbidity was similar among cohorts (p = 0.464). No difference in 30-day mortality existed among cohorts (p = 0.055).

**Conclusion:** Despite differences in surgical approach, patient characteristics, and comorbidities associated with obesity, morbidity and 30-day mortality were similar. Morbidly obese patients were more likely to undergo minimally invasive surgery, however conversion to open hepatectomy and postoperative wound dehiscence was more likely and long term potential benefits are unknown.

**MO 103**

DEVELOPMENT OF A HEPATOPANCREATOBILIARY SURGERY TERTIARY REFERRAL CENTER WITHIN THE VETERANS AFFAIRS MEDICAL SYSTEM: EARLY EXPERIENCES

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**Objective:** The consolidation of complex surgical care in high volume institutions has shown benefit for patient experiences and outcomes. Consolidation is sometimes difficult to achieve for hepatopancreatobiliary (HPB) diseases given the specialized personnel and resources required. The development of Multidisciplinary Clinics (MDC) allows simultaneous consultations with multiple specialties and has shown improvements in patient satisfaction, timeliness of care, and outcomes.

**Methods:** After an HPB referral center was established at the Kansas City Veterans Affairs (VA) Medical Center in August 2014, surgical volumes, consultations, and patient experiences were compared to the previous two years. Clinical outcomes and patient satisfaction were also analyzed after a Liver MDC was created in February 2016.

**Results:** Between 8/2014 and 8/2016, 175 patients were referred for HPB consultation, a 483% increase compared to 2012–2014. Surgical intervention occurred in 47.4% of patients. HPB consultations and surgical interventions increased 32.7% and 30.6%, respectively, during the second year when compared to the first (Fig. 1). 15% of consultations were referrals from other VA hospitals. After implementation of Liver MDC, 98 clinic visits were completed. No difference in time to intervention (surgical or palliative) between patients seen in the traditional consultation model versus MDC was identified (1.78 vs. 1.67 months, p = 0.84). 85.4% of patients reported satisfaction with seeing multiple physicians in one clinic visit; 70% reported not feeling rushed when compared to traditional clinic visits.

**Conclusion:** Successful development of an HPB referral center within a VA medical system is feasible. The ability to treat patients efficiently and safely results in improved patient satisfaction.
MO 104
THE TODANI CLASSIFICATION: STILL USEFUL AFTER ALL THESE YEARS?
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Objective: The Todani classification for choledochal cysts (CCs) has been in use for almost 40 years. We hypothesize that the Todani classification does not serve much use in accurately describing congenital CCs.

Methods: The clinical and operative findings of 57 adult and pediatric patients who were treated for CCs from 1979 to 2016 were retrospectively analyzed. All available preoperative imaging and radiology reports were reviewed to verify the morphologic condition of the presenting biliary anomalies.

Results: The presenting symptom in adult patients (n = 39) was pain (69%) and in pediatric patients (n = 18) was jaundice (56%). Based on the Todani classification, we found 45 cases of type I (79%) and 7 cases of type IVA (12%) which made up 91% of the total cases examined. The remaining CC cases did not fit into the other categories of Todani type II, III, or V and are listed in Table 1. In 25% of patients, reference to type I and type IVA or “type I/IV” were all used interchangeably in describing the CC despite clear assessment on radiographic imaging.

Conclusion: The Todani classification is not practical, falsely grouping together all abnormalities of the biliary tree as choledochal cysts. Types I and IVA are often indistinguishable, and should be combined under the name CC. For the remaining spectrum of biliary tree abnormalities, both the rarely seen Todani subtypes and significant portion not encompassed by Todani, a descriptive characterization is needed.

Table 1 Choledochal cysts outside of the Todani classification.

<table>
<thead>
<tr>
<th>Patient no/age sex</th>
<th>Symptom</th>
<th>Location of CC</th>
<th>Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/61F</td>
<td>Pain</td>
<td>Central CC from anterior sector bile duct</td>
<td>Central hepatectomy</td>
</tr>
<tr>
<td>2/51F</td>
<td>Jaundice</td>
<td>CC from left hepatic bile duct</td>
<td>Cholecystectomy, Left hepatectomy</td>
</tr>
<tr>
<td>3/36F</td>
<td>Pain</td>
<td>Intrapancreatic CC involving union of CBD and PD</td>
<td>Whipple pancreaticoduodenectomy</td>
</tr>
<tr>
<td>4/1M</td>
<td>Jaundice, secondary biliary cirrhosis</td>
<td>Extrahepatic biliary atresia with CC (segments 2, 3)</td>
<td>Living donor liver transplant</td>
</tr>
<tr>
<td>5/1M</td>
<td>Down Syndrome screening US</td>
<td>CC in segment 4b/5 of liver</td>
<td>Hepatotomy and cyst excision</td>
</tr>
</tbody>
</table>

CC – choledochal cyst; CBD – common bile duct; PD – pancreatic duct; US - ultrasound

MO 105
THE IMPACT OF RACE/ETHNICITY ON GALLBLADDER CANCER: AN ANALYSIS OF THE NATIONAL CANCER DATABASE
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Objective: Gallbladder cancer is a lethal disease with high incidence among Hispanics. However, overall survival (OS) and hazard ratios (HR) for survival among races/ethnicities have not been described. We hypothesize that stage-specific prognosis of gallbladder cancer is worse for Hispanics compared to similar non-Hispanic populations.

Methods: Patients with gallbladder cancer were identified from the National Cancer Database (2007–2012), and categorized as Caucasian, Black, Hispanic, and Other. Descriptive statistics, OS, and Cox regression checking for two-way interactions were described.

Results: The study identified 12,952 patients with gallbladder cancer. Median age was 71 years and 68.8% were female. The study identified 69.8% Caucasian, 13.9% Black, 11.0% Hispanic, and 5.4% Other. All-stage overall...
survival curves differed, with the greatest 5-year survival in Hispanic patients (27% vs. 23% Other, 18% Caucasian, and 17% Black, \( p < 0.001 \)). Hispanics presented at earlier ages compared to Caucasians (67 vs 72 years, \( p < 0.001 \)), were more likely to be uninsured (17.3% vs 3.9% \( p < 0.001 \)), had lower income (\( p < 0.001 \)), and education levels (\( p < 0.001 \)) compared to Caucasians. When stratified by stage, Hispanics demonstrated greater OS for stage 0-3 disease. Following multivariate Cox regression modelling stratified for non-proportional hazards, only treatment at an academic facility (HR 0.90, 95% CI [0.84–0.97]) and diagnosis year (HR 0.90, 95% CI [0.88–0.92]) related to survival. Hispanic ethnicity did not show significance (\( p = 0.207 \)).

**Conclusion:** Hispanics exhibit the highest overall survival for gallbladder cancer, but after adjusting for covariates this does not appear to independently impact survival. Interestingly, treatment at an academic facility provides a survival benefit.

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**MO 106**

**WHAT IS THE CLINICAL VALUE OF A MARGIN NEGATIVE RESECTION IN LYMPH NODE POSITIVE GALLBLADDER CANCER?**


*NorthShore University HealthSystem, Evanston, IL, USA*

**Objective:** Achieving free surgical margins in gallbladder cancer (GBAC) often requires an operation more morbid than cholecystectomy. There is little data examining the value of a margin negative resection in patients with lymph node positive GBAC and thus high risk for distant disease recurrence.

**Methods:** We queried the National Cancer Database to identify patients undergoing resection for lymph node positive GBAC between 2004 and 2012. Patients receiving neoadjuvant chemoradiotherapy and those with gross residual (R2) disease were excluded. Multivariable and Cox Models adjusted for age, facility type, Charlson index, margin status, tumor grade, pathologic stage, number of nodes examined, procedure type and adjuvant chemoradiotherapy.

**Results:** 826 (78.1%) patients had free microscopic margins on final pathology (R0); 231 (21.9%) had microscopic positive margins (R1). Multivariable regression identified limited (≤2 nodes) lymphadenectomy (OR 2.014, 95% CI [1.366, 2.971]), pathologic N2 (OR 3.100, 95% CI [1.339, 7.178]) and T3 disease (OR 4.670, 95% CI [1.479, 14.751]) as independently associated with R1 resection. Cox modeling identified R0 resection (HR 0.639, 95% CI [0.531, 0.769]) and receipt of adjuvant chemoradiotherapy (HR 0.498, 95% CI [0.416, 0.597]) as independently associated with improved overall survival and advanced age (HR 1.432, 95% CI [1.119, 1.834]), T3 disease (HR 1.895, 95% CI [1.176, 3.053]), and Charlson score≥2 (HR 1.450, 95% CI [1.092, 1.925]) with poor survival. Patients undergoing R0 resection had median survival of 20.6 months compared to 9.99 months for those undergoing R1 resection (\( p < 0.0001 \)).

**Conclusion:** For patients with node positive GBAC, operations that carry greater risk of morbidity but achieve negative surgical margins are justifiable.

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**MO 107**

**TARGETED LYSOPHOSPHATIDIC ACID RECEPTOR ANTAGONISTS FOR HEPATOCELLULAR CARCINOMA CHEMOPREVENTION**

N. Skill and M. Maluccio

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**Objective:** Hepatocellular carcinoma (HCC) is a burden to our health care system. In response, we have identified aberrant serum lysophosphatidic acid (LPA) variant profiles as biomarkers of HCC in order to identify high-risk patients. Also, we have demonstrated that inhibiting LPA biosynthesis/signaling in mice, predisposed to HCC, reduces HCC. We hypothesize that LPA variant profile aberrancy is linked to changes in the hepatic expression of the six known LPA receptors (LPAR1-6) and that identification and study of LPAR antagonists will reduce HCC emergence.

**Methods:** Hepatic LPAR expression profiles were quantitated in cirrhotic livers +/- HCC by Western blotting and
RT-PCR. LPA variant binding affinities to LPARs was performed using commercially available cell based LPAR agonist assays. LPAR inhibitors were identified by 3D computational docking of 1.2 million compounds against the active site of the LPA biosynthetic enzyme, autotaxin. LPAR antagonism was determined using commercially available cell based LPAR antagonist assays.

Results: LPAR2 and LPAR3 were the main hepatic LPARs. Hepatic LPA2 and LPA3 expression was greater in cirrhotic livers with HCC when compared to livers without HCC. LPAR2 and LPAR3 selectively bound 18:2LPA (RC50 1.6 μM) in preference to other LPA variants (e.g. 20:4LPA RC50 2.4μM). Six compounds were identified with LPAR IC50 <10 nM.

Conclusion: HCC associated aberrant LPA variant profile is theoretically linked to changes in hepatic LPAR expression and variant specific LPAR binding affinities. LPAR is a potential target to reduce HCC emergence. The six potent LPAR antagonists should be tested in murine models in order to determine effectiveness.

MO 108

CHANGES OF INTRAHEPATIC LIPID COMPOSITION AFTER PORTAL VEIN EMBOLIZATION

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Objective: Portal vein embolization is performed to prevent postoperative liver failure by enlarging the future remnant small liver. Since the liver is a main organ to organize lipid metabolism, lipid composition would be significantly changed in ipsilateral liver lobe after portal vein embolization. The purpose of this study is to examine the change of intrahepatic lipid composition after portal vein embolization by mass spectrometry.

Methods: As an animal model, the left portal vein branch was ligated under stereoscopic microscopy in 9–12-week-old C57BL/6j mice. Liver samples were taken before and 6, 12, 24, 72 and 168 hr after surgery. Intrahepatic lipid change was evaluated with Oil red O staining and mass spectrometry (MALDI-IMS).

Results: The weight of non-PVL lobe (nPVL) was significantly increased 72 hr after PVL. Oil red O staining showed the transient increase of triglyceride (TG) in nPVL 24 hr after PVL. By MALDI-IMS analysis, the levels of phosphatidylcholine (PC), but not lysophosphatidylcholine (LPC), significantly increased in nPVL 72 hr after PVL. As the results, the ratio of PC against LPC in nPVL 72 hr after PVL was significantly higher than in PVLL.

Conclusion: PVL induces the transient increase of PCs, major components of celllular membrane, in future regenerating liver (non-PVL lobe). Such phospholipid increase would be necessary for increased turnover of cell membrane to gain the liver volume.

MO 109

SIGNIFICANCE OF LYSIL OXIDASE-LIKE 2 (LOXL2) EXPRESSION IN HEPATOCELLULAR CARCINOMA

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Objective: In this study, we aimed to investigate the exact role of LOXL2 and the correlation between LOXL2 and epithelial-mesenchymal transition (EMT), and inhibition of LOXL2, using Beta-aminopropionitrile (BAPN), initiated reduced tumor progression in hepatocellular carcinoma (HCC).

Methods: The expression levels of LOXL2 in HCC tissue and adjacent noncancerous tissue were evaluated by quantitative reverse transcription polymerase chain reaction and clonichopathological analysis. The effect of BAPN on cell proliferation, migration, and invasion was investigated in vitro. Additionally, LOXL2 expression in culture supernatant of HCC cell lines were measured.

Results: Our study showed that LOXL2 expression was increased in HCC cell lines and tissue. There was a significant correlation between EMT status and LOXL2 levels (P = 0.004). BAPN reduced the migration and invasion of HCC cells. HCC patients with high expression of LOXL2 had relatively shorter disease-free survival (p = 0.009) and overall survival (p = 0.035). The expression levels of LOXL2 in culture supernatant were parallel to LOXL2 expression in HCC cell lines. Multivariate analysis demonstrated that portal vein invasion (p = 0.015), venous invasion (p = 0.026), serum AFP level (p = 0.019), and LOXL2 expression (p = 0.009), were independent prognostic factors.

Conclusion: Our results suggest that increased LOXL2 expression may contribute to tumor progression and the clinical value of LOXL2 as a therapeutic target in HCC.

MO 110

TUMOR VOLUME AS A PERCENTAGE OF TOTAL LIVER VOLUME: A NOVEL PROGNOSTIC TOOL FOR PATIENTS WITH COLORECTAL LIVER METASTASIS

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Objective: While tumor size and number have long been recognized as prognostic factors in patients with colorectal liver metastases (CRLM), routine radiologic assessment of CRLM may not capture the subtleties of tumor morphology. We aimed to harness the power of imaging data to develop a new prognostic tool by assessing the ratio (%TLV) of total tumor volume (TTV) to total liver volume (TLV).

Methods: Preoperative TLV and TTV were measured by tracing the liver outline by hand on axial portal venous
phase CT images. %TLV (TTV/TLV) was then calculated. Using Receiver operating characteristic (ROC) analysis, a cut-off of 0.8% was determined for %TTV. Survival analysis according to %TTV value was then performed.

Results: A total of 174 patients were included. Median TLV was 1536 mL (IQR: 1349–1936 mL), TTV was 8.0 mL (IQR: 2.2–19.4 mL) and %TTV was 0.49 (IQR: 0.15–1.16). On pathology, median maximum tumor size was 2.4 cm (IQR: 1.6–4.0); tumor number was 2 (IQR: 1–4). ROC analysis demonstrated that %TTV is a better predictor of survival than either tumor size (AUC: 0.638 vs 0.551; p = 0.008) or number (AUC: 0.638 vs 0.588; p > 0.05), although the latter did not reach significance. Importantly, in multivariate analysis, a %TTV > 0.8% was an independent predictor of mortality (HR: 2.19 (1.20–4.02); p = 0.011) (Figure).

Conclusion: %TTV values may have prognostic significance and can be calculated through routine imaging studies, without additional cost or risk. As such, the validity and clinical applications of the %TTV model merit further study.

MO 111
MANAGING HEMORRHAGING HEPATIC TUMORS: THE PLACE OF MICROWAVE ABLATION IN A MULTIMODALITY ALGORITHM
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Objective: This study examined the outcomes of microwave ablation (MWA) for the management of hemorrhage from ruptured liver tumors. Though resection is often considered the preferred treatment for ruptured hepatic tumors, rapid coagulative necrosis induced by MWA may obviate the need for immediate resection in physiologically challenged patients. While management protocols exist for specific tumors, a global hemodynamic, oncologic, and hepatic functional assessment may be better suited to the range of pathology seen in modern hepatobiliary practice.

Methods: Patients treated for bleeding liver tumors at a single institution from January 1, 2008 to September 30, 2015 were retrospectively analyzed using standard statistical methods. Tumor characteristics, interventions, and operative outcomes are reported.

Results: Eighteen patients underwent surgical intervention for bleeding tumors; 12 (66.7%) presented with ruptured HCC, 5 (27.8%) with ruptured hepatic adenoma, and one melanoma liver metastasis. Ten patients (55.6%) underwent hepatic artery embolization (HAE); this was unsuccessful in 3 cases. Laparotomy was reserved for hemodynamically unstable patients (n = 6, 33%). Hemostasis was obtained with MWA in 14 cases (77.8%); the remaining tumors were resected without performing ablation. One ablation was converted to resection after hemostasis was achieved. No reoperation occurred for bleeding following MWA.

Conclusion: MWA is an effective modality for controlling hemorrhage from ruptured liver tumors. Hemorrhage control without emergent hepatectomy allows resuscitation and planned intervention should further liver-directed therapy be required. An algorithmic approach to bleeding liver tumors is proposed based on review of this experience and published disease process-specific algorithms (Figure 1).

Figure 1: Algorithm for the Management of Bleeding Liver Tumors
- The decision for MWA vs. resection is based on liver function, presence of cirrhosis, tumor size, and location.
- For patients who do not emergently undergo exploration, oncologic tumor control is HAE, resection, or medical management is based on staging imaging, patient comorbidity, the specific disease process, tumor characteristics, and hepatic functional reserve.
- For patients who undergo emergent MWA for hemorrhage control, complete lesion destruction is intended.
Objective of this work was to determine whether phlebotomy is protective of transfusion, after accounting for other known confounders.

**Methods:** Consecutive patients who underwent liver resection at one institution (2010–2016) were examined. Factors predictive of perioperative blood transfusion, both on univariate analysis and previously published, were modelled using multivariate logistic regression.

**Results:** A total of 373 patients underwent liver resection (48% major). Phlebotomy was performed in 45 patients (12%) since 2013, for a median of 496 mL of removed blood (range 247–809). Phlebotomy patients were more likely to have a primary malignancy (31% vs 17%, p = 0.0278) and to have a major resection (84% vs 43%, p < 0.0001). A trend towards decreased blood loss was noted with phlebotomy (569 vs 748 mL, p = 0.0563). On multivariate logistic regression, only having a phlebotomy (OR 0.231, 95% CI 0.081–0.655, p = 0.0059), major liver resection (OR 2.858, 95% CI 1.622–5.036, p = 0.0003), and preoperative hemoglobin <12.5 g/dL (OR 6.045, 95% CI 3.482–10.493, p < 0.0001) were significantly associated with perioperative red blood cell transfusion. Gender, BMI, history of coronary disease, prior liver resection, having a primary malignancy, preoperative platelets, Pinte, and extrahepatic resection were not significantly associated with transfusion.

**Conclusion:** Phlebotomy with controlled hypovolemia appears to be significantly protective of red blood cell transfusion, independently from other known risk factors. This intervention warrants further study.

**MO 113**

**ROBOT-ASSISTED VERSUS LAPAROSCOPIC LIVER RESECTION: A REVIEW OF THE LITERATURE AND A COST-BENEFIT ANALYSIS FROM A SINGLE HIGH-VOLUME CENTER**


**Carolina Medical Center, Charlotte, NC, USA**

**Objective:** Considerable debate exists regarding outcomes and cost-effectiveness of robot-assisted versus laparoscopic approaches to hepatectomy. The goals of this study were to review published data, and compare them to cost-benefit analyses for major hepatectomies performed at a single, high-volume hepatopancreato-biliary surgery center.

**Methods:** A comprehensive literature review of minimally invasive robotic-assisted and laparoscopic hepatectomy (2008 to 2016) were analyzed to compare patient data, operative characteristics, and outcomes. We performed a retrospective analysis (2008–2016) of identical parameters for patients at our center undergoing a major (≥3 segments) laparoscopic hepatectomy (n = 181 of whom n = 57 robot-assisted and n = 124 laparoscopic).

**Results:** Published data report similar perioperative characteristics and post-operative outcomes for robot-assisted versus laparoscopic hepatectomy. However, a lack of consistency in data availability precluded establishing a valid conclusion on superiority or relative cost-effectiveness between the two approaches. Analyzing data from our center revealed patients undergoing robot-assisted versus laparoscopic major hepatectomy were older (58.1 ± 15.7 versus 53.1 ± 15.6 years, respectively; p < 0.05), went to the ICU post-operatively less often (46.3% versus 62.8%, respectively; p < 0.05), and were readmitted less often within 90 days (5.3% versus 20.2%, respectively; p = 0.01). No significant differences were found between the two approaches for blood loss/transfusion volume, operative times, and total length of stay. Mean total cost was not significantly different between the robot-assisted versus laparoscopic approach ($31,732 versus $27,053, respectively; p > 0.05).

**Conclusion:** Robot-assisted hepatectomy is a safe, feasible, and effective alternative to laparoscopic hepatectomy with no significant cost differential. Improved standardization of data collection/reporting will enhance and clarify future data interpretation.

**MO 114**

**INTERVAL MAGNETIC RESONANCE IMAGING IS AN ALTERNATIVE TO CURRENT GUIDELINES FOR EVALUATION OF INDETERMINATE NODULES IN THE CIRRHOTIC LIVER: JUST RELAX FOR 3 MONTHS**

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**Objective:** Patients with cirrhosis are screened for HCC. Current guidelines from the AASLD and NCCN recommend repeat imaging by alternate modality or biopsy for indeterminate nodules ≤1 cm identified by CT or MRI. We hypothesize that repeat MRI after 3 months is an acceptable alternative strategy.

**Methods:** Patients with cirrhosis and indeterminate nodule ≤1 cm were included. The dataset included the interval MRI at 3 months is a reasonable alternative strategy.

**Results:** There were 111 patients in the study. LTB recommendations were 3-month (n=64, 58%) or 6-month (n=34,31%) MRI follow-up and most patients (n=93, 84%) were compliant with recommended follow-up. A total of 31 patients (28%) developed HCC during the period of follow-up (median 25.5 months). Of these, 25 (81%) developed HCC in the original nodule with median time to development of HCC of 6.5 months (IQR: 3 11.5, FIGURE). There were no differences in gender, age, race, etiology of cirrhosis, MELD score or nodule size between patients who did and did not develop HCC. Patients who later developed HCC had higher median AFP (p=0.034). Median overall survival for the patients with HCC was 26.5 months from identification of indeterminate nodule.

**Conclusion:** An interval MRI at 3 months is a reasonable strategy for patients with cirrhosis and an indeterminate nodule ≤1 cm, and this option should be added to current guidelines. CT scan is unlikely to make definitive diagnosis if high quality MRI does not. Further, a short delay of 3 months allows some nodules to slightly grow improving subsequent diagnostic accuracy.
MO 115
MINIMALLY INVASIVE LIVER SURGERY FOR PRIMARY AND METASTATIC LIVER TUMORS: INFLUENCE OF AGE ON PERIOPERATIVE COMPLICATIONS AND MORTALITY

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University of Pittsburgh Medical Center, Pittsburgh, PA, USA

Objective: As minimally-invasive technique becomes more popular, an increasing number of elderly patients were considered for laparoscopic liver surgery (LLS). Limited physiologic reserve remains a major concern, which frequently leads surgeons to recommend second-line/nonresectional alternatives. We sought to evaluate complications and outcomes of elderly patients undergoing LLS.

Methods: 831 patients that underwent MILS were classified into group A, B, C based on age [(<70, n = 629), (70–79, n = 148), (≥80, n = 54) years old, respectively].

Results: Gender distribution, BMI, and cirrhotic status were comparable among all groups. Group B and C had higher average MELD (p = 0.047) and ASA (p = 0.001) scores. Operative-time (170, 157, 152 minutes; p = 0.64) and estimated blood-loss (145, 130, 145 ml; p = 0.95) were statistically equal. Overall postoperative complications were greater in older groups (6.5%, 12.9%, and 9.3%, p = 0.46 in group A, B, and C, respectively), however, complications in octogenarian group were all minor (Clavien–Dindo I–II). Major complications (Clavien–Dindo III–IV) were higher in group B when compared to the younger group (6.8% versus 2.7%, respectively; p = 0.43). This finding correlated with greater ICU admission for group B, compared to group A and C (5.4% versus 1.4% and 1.9%; p = 0.75). Hospital-stay was longer in older groups (2.5, 3.6, 3.5 days; p = 0.0012). 30-day mortality rate was 0.3%. Median overall-survival for octogenarians was 31.9 months and 5-year-OS was 71%.

Conclusion: Despite a trend toward greater overall complications and ICU admission for older patients, only minor complications were seen in ≥80 year-old group. LLS can be performed with acceptable morbidity and good outcomes in octogenarians.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Group A (n = 629)</th>
<th>Group B (n = 148)</th>
<th>Group C (n = 54)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age(year)</td>
<td>52.3 (17–69)</td>
<td>73.9 (70–79)</td>
<td>83.4 (80–91)</td>
<td>0.001</td>
</tr>
<tr>
<td>Body mass index BMI (kg/m²)</td>
<td>27.4 (16.3–60.5)</td>
<td>27.5 (17.2–43.4)</td>
<td>25.9 (18.3–36.1)</td>
<td>0.05</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Female</td>
<td>417 (66.3%)</td>
<td>75 (50.7%)</td>
<td>31 (57.4%)</td>
<td>1</td>
</tr>
<tr>
<td>b. Male</td>
<td>212 (33.7%)</td>
<td>73 (49.3%)</td>
<td>23 (42.6%)</td>
<td></td>
</tr>
<tr>
<td>ASA score *</td>
<td>2.5</td>
<td>2.9</td>
<td>3.1</td>
<td>0.001</td>
</tr>
<tr>
<td>Background liver cirrhosis</td>
<td>30%</td>
<td>35%</td>
<td>30%</td>
<td>0.55</td>
</tr>
<tr>
<td>MELD score **</td>
<td>7.6 (6–22)</td>
<td>8.7 (6–24)</td>
<td>8.7 (6–21)</td>
<td>0.07</td>
</tr>
<tr>
<td>Child Pugh score</td>
<td>5.2 (5–12)</td>
<td>5.7 (5–10)</td>
<td>5.7 (5–9)</td>
<td>0.75</td>
</tr>
<tr>
<td>Liver pathology</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Hepatocellular carcinoma</td>
<td>82 (13%)</td>
<td>34 (23%)</td>
<td>14 (25.9%)</td>
<td>0.07</td>
</tr>
<tr>
<td>b. Colorectal cancer</td>
<td>72 (11.4%)</td>
<td>26 (17.6%)</td>
<td>12 (22.2%)</td>
<td>0.25</td>
</tr>
<tr>
<td>c. Intrahepatic cholangiocarcinoma</td>
<td>11 (1.7%)</td>
<td>6 (4.1%)</td>
<td>1 (1.9%)</td>
<td>0.91</td>
</tr>
<tr>
<td>d. Gallbladder cancer</td>
<td>5 (0.8%)</td>
<td>0</td>
<td>2 (3.7%)</td>
<td>0.92</td>
</tr>
<tr>
<td>e. Neuroendocrine tumor</td>
<td>9 (1.4%)</td>
<td>5 (3.4%)</td>
<td>1 (1.9%)</td>
<td>0.93</td>
</tr>
<tr>
<td>f. Breast cancer</td>
<td>20 (3.2%)</td>
<td>5 (3.4%)</td>
<td>0</td>
<td>0.92</td>
</tr>
<tr>
<td>g. Hepatic adenoma</td>
<td>43 (6.8%)</td>
<td>1 (0.7%)</td>
<td>0</td>
<td>0.39</td>
</tr>
<tr>
<td>h. Focal Nodular Hyperplasia</td>
<td>63 (10%)</td>
<td>0</td>
<td>0</td>
<td>0.10</td>
</tr>
<tr>
<td>i. Liver cystic mass</td>
<td>168 (26.7%)</td>
<td>49 (33.1%)</td>
<td>17 (31.5%)</td>
<td>0.44</td>
</tr>
<tr>
<td>j. Hemangioma</td>
<td>59 (9.4%)</td>
<td>6 (0.4%)</td>
<td>0</td>
<td>0.35</td>
</tr>
<tr>
<td>k. Benign fibrotic nodule</td>
<td>28 (4.5%)</td>
<td>4 (0.3%)</td>
<td>3 (5.6%)</td>
<td>0.93</td>
</tr>
<tr>
<td>k. Others</td>
<td>69 (11%)</td>
<td>12 (8.1%)</td>
<td>4 (7.4%)</td>
<td>0.81</td>
</tr>
<tr>
<td>Major hepatectomy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Left lateral sectionectomy</td>
<td>110 (17.5%)</td>
<td>22 (14.9%)</td>
<td>9 (16.7%)</td>
<td>0.88</td>
</tr>
<tr>
<td>b. Central hepatectomy</td>
<td>40 (6.4%)</td>
<td>4 (2.7%)</td>
<td>3 (5.6%)</td>
<td>0.78</td>
</tr>
<tr>
<td>c. Nonanatomic ≥2 segments</td>
<td>66 (10.5%)</td>
<td>13 (8.8%)</td>
<td>5 (9.3%)</td>
<td>0.94</td>
</tr>
<tr>
<td>d. Right hepatectomy</td>
<td>19 (3%)</td>
<td>2 (1.4%)</td>
<td>1 (1.9%)</td>
<td>0.95</td>
</tr>
<tr>
<td>e. Left hepatectomy</td>
<td>31 (4.9%)</td>
<td>7 (4.7%)</td>
<td>1 (1.9%)</td>
<td>0.93</td>
</tr>
</tbody>
</table>

Minor hepatectomy
MO 116
LIVER RESECTION SYNCHRONOUS WITH HEPATIC ARTERIAL INFUSION PUMP (HAIP) FOR COLORECTAL CANCER LIVER METASTASES IS ASSOCIATED WITH IMPROVED SURVIVAL COMPARED TO HAIP ALONE

I. T. Konstantinidis, F. Tozzi, S. Warner, P. Ituarte, Y. Fong and G. Singh
City of Hope Cancer Center, Duarte, CA, USA

Objective: Experience with hepatic arterial infusion pump (HAIP) for colorectal cancer liver metastases (CRCLM) comes from few specialized centers. Little is known about its use in a large, population based cancer registry level.

Methods: We contacted a case-only analysis of California Cancer Registry (CCR) data (2000–2012) to detect patients who underwent HAIP placement for CRCLM. Survival analyses were conducted with the Kaplan–Meier method and differences assessed with the log rank test.

Results: A total of 349 patients who underwent HAIP placement were analyzed. The majority were placed in the first half of the period (2000–2005 (80.8%). Patients were more frequently male (59.4%) white (67.4%), married (71.6%), has a median age of 58 yrs (range 25–89), private insurance (56.2%), and were of either high (29.2%) or very high (33.2%) socioeconomic status (SES). The vast majority had few comorbidities (Charlson comorbidity index = 0 for 84.5%) and received concurrent liver resection in 35.4% and/or ablation in 27.4%. Median overall survival (OS) was 26 months and 5 year survival 25%. Patients who underwent liver resection at the time of HAIP placement had a better OS of 42 months compared to the patients who only received HAIP placement (figure).

Conclusion: Patients with colorectal liver metastases who undergo HAI pump placement have specific demographic and SES profile. The ability to resect their liver disease correlates with survival and should be taken into account in the selection process.

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(continued)

<table>
<thead>
<tr>
<th>Demographic and clinicopathologic Characteristics</th>
<th>Group A</th>
<th>Group B</th>
<th>Group C</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age &lt;70 (n=629)</td>
<td>Age 70–79 (n=148)</td>
<td>Age ≥80 (n=54)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Liver cystic mass fenestration</td>
<td>141 (22.4%)</td>
<td>45 (30.4%)</td>
<td>16 (29.6%)</td>
<td>0.25</td>
</tr>
<tr>
<td>b. Nonanatomic &lt;2 segments</td>
<td>222 (35.3%)</td>
<td>55 (37.2%)</td>
<td>19 (35.2%)</td>
<td>0.15</td>
</tr>
<tr>
<td>Operative time (minute)</td>
<td>170 (20–654)</td>
<td>157 (37–490)</td>
<td>152 (62–373)</td>
<td>0.64</td>
</tr>
<tr>
<td>Estimated blood loss (ml)</td>
<td>145 (5–7700)</td>
<td>130 (6–3600)</td>
<td>145 (10–2100)</td>
<td>0.93</td>
</tr>
<tr>
<td>Unplanned open conversion</td>
<td>10 (1.6%)</td>
<td>1 (0.7%)</td>
<td>0</td>
<td>0.96</td>
</tr>
<tr>
<td>Blood transfusion</td>
<td>15 (2.4%)</td>
<td>4 (2.7%)</td>
<td>5 (9.3%)</td>
<td>0.70</td>
</tr>
<tr>
<td>Intensive care unit admission</td>
<td>9 (1.4%)</td>
<td>8 (5.4%)</td>
<td>1 (1.9%)</td>
<td>0.75</td>
</tr>
</tbody>
</table>

Overall complications

| a. Clavien–Dindo grade I | 10 (1.6%) | 6 (4%) | 2 (3.7%) | 0.89 |
| b. Clavien–Dindo grade II | 14 (2.2%) | 3 (2%) | 3 (5.6%) | 0.92 |
| c. Clavien–Dindo grade III | 12 (1.9%) | 4 (2.7%) | 0 | 0.96 |
| d. Clavien–Dindo grade IV | 5 (0.8%) | 6 (4.1%) | 0 | 0.81 |

Minor complications

| a. Superficial wound infection | 0 | 0 | 0 | 1 |
| b. Intestinal ileus | 5 (0.8%) | 1 (0.7%) | 1 (1.9%) | 0.99 |
| c. Delirium | 2 (0.3%) | 1 (0.7%) | 0 | 0.99 |

Major complications

| a. Bleeding | 5 (0.8%) | 0 | 1 (1.9%) | 0.98 |
| b. Small bowel obstruction | 0 | 1 (0.7%) | 0 | 0.99 |
| c. Bile leak | 5 (0.8%) | 1 (0.7%) | 0 | 0.98 |
| d. Cardiac complications | 3 (0.5%) | 2 (1.4%) | 1 (1.9%) | 0.98 |
| e. Respiratory complications | 7 (1.1%) | 7 (4.7%) | 1 (1.9%) | 0.79 |
| f. DVT/PE ** | 2 (0.3%) | 2 (1.4%) | 1 (1.9%) | 0.97 |
| g. Intra-abdominal infection | 4 (0.6%) | 1 (0.7%) | 0 | 0.99 |
| h. Hernia | 5 (0.8%) | 1 (0.7%) | 0 | 0.99 |
| i. Narcotic related complications | 3 (0.5%) | 1 (0.7%) | 0 | 0.99 |
| j. Others | 0 | 1 (0.7%) | 0 | 0.99 |
| Length of hospital stay (day) | 2.7 (1–17) | 3.6 (1–49) | 3.5 (1–9) | 0.007 |
| 30-day mortality | 2 (0.3%) | 0 | 0 | 0.99 |
| 90-day mortality | 11 (1.7%) | 0 | 0 | 0.93 |

** Deep venous thrombosis/Pulmonary embolism
MO 117
EXTENDED PHARMACOLOGIC THROMBOPROPHYLAXIS IN LIVER SURGERY IS SAFE AND EFFECTIVE
B. Kim, R. Day, C. W. Tzeng and T. Aloia
University of Texas, MD Anderson Cancer Center, Houston, TX, USA

Objective: Given the traditionally high rates of postoperative venous thromboembolism (VTE) after liver surgery, this study evaluated the safety and efficacy of extended pharmacologic thromboprophylaxis (EPT).

Methods: From August 2013 to August 2016, 125 patients who underwent liver resection for malignancy were placed on an EPT protocol. Perioperative prophylaxis included preoperative TED and SCD placement. Once hemostasis was assured following hepatectomy, chemical VTE prophylaxis was initiated and continued for the duration of the hospitalization. After hospital discharge, the large majority of patients (114, 91.2%) continued chemical thromboprophylaxis (enoxaparin) to complete a total course of 14 days in lower risk patients (MIS/minor hepatectomy) or 28 days in higher risk patients (VTE history, major hepatectomy, discharge with drain).

Results: Median age was 77 (range: 22–79 yrs) and 52% were male. 4.8% of patients presented on therapy for preoperative VTE, 26.4% underwent a major hepatectomy and 30.4% were approached laparoscopically. Severe complication rate was 5.6% and there were no 90-day mortalities. The intraoperative and postoperative transfusion rates were 5.6% and 8.0%, respectively. 32.8% started pharmacologic thromboprophylaxis on postoperative day (POD) 0 and 67.2% began on POD1. Clinically, there were zero postoperative DVT and/or pulmonary embolism events. Within 90 days of surgery, 91.2% of patients underwent at least one intravenous contrast computed tomography scan of the chest/abdomen/pelvis with no patients found to have thoracic/portal/pelvofemoral VTE. Two patients (1.6%) had outpatient gastrointestinal bleeding events that resolved after discontinuation of enoxaparin and neither required blood transfusion.

Conclusion: A coordinated pharmacologic thromboprophylaxis regimen including post-discharge dosing for liver surgery patients is safe and effective.

MO 118
SURGICAL PHYSICIAN ASSISTANT PERCEPTIONS OF MENTORING
Lindsey L. Manos and Joan S. Leafman
The Johns Hopkins Hospital, Baltimore, MD, USA

Objective: Physician assistants (PAs) are important members of the healthcare team. Surgical PAs represent a group whose practice often involves additional skills, requiring support beyond the training covered in traditional PA programs. A paucity of literature regarding the desire for and perceptions of professional and clinical mentoring among surgical PAs exists. The aim of this study was to explore surgical PAs’ perceptions of mentoring.

Methods: A quantitative descriptive study was conducted using nonprobability convenience sampling. Two existing survey tools, Bouquillon’s Instrument and the Perceptions of Mentoring Relationships Survey were adapted to create the tool used in this study. The adapted survey was disseminated through the American Academy of Surgical Physician Assistants and posted in a closed Facebook group for PA’s.

Results: A total of 144 surgical PAs responded. Among 128 eligible participants, 119 (93%) felt that mentoring was important and 70 (55%) considered a physician the ideal mentor. Ninety (73%) surgical PAs reported having or having had a mentor and among those, 72 (80%) reported the mentor to be a physician. The physician served as the surgical PA’s supervising physician in 66 (92%) cases. The most important mentor characteristic was for the mentor to be an effective teacher when compared to the outcome variable, overall value of mentoring, and with the other independent variables.

Conclusion: Surgical PAs desire mentoring and many consider a physician to be an ideal mentor. Physicians, especially a surgical PA’s supervising physician, should be aware of the potential affect their time and effort can have on a PA’s career.

MO 119
RISK FACTORS ASSOCIATED WITH BILE LEAK AFTER LIVER RESECTION
D. Pointer, A. Volk, A. Hauch, J. Sulzer, L. Deeresare, E. Wynter and J. Buell
Tulane University, New Orleans, LA, USA

Objective: Bile leak is a dreaded complication after liver resection. However, the reported incidence of bile leaks after liver resection is significantly variable in the literature ranging from 7 to 23%. This study seeks to identify the true incidence of bile leak after liver resection and underlying associated risk factors in a large single center series.

Methods: Retrospective analysis was performed to identify the incidence of post resection bile leaks after 856 resections performed in 703 patients. Thirty-one (4.4%) bile leaks were identified in our cohort of 266 open and 437 laparoscopic resection patients. Etiology and outcome analysis was performed through regression analysis using SPSS.

Results: The overall incidence of bile leak was 4.4% in the complete cohort but it was 6.0% (n = 16) in the open resection group and 3.4% (n = 15) in the laparoscopic group which was not statistically different in univariate analysis (p = 0.106). Tumor size and extent of resection appeared to be predictive of blood loss, transfusion rate and operative time. The bile leak group had significantly higher readmission rate (11.1% vs. 44.4%, p < 0.001) and a higher complication grade (Clavien–Dindo) (p < 0.003).

Conclusion: This study identified a lower than previously reported incidence of bile leaks. Regression analysis indicated obesity and size of resection as significant variables in the occurrence of leaks. This data serves as a clear indicator that a multi-institutional international study should be performed to further evaluate the impact of obesity, liver characteristics and technical aspects of transection.
MO 120
WANT TO KNOW THE BEST WAY TO TAKE CARE OF A HEPATECTOMY PATIENT? JUST ASK THEM
University of Texas, MD Anderson Cancer Center, Houston, TX, USA

Objective: To determine the optimal perioperative care strategy for hepatectomy patients by measuring patient-reported outcomes.

Methods: One-hundred seventy-four patients with liver malignancy were administered a validated patient reported outcomes tool before and after hepatectomy to assess symptom scores (core and GI-specific symptoms) and life interference ratings. The median age was 56 years (range: 22–98 yrs), 54% were male, and 94% were ASA score ≥3. 51 patients (29%) had 4 liver segments resected and 51 patients (29%) were operated with a minimally-invasive approach. Anesthetic approaches included epidural (94 pts, 54%), TAP block (63 pts, 36%), non-narcotic intraoperative IV analgesia (36 pts, 21%) and enhanced recovery protocol (ERP, 123 pts, 71%), consisting of non-narcotic oral analgesia, early feeding and early ambulation.

Results: The median length of hospital stay was 5 days (range: 1–19 days), with 11 patients (6%) experiencing major complications, including 1 patient (0.6%) with liver failure and 5 patients (3%) with postoperative bile leak. Within 90 days of surgery, 3 patients required reoperation, 3 were readmitted and there were no mortalities. In multivariate analysis, return to baseline for core symptoms was associated with LOS <6 days (OR: 2.78, p = 0.004) and absence of complications (OR: 2.63, p = 0.007), return of GI function was only associated with smaller magnitude of surgery (OR: 5.1, p = 0.001), and return to overall functional status was associated with absence of complications (OR: 2.32, p = 0.03) and ERP-directed care (OR: 2.29, p = 0.04).

Conclusion: Independent of surgical approach and perioperative anesthetic technique, patients report that the strongest predictor of rapid return to normal function after hepatectomy is management on an enhanced recovery protocol.

MO 121
THE IMPACT OF OPERATING ROOM SCHEDULING ON PERIOPERATIVE OUTCOMES AFTER PANCREATODUODENECTOMY
G. Karagkounis, A. Jarrar, G. Sharma, J. Hammel, R. M. Walsh and G. Morris-Stiff
Cleveland Clinic Foundation, Cleveland, OH, USA

Objective: Conventional wisdom holds that complex, often long cases such as pancreaticoduodenectomy (PD) benefit from early operating room (OR) scheduling due to the potential negative effects of surgical team fatigue on outcomes in late cases. The purpose of this study was to determine whether late scheduling was associated with increased complication rates after PD.

Methods: Patients who underwent PD at a single academic tertiary care center were included. Clinicopathological, demographic and perioperative data were collected. Cases were considered “early” if the operative start (incision) time was before 11 am and “late” if it was after. Possible associations between postoperative complications and start time, as well as other established predictors of perioperative morbidity, were assessed using chi-square and multivariable logistic regression.

Results: 210 patients (mean age 64.3 years) were included. 163 cases were “early” (77.3%) and 47 were “late” (22.7%). The preoperative characteristics of the two groups were comparable, with no difference in the Charlston co-morbidity index (mean score 5.07 for “early” patients and 5.72 for “late”, p = 0.46) or pathology (75.3% of “early” and 78.7% of “late” had malignant disease, p = 0.47). 148 patients developed complications. “Late” OR time was associated with decreased rate of complications (Odds Ratio 0.47, 95% Confidence Interval 0.24–0.92) on univariable analysis. This effect was maintained once other predictors of perioperative outcomes were adjusted for in multivariable models (OR 0.41, 95% CI 0.19–0.90).

Conclusion: These findings indicate that there is no adverse effect of late operating room scheduling on the perioperative outcomes of PD.

MO 123
MAKING PROGRESS IN PANCREATIC CANCER: IMPROVEMENTS IN SURVIVAL FOLLOWING RESECTION
A. Fisher, A. Salem, S. Campbell-Flohr, X. Wang, Y. Ma, D. Abbott, E. Winslow and S. Weber
University of Wisconsin, Madison, WI, USA

Objective: Pancreatic cancer is the third leading cause of cancer deaths in the United States with a rising number of diagnoses each year. With a changing patient population and improved understanding of factors contributing to survival, we sought to evaluate trends in treatment and outcome for patients with resected pancreatic adenocarcinoma.

Methods: The National Cancer Data Base (2004–2010) was used to identify patients with resected pancreatic adenocarcinoma. Trends in demographics, treatments, and clinical outcomes were evaluated and Cox multivariable regression models employed.

Results: A total of 28,192 patients were included, and there were no significant changes in the pathologic stage of disease over time (Table 1). 90-day peri-operative mortality declined steadily from 8.1% in 2004 to 7.6% in 2010.
(p = 0.015) and 3-year overall survival improved from 26.9% to 31.5% (p < 0.0001). The increase in survival was mirrored by increased use of chemotherapy (57.5% to 68.3%, p < 0.0001) and shift in percentage of cases performed at high volume centers (53.7% at top 2 quintiles in 2004 vs. 66.4% in 2010, p < 0.0001). On multivariable analysis, significant predictors of survival included surgery at higher volume centers (HR 0.87, 95% CI 0.84—0.90), receiving chemotherapy (HR = 0.65, 95% CI 0.62—0.67), R0 resection (0.65, 0.63—0.67), and vascular tumor extension (HR 1.2, CI 1.14—1.29).

**Conclusion:** Over the period from 2004 to 2010, survival improved following resection of pancreas cancer due to lower peri-operative mortality, increasing use of multimodal therapy, and increasing referral to high volume centers. Continued emphasis on these factors will likely continue to improve outcomes for patients with pancreas cancer.

**Table 1** Demographic, treatment, and outcome variables.

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<th>Year of diagnosis</th>
<th>p-value</th>
</tr>
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<td>2005 (n = 3469)</td>
</tr>
<tr>
<td>Age (Median)</td>
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</tr>
<tr>
<td>Sex (% Male)</td>
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</tr>
<tr>
<td>Race (%)</td>
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<td>Black</td>
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<tr>
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<tr>
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<td>pTNM (%)</td>
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<tr>
<td>Stage IV</td>
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<td>Vascular/colon tumor extension (%)</td>
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<td>Clinical outcomes</td>
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<td>Median survival (months)</td>
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<tr>
<td>3-yr survival (%)</td>
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<td>30-day mortality (%)</td>
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<td>90-day mortality (%)</td>
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<td>Treatment variables</td>
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MO 124
INCIDENCE AND IMPLICATIONS OF IMPAIRED GLYCEMIC CONTROL FOLLOWING DISTAL PANCREATECTOMY

A. Hallac, C. Brady, M. Rogers, G. A. Falk, R. M. Walsh and G. Morris-Stiff
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Objective: New onset Diabetes Mellitus (DM) is an important consequence of distal pancreatectomy (DP) partially due to preferential ß-cell location in the body and tail, and also the underlying pancreatic pathology. Understanding the frequency of this outcome may alter the treatment course for patients.

Methods: A prospectively maintained institutional pancreatic resection database was interrogated to identify all patients who underwent DP from 2005 through 2015. Pre and post-operative endocrine function, histopathology, demographics and pancreas resection volume were collected.

Results: 371 patients underwent distal pancreatectomy, 95 patients (25.6%) were diabetic preoperatively. New onset post-operative DM was diagnosed at a mean time of 614 months with an incidence of 14.18% (39/275), most commonly in patients with chronic pancreatitis (CP) and adenocarcinoma. DM was present pre-operatively in 26/51 of patients with CP (50.98%). The incidence of new onset post-operative DM in CP was 20% (5/25%). The prevalence of pre-operative DM in patients undergoing DP for adenocarcinoma resection was 32.85% (23/70). The incidence of new onset post-operative DM in patients with DP for adenocarcinoma resection was 29.78% (14/47). There was no statistically significant correlation between the incidence of post-operative DM and patient age or volume resected. The median BMI of patients with new onset post-operative DM was higher than those without post-operative DM (29.28 versus 26, P = 0.025).

Conclusion: Impaired glycemic control is common following DP, especially in those resected for chronic pancreatitis or cancer. There is a positive correlation between high BMI and the incidence of new onset DM and so this population requires additional vigilance.

MO 125
PREOPERATIVE NOMOGRAM TO PREDICT SURVIVAL FOR PATIENTS WITH RESECTABLE AND BORDERLINE RESECTABLE PANCREATIC CANCER

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Objective: Nomograms have been developed for patients with localized pancreatic cancer (PC) who undergo upfront surgery, but have not been developed for patients who have received alternative treatment sequencing to include neoadjuvant therapy. We sought to develop and internally validate a prognostic nomogram that predicts survival among patients who received neoadjuvant therapy prior to surgery.

Methods: Clinical data and survival outcomes of patients with PC who completed neoadjuvant therapy and surgery at a single institution were collected. Survival at 1-, 2-, and 3-years from the date of restaging after neoadjuvant therapy and prior to surgery were used for the purpose of nomogram construction. Concordance index (c-index) and calibration plots were used to assess predictive accuracy. Clinical stage was defined at the time of diagnosis as resectable or borderline resectable disease.

Results: The nomogram was developed from a cohort of 168 patients with resectable and borderline resectable PC. A parsimonious nomogram including clinical stage, preoperative CA19-9, and age predicted 1-, 2-, and 3-year survival with c-indices of 0.64, 0.64, and 0.65, respectively. The c-indices for 1-, 2-, and 3- years using the AJCC staging system were 0.58, 0.55, and 0.55, respectively. Clinical stage (HR: 2.32; 95% CI: 1.49–3.62) and preoperative CA19-9 levels (HR: 1.66; 95% CI: 1.08–2.58) were the strongest prognostic factors.

Conclusion: Prognostic nomograms utilizing clinical stage, preoperative CA19-9, and age provide more accurate survival prediction than the AJCC stage. This nomogram can be used to identify patients at high risk for early disease recurrence, prior to surgery. External validation will be performed to assess the nomogram’s generalizability.

MO 126
SURVIVAL OF BORDERLINE RESECTABLE PANCREATIC CANCER PATIENTS RECEIVING NEOADJUVANT THERAPY AND SURGERY

Medical College of Wisconsin, Milwaukee, WI, USA

Objective: Practice guidelines recommend NeoTx for patients with BRPCa. Here we report the survival of patients (pts) with BRPCa who received NeoTx prior to surgery.

Methods: Clinical data and survival outcomes of patients with PC who completed neoadjuvant therapy and surgery at a single institution were collected. Survival at 1-, 2-, and 3-years from the date of restaging after neoadjuvant therapy and prior to surgery were used for the purpose of nomogram construction. Concordance index (c-index) and calibration plots were used to assess predictive accuracy. Clinical stage was defined at the time of diagnosis as resectable or borderline resectable disease.

Results: The nomogram was developed from a cohort of 168 patients with resectable and borderline resectable PC. A parsimonious nomogram including clinical stage, preoperative CA19-9, and age predicted 1-, 2-, and 3-year survival with c-indices of 0.64, 0.64, and 0.65, respectively. The c-indices for 1-, 2-, and 3- years using the AJCC staging system were 0.58, 0.55, and 0.55, respectively. Clinical stage (HR: 2.32; 95% CI: 1.49–3.62) and preoperative CA19-9 levels (HR: 1.66; 95% CI: 1.08–2.58) were the strongest prognostic factors.

Conclusion: Prognostic nomograms utilizing clinical stage, preoperative CA19-9, and age provide more accurate survival prediction than the AJCC stage. This nomogram can be used to identify patients at high risk for early disease recurrence, prior to surgery. External validation will be performed to assess the nomogram’s generalizability.
Methods: Data regarding demographics, NeoTx, surgical outcomes, pathology and survival data were abstracted on consecutive pts with BRPCa, diagnosed between 2008 and 2016 and not enrolled in clinical trials. BRPCa was defined based on local tumor anatomy, pre-treatment CA19-9 >2000, presence of indeterminate radiographic lesions suspicious for metastases, or rarely, performance status concerns thought to be recoverable.

Results: NeoTx was given to 154 pts with BRPCa; 19 (12%) pts received chemoradiation, 13 (8%) chemotherapy, and 122 (79%) had both. Of the 154 pts, 92(60%) completed all NeoTx and surgery. Of the 92 resected patients, 65 [71%] underwent pancreaticoduodenectomy and vascular reconstruction was performed in 51 (60%) pts. Final pathology in the 92 pts demonstrated that 68 (74%) were node negative and 5 (5%) were margin positive. Median overall survival for all patients was 19 months; 30.8 months for the 92 pts who completed all therapy including surgery and 11.9 months for the 62 pts who underwent NeoTx but were not resected (p < 0.001). For the 92 pts, the two and three year survivals were 61% and 46% respectively.

Conclusion: Following NeoTx, surgical resection was performed in 60% of patients with BRPCa. Adaptive approaches to neoadjuvant therapy guided by objective biochemical and radiographic responses to therapy are needed to optimize NeoTx for BRPCa patients and better determine who should and should not undergo operation.

Objective: We postulate a disparity in pancreatic cancer treatment (surgery alone, surgery + chemotherapy ± radiation, and no surgery (chemotherapy ± radiation)) leads to adverse outcomes in certain groups.

Methods: We performed a retrospective review of Medicare-Surveillance, Epidemiology and End Results from 1973–2013. The association of socioeconomic and treatment disparities on 3-year overall survival was analyzed.

Results: We identified 11,412 patients with pancreatic adenocarcinoma (stage II/III, 5,504 (48.2%), stage IV, 4,816 (42.2%) and stage I, 1,092 (9.6%)). Three-year overall survival for stage II/III pancreatic cancer demonstrated surgery + chemotherapy ± radiation group has the greatest overall survival (Figure 1). Multivariate analysis of stage II and III pancreatic cancer demonstrated the surgery + chemotherapy ± radiation group had improved overall survival compared to the surgery alone ([OR] = 0.74 (0.69–0.78)), in addition, patients who did not undergo surgery had worse overall survival than patients who underwent resection ([OR] = 1.23 (1.15–1.13)). African Americans and patients older than 74 years receive significantly less surgery + chemotherapy ± radiation than Caucasians and patients younger than 74 years, ([OR] = 0.50; 95% CI, 0.37–0.68) and ([OR] = 0.56; 95% CI, 0.47–0.67), respectively. This disparity is reflected in their significantly worse survival ([OR] = 1.11; 95% CI (1.01–1.23) and ([OR] = 1.35 (1.27–1.43), respectively.

Conclusion: In this elderly cohort, this study identified disparities independently associated with pancreatic cancer survival; race, age, and treatment. Three-year overall survival for stage II/III pancreatic cancer is increased with surgery + chemotherapy ± radiation. To improve outcomes, increase accessibility, and limiting treatment choice to disease related factors should be sought even for elderly patients.

Figure 1 Association of different treatment modalities with overall survival for patients with stages II and III pancreatic adenocarcinoma.

MO 127
RACIAL AND AGE DISPARITIES IN PANCREATIC CANCER TREATMENT AND SURVIVAL
A. Scholer, O. Mahmoud, D. Gosh, R. Wieder, N. Adam and R. Chokshi
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MO 128
PREDICTORS OF FAILURE TO RESCUE AFTER PANCREATICODUODENECTOMY
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Drexel University College of Medicine, Philadelphia, PA, USA

Objective: Failure to rescue is a recently described outcome metric for quality of care. However, the predictors of failure to rescue have not been adequately investigated, particularly after pancreaticoduodenectomy. The aim of this study is to identify predictors of failure to rescue for patients after pancreaticoduodenectomy.

Methods: We reviewed all patients who developed a serious morbidity after pancreaticoduodenectomy from 2005 to 2012 in the ACS-NSQIP database. Logistic regression was used to identify preoperative and postoperative risks for 30-day mortality within the group from a development cohort (random 80% of the database). A score was created using weighted beta coefficients. The predictive accuracy was assessed on the validation cohort (the remaining 20%) using a receiver operator characteristic curve and calculating the area under the curve (AUC).

Results: The 30-day failure to rescue rate was 7.2% for patients who had serious morbidity after pancreaticoduodenectomy (n = 5,010). We identified 5 independent risk factors: age ≥ 65 and albumin ≤ 3.5 g/dL, preoperatively; and development of shock, renal failure, and reintubation, postoperatively. The score created from weighted beta coefficients had an AUC = 0.830 (95% CI, 0.771–0.890) when tested on the validation cohort. Using the score: 1*Albumin ≤ 3.5 g/dL + 2*Age ≥ 65 + 2*Shock + 5*Renal failure + 5*Reintubation, failure to rescue rates increase with increasing score (p < 0.001, Graph).

Conclusion: Failure to rescue rates have previously been shown to be associated with hospital factors. We show that failure to rescue rates are also associated with patient-specific factors, including preoperative albumin and age, and driven by specific major complications.

MO 129
TRANSDUODENAL AMPULLECTOMY FOR AMPULLARY NEOPLASMS - A SYSTEMATIC REVIEW AND META-ANALYSIS
M. Papoulas, P. Pucher, N. Pinsker, H. Abbas, A. Nawaz and M. Sodergren
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Objective: To assess the role of transduodenal ampullectomy (TDA) in the treatment of ampullary neoplasms.

Methods: Systematic review of Medline and PubMed to identify articles which reported TDAs for ampullary neoplasms. A meta-analysis to compare TDA and PD was performed by using Review Manager 5.3.

Results: Twenty-three studies fulfilled the inclusion criteria and included 382 patients that underwent TDA. Mean age was 65.2 years and median tumour size 2.28 cm. Overall morbidity was 27.5% and mortality 0.26%. Diagnostic accuracy of preoperative biopsy varied from 40 to 90%. The accuracy of intraoperative frozen section was 89%. Ninety-three percent of the patients had microscopically free margins. Adenocarcinoma was present in 25% of the cases (Tis and T1 83%) and the overall recurrence rate was 18% (n = 69). Twenty-two patients underwent salvage PD (5.8%) following TDA and another 23 patients had PD due to disease recurrence. Eight patients with inadequate local excision were not fit for PD. Mean duration of follow-up was 41.2 months and overall survival 87%. TDA was significantly associated with lower morbidity (RR 0.532, 95% CI = 0.306–0.925; p = 0.025), shorter operative time (SMD = -2.363, 95% CI = -2.839–1.887; p < 0.001) and less intraoperative blood loss (SMD = -1.24, 95% CI = -1.65–0.83; p < 0.001) when compared to PD.

Conclusion: TDA is a safe and feasible treatment for early stage ampullary cancer. TDA may be suitable for elderly patients with higher surgical risk. Intraoperative frozen section and periduodenal lymph node sampling are imperative.
<table>
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<th>Authors</th>
<th>Patient M:F</th>
<th>Gender</th>
<th>Mean Age</th>
<th>ASA Grade</th>
<th>Median Tumour</th>
<th>False negative</th>
<th>Diagnostic Frozen Section</th>
<th>Adenoma</th>
<th>Adenoma carcinoma</th>
<th>Morbidity (%)</th>
<th>Morbidity (%)</th>
<th>Mean Hospital Days</th>
<th>Disease Recu</th>
<th>Resection Mar</th>
<th>Overall PD</th>
<th>Additional PD</th>
<th>Blood Loss (ml)</th>
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<td>–</td>
<td>–</td>
<td>6.25</td>
<td>81.5</td>
<td>100%</td>
<td>30</td>
<td>–</td>
<td>–</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>–</td>
<td>4</td>
<td>29</td>
</tr>
<tr>
<td>Ahn et al, 2010</td>
<td>2</td>
<td>1,1</td>
<td>65</td>
<td>I</td>
<td>2.25</td>
<td>0%</td>
<td>100%</td>
<td>–</td>
<td>1</td>
<td>1</td>
<td>–</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>8.5</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Schneider et al, 2015</td>
<td>44</td>
<td>16,28</td>
<td>67</td>
<td>–</td>
<td>–</td>
<td>6.80%</td>
<td>93%</td>
<td>97.7%</td>
<td>40</td>
<td>37</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>37</td>
<td>2.2</td>
<td>10</td>
<td>1</td>
</tr>
<tr>
<td>Ceppa et al, 2013</td>
<td>41</td>
<td>16,25</td>
<td>57</td>
<td>–</td>
<td>–</td>
<td>6%</td>
<td>90%</td>
<td>23</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>5</td>
<td>0</td>
<td>42</td>
<td>0</td>
<td>10.1</td>
<td>37</td>
<td>4</td>
</tr>
</tbody>
</table>

**Operative tin:**

- Posner et al, 2001: n180 transfusion
- Beger et al, 1999: PD
- Dixon et al, 2005: 230ml
- Meneghetti et al, 2005: 4ml
- Genc et al, 2007: 150ml
- Shibata et al, 2010: 102ml
- Honda et al, 2010: 208ml
- Hoyela et al, 2010: 52ml
- Onkendi et al, 2014: 135ml
- Kim et al, 2011: 175ml
- Lee et al, 2016: 233ml
- Gao et al, 2016: 175ml
- Mathur et al, 2016: 255ml
- Schneider et al, 2015: 1ml
- Ceppa et al, 2013: 1ml
MO 130
USE AND ACCEPTANCE OF THE INTERNATIONAL STUDY GROUP FOR PANCREATIC FISTULA (ISGPF) CRITERIA IN SURGICAL LITERATURE
Brian P. Chen, Sean Bennett, Kimberly Bertens, Richard Mimeault, Fady K. Balaa and Guillaume Martel
University of Ottawa, Ottawa, Canada

Objective: The International Study Group for Pancreatic Fistula (ISGPF) developed a definition for postoperative pancreatic fistula (POPF) in 2005. The aim of this study was to determine the acceptance of the ISGPF definition and evaluate its use in surgical literature.

Methods: Two literature searches were performed to identify primary papers as well as review papers and textbooks published from 2006 to 2015. Papers were screened for inclusion via a two-stage screening process. Included primary papers were assessed for their definition of POPF and use of the ISGPF criteria, while review papers and textbooks were graded on a 4-point scale based on their definition of POPF: 0 – not defined, 1 – non-ISGPF definitions, 2 – ISGPF along with other definitions, 3 – only ISGPF.

Results: 264 primary papers and 90 reviews/textbooks were included. From 2006 to 2015, there was a significant increase in use of the ISGPF criteria in primary papers (p < 0.001) (Figure 1). Among studies that used the ISGPF criteria, 36% reported grades B and C separately and 14% reported only B and C. 88% of European papers used the criteria compared to 77% and 72% of Asian and North American papers, respectively (p = 0.033). 46% of reviews/textbooks did not define POPF. Among those that defined POPF, 74% cited the ISGPF definition while 22% used ISGPF along with other definitions.

Conclusion: The ISGPF criteria are widely used and accepted as the standard for defining POPF. Many authors emphasize clinically relevant grades in their reporting while some omit grade A altogether, placing the importance and utility of grade A fistulas in question.

Figure 1 Use of ISGPF criteria for POPF by year.

MO 132
NEOADJUVANT FOLFOX + NAB-PAACLITAXEL (FOLFOX-A) IN LOCALLY ADVANCED PANCREATIC CANCER
Sydney Radding, Asha Zimmerman, Howard Safran, Rimini Breakstone, Kalyan Mantripragada, Kara Leonard and Kevin Charpentier
Brown University, Pawtucket, RI, USA
**Objective:** A phase I study recently conducted at our institution using FOLFOX and Nab-Paclitaxel in patients with advanced pancreatic cancer (11 locally advanced, 24 metastatic) determined the maximum tolerated dose of Abraxane with FOLFOX to be 150 mg/m² every 2 weeks. We present a subset analysis of eleven patients with locally advanced disease treated with FOLFOX-A.

**Methods:** We conducted a subset analysis of patients with biopsy confirmed locally advanced pancreatic cancer between November 2012 to September 2014 who were treated with FOLFOX-A in a prospective phase 1 dose escalation trial. Outcomes evaluated were conversion to operative resection, resection margin negativity and operative morbidity.

**Results:** Four of 11 (36.3%) patients with locally advanced disease were able to undergo resection following study treatment: pancreaticoduodenectomy (3), subtotal pancreatectomy, (1). Median follow-up time was 18 months. An R0 resection was achieved in 4/4 patients. Patients receiving neoadjuvant FOLFOX-A had a high rate of complications: chyle leak (1), GI bleed (1), pancreatic leak (2) and high EBL (500–1600 cc). There were no operative mortalities. Reoperation was required in 1 patient for portal vein thrombosis. Two of 4 patients remain alive, one without evidence of disease.

**Conclusion:** FOLFOX-A shows promise as a novel neoadjuvant therapy for locally advanced pancreatic cancer. We are currently conducting a phase II prospective trial of Neoadjuvant FOLFOX-A for locally advanced pancreatic adenocarcinoma to better define patient survival and operative morbidity.

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**MO 133**

**ESTIMATED BLOOD LOSS AND BLOOD TRANSFUSION ARE SIGNIFICANT PREDICTORS OF HOSPITAL LENGTH OF STAY AND LONG-TERM SURVIVAL IN PATIENTS UNDERGOING PANCREATECTOMY**

T. Newhook, F. Turrentine, G. Stukenborg, N. Pope, M. Mullen, V. Zaydfudim, R. Adams and T. Bauer

**University of Virginia, Charlottesville, VA, USA**

**Objective:** To evaluate the predictive relationship of intraoperative estimated blood loss (EBL) and blood transfusion (BT) on perioperative outcomes and survival for patients undergoing pancreaticoduodenectomy (PD) and distal pancreatectomy (DP).

**Methods:** Data for 517 patients undergoing pancreatectomy (PD = 366, DP = 151) from a prospectively-collected HPB database were matched to the local NSQIP database. 177 patients had a diagnosis of pancreatic ductal adenocarcinoma (PDAC). The statistical relationship between EBL, BT and outcomes was assessed for PD, DP and PDAC patients using proportional hazards regression for survival, linear regression for length-of-stay (LOS), and logistic regression for occurrence of serious morbidity.

**Results:** EBL was associated with significantly longer LOS following PD or DP. Patients with PD in the highest EBL quintile (>850 cc) had mean LOS 4.1 days longer than the lowest (<200 cc) quintile (14.4 vs 10.3 days, p = 0.01). Patients with DP with EBL above median (>300 cc vs <300 cc) had mean LOS 2.3 days longer (8.3 vs 6.0 days, p = 0.04). EBL was a significant predictor of survival following PD - patients with EBL above median (>400 cc vs <400 cc) had significantly higher risk of death (Hazard Ratio (HR) = 1.4; p = 0.04). BT was a significant predictor of survival in the PDAC subset. In multivariable analysis with adjustment for PDAC stage of disease, patients with BT had significantly increased risk of death (HR = 1.5, p = 0.02) compared to patients without transfusion.

**Conclusion:** EBL with or without BT is a significant predictor of hospital LOS and long-term survival in patients undergoing pancreatectomy. Techniques aimed at minimizing blood loss will likely lead to improved short-term and long-term outcomes.

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**MO 134**

**PRACTICE PATTERNS OF OPERATIVELY PLACED DRAINS FOLLOWING PANCREATEDUODENECTOMY: TOO MUCH VARIATION**

J. Beane, M. House, E. Ceppa, S. Dolejs, B. Zarzaur and H. Pitt

**Indiana University School of Medicine, Indianapolis IN, USA**

**Objective:** Early drain removal, when guided by POD#1 drain fluid amylase (DFA-1), is associated with reduced rates of clinically relevant postoperative pancreatic fistula (CR-POPF) and abdominal complications following pancreateoduodenectomy (PD). However, whether surgeons have altered their management strategy based on these findings is unknown. Our aim is to report current practice patterns and management of intraoperatively placed drains following PD in a large, national cohort.

**Methods:** The American College of Surgeons-National Surgical Quality Improvement Program (ACS-NSQIP) Participant Use File for 2014 was queried to identify patients having undergone PD (n = 3,069). Patients with intraoperatively placed drains were stratified according to the day of drain removal. Use of DFA as part of the management strategy and outcomes were recorded.

**Results:** Of 2698 patients, only 580 (21.5%) of patients had a DFA-1 recorded and 626 (23.2%) patients never had a DFA analyzed in the postoperative period. The use of DFA-1 varied based on timing of drain removal. Outcomes following Early (day 1–3; n = 207, 7.7%), Routine (days 4–7; n = 1,131, 41.9%), Delayed (days 8–14; n = 498, 18.5%), Late (days 15–28; n = 292, 10.8%), and Very Late ≥29 days (n = 293, 10.9%) day of drain removal are shown in the table.

**Conclusion:** Significant variation exists in the use of drain fluid amylase in the management and timing of surgical drain removal following pancreateoduodenectomy. Using an evidence based approach to the management of drains has the potential to improve postoperative outcomes and should be implemented in the care of these patients.

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**HPB 2017, ■ (■), 1–69**
MO 135
POSTOPERATIVE PROGNOSTIC NUTRITIONAL INDEX PREDICTS THE PROGNOSIS OF RESECTED PANCREATIC CANCER
Shizuoka Cancer Center, Shizuoka, Japan

Objective: To investigate the impact of post-PNI on the postoperative survival after pancreatectomy for pancreatic cancer.

Methods: A total of 346 patients who underwent pancreatic resection between January 2007 and December 2015 were included in this retrospective study. Onodera's PNI, calculated as 10α—albumin (g/dl) + 0.005α—total lymphocyte count (per mm3) was used in this study. Multivariate analysis was performed to evaluate the postoperative prognostic factors for pancreatic cancer. Relationship between pre- and intra-perioperative factors and post-PNI was investigated.

Results: Multivariate analysis identified lymph node metastasis (hazard ratio (HR): 2.74, p < 0.001), lack of adjuvant chemotherapy (HR = 1.94, p < 0.001), CA19-9 value >300 U/ml (HR = 1.64, p = 0.001), and post-PNI <43 (HR = 1.48, p = 0.012) as significant prognostic factor for overall survival. Median survival time of patients with post-PNI <43 was 15.6 months, whereas that of patients with post-PNI >43 was 29.8 months, respectively. The risk factors of low post-PNI were preoperative PNI (pre-PNI) <43 (odds ratio (OR) = 4.51, p < 0.001), procedure (pancreateoduodenectomy) (OR = 4.48, p = 0.002), age >73 years old (OR = 2.55, p = 0.002), blood loss >1000 ml (OR = 20.13, p = 0.005), and dissection of nerve plexus around superior mesenteric artery (OR = 2.38, p = 0.008), respectively.

Conclusion: The post-PNI (but not pre-PNI) was a significant prognostic factor of resected pancreatic cancer.

MO 136
PREOPERATIVE REMNANT LIVER FUNCTIONAL ASSESSMENT IN MAJOR HEPATECTOMY AFTER PORTAL VEIN EMBOLIZATION USING 99MTC-GSA SCINTIGRAPHY /3D-CT FUSED IMAGING
Satoshi Kairara, Sena Iwamoto, Kenji Uryuhara and Ryo Hosotani
Kobe City Medical Center General Hospital, Kobe, Japan

Objective: The objective of this study was to elucidate the utility of Tc-99m-diethylenetriamine-penta-acetic acid-galactosyl human serum albumin (99mTc-GSA) scintigraphy/3D-CT fusion imaging for remnant liver function assessment in major hepatectomy after portal vein embolization (PVE).

Methods: From 2012 to September 2016, eleven patients who underwent major hepatectomy for various indications after right PVE were retrospectively analyzed. 3D-CT volumetry and 99mTc-GSA were performed before and after PVE. Indocyanine green plasma clearance rate (KICG) value was also examined and remnant % volume KICG (rem%V = KICG × 3D-CT volumetric rate) and remnant functional % KICG (rem%F = KICG × 99mTc-GSA/3D-CT fused imaging functional rate) were calculated. Optimal hepatectomy was performed when rem%F < 30%.

Results: The rem%V increased from 33.4 to 46.5, and the increment was 29.1%. The rem%F was also increased from 30.6 to 45.5, and the increment was 49.7%. The increment was 20.6% higher in the rem%F compared with rem%V (P < 0.01). Two cases of right trisectionectomy and 8 cases of right hepatectomy were performed according to rem%F criteria. In a case, right hepatectomy was abandoned due to the rem%F was under 0.05 after PVE, bisegmentectomy (S7-8) was undergone based on the criteria. Duration of postoperative hospitalization was 12.5 (7–96) days.

One case has failed in Clavien – Dindo grade IIIb, and another one case has failed in grade A posthepatectomy liver failure. There was no peri-operative mortality.

Conclusion: 99mTc-GSA/3D-CT fused imaging can estimate accurate future remnant liver function and suitability for major hepatectomy after PVE.
MO 138
HEPATIC ARTERY RECONSTRUCTION DURING LIVER RESSECTION FOR HEPATOBILIARY MALIGNANCY
A. Hemming, J. Berumen, J. Sicklick, D. Hemming and K. Mekeel
University of California, San Diego, La Jolla CA, USA

Objective: Hepatic arterial reconstruction, remains controversial during liver surgery. This study assesses the utility, and safety of hepatic arterial reconstruction during liver resection for malignancy.

Methods: 30 patients undergoing liver resection with hepatic arterial reconstruction between 2000 and 2016 were reviewed. Median patient age was 54 years. Resections were carried out for cholangiocarcinoma in 18 patients, gallbladder adenocarcinoma in 9 and recurrent adenocarcinoma and recurrent hepatocellular carcinoma in two and one patient respectively. Resections performed were left trisectionectomy (8) right trisectionectomy (7), left hepatectomy (7) segment 4B, 5 (4) and right hepatectomy (4). Arterial reconstructions performed were: Proper hepatic artery (PHA) to PHA (7), PHA to Right HA (RHA) (6), common HA to PHA (5), Replaced RHA to Replaced RHA (4), RHA to right posterior HA (3), PHA to left HA (1), left HA to RHA (1) and gastro-duodenal to RHA (2) or LHA (1). 27 patients had resection of the extrahepatic bile duct with 8 patients also requiring pancreaticoduodenectomy. Portal vein resection was required in 7 patients.

Results: There was a 3 %, 90 day operative mortality with the single death from liver dysfunction. All vascular reconstructions were patent at 30 days. Overall morbidity was 46%. Median survival was 35 months (95% CI 13–60 months) with a five-year actuarial survival of 21%. Negative margins were achieved in 85% of cases.

Conclusion: Resection of the hepatic artery during liver resection can be performed safely. Long term survival is possible.

MO 139
IMPROVED SURVIVAL FOLLOWING HEPATECTOMY PERFORMED AT LIVER TRANSPLANT CENTERS: ANALYSIS OF A STATE POPULATION
D. Hashimoto, Y. Bababekov, S. Stapleton, K. Lillemoe, D. Chang and P. Vagefi
Massachusetts General Hospital, Boston, MA, USA

Objective: Volume-outcomes relationships (VOR) for specific operations have been described, but little is known about the impact of similar procedures on VOR. We aimed to assess the impact of hospital experience in liver transplantation on mortality after hepatectomy.

Methods: The New York (NY) Statewide Planning and Research Cooperative System (SPARCS) inpatient database was utilized. All patients over the age of 18 years who underwent wedge hepatectomy or lobectomy from 2000 to 2014 were included. Liver transplant centers were identified as those who had a recipient liver transplant coded at their institution during the study period. Primary endpoint was inpatient mortality. Adjusted analysis accounted for age, race, payer status, Charlson Comorbidity Index (CCI), cirrhosis, viral/alcoholic hepatitis, hepatic malignancy (primary vs. secondary tumor), need for biliary-enteric reconstruction, and hospital hepatectomy volume.

Results: A total of 13,485 hepatectomies were performed from 2000 to 2014 in the state of NY with a mean inpatient mortality of 2.35% (± 15.1% SD). Of these, 86.6% of hepatectomies were performed at liver transplant centers. Increased hospital hepatectomy volume was associated with a decrease in mortality. Adjusted analysis revealed hepatectomy performed at liver transplant centers was associated with a 33% decreased risk of mortality (OR 0.67, 95%CI 0.48–0.94, p = 0.02).

Conclusion: Hepatectomy performed at a liver transplant center is associated with a decreased risk of inpatient mortality. Further investigation into hospital factors such as staffing and organization may reveal systemic practices that can be applied to non-transplant centers to promote patient survival.
Table 1 Comparison of hepatectomy patients at liver transplant centers and non-liver transplant centers. Values presented as median (interquartile range) unless otherwise noted. Alpha set at p=0.05.

<table>
<thead>
<tr>
<th></th>
<th>Transplant (n = 11,680)</th>
<th>Non-Transplant (n = 1,805)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>58 (48,68)</td>
<td>63 (53,71)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Female gender</td>
<td>5851 (50.1%)</td>
<td>958 (53.1%)</td>
<td>0.02</td>
</tr>
<tr>
<td>CCI</td>
<td>6 (3,9)</td>
<td>8 (4,9)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Cirrhosis</td>
<td>2205 (18.86%)</td>
<td>187 (10.38%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Biliary</td>
<td>1040 (6.24%)</td>
<td>57 (3.16%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Liver tumor</td>
<td>4713 (28.26%)</td>
<td>225 (12.46%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Adjusted mortality OR (95% CI)</td>
<td>0.67 (0.48, 0.94)</td>
<td>1.00 (N/A)</td>
<td>0.02</td>
</tr>
</tbody>
</table>

MO 140
BREAST CANCER LIVER METASTASES IN A UK TERTIARY CENTRE: OUTCOMES FOLLOWING REFERRAL TO TUMOR BOARD MEETING

King’s College Hospital, London, United Kingdom

Objective: To assess the outcomes from multidisciplinary board meetings (MDM) for patients with breast cancer liver metastases (BCLM) and identify prognostic factors for survival.

Methods: A retrospective review of MDM records for patients referred with BCLM to a tertiary center between 2005 and 2016. Patient demographics, disease factors and intervention type were analyzed to find predictive factors for overall survival.

Results: 51 patients with BCLM with a median age of 55 yrs (range: 26–94) were referred to the MDM of whom 35 (92.1%) had an original diagnosis of ductal carcinoma. Treatment pathways included surgical resection (n = 19), radiofrequency ablation (RFA, n = 10), or chemotherapy (n = 22).

Surgical resection resulted in an improved median overall survival compared to chemotherapy (48 v 16 months; p < 0.001). RFA showed comparable survival benefit (42.5 v 16 months; p = 0.002). Resection and RFA showed no significant difference in survival over one another (48 v 42.5; p = 0.731). Survival analysis identified that resection (p = 0.002) and RFA (p = 0.004) were associated with improved overall survival compared to chemotherapy.

Univariate analysis identified the following negative prognostic factors for overall survival: extrahepatic metastases (HR = 3.43; p = 0.031), lack of response to chemotherapy (HR = 6.02; p = 0.017) and chemotherapy only compared to resection (HR = 2.59; p = 0.006). Bone metastases were not associated with reduced survival (HR = 2.83; p = 0.51). Multivariate analysis confirmed extrahepatic disease as a prognostic factor (HR = 5.76; p = 0.037).

Conclusion: Surgical resection of BCLM may improve the overall survival in selected patients groups. This study identifies a cohort of patients, without extrahepatic disease and responsive to chemotherapy, who may particularly benefit from surgery.

MO 141
RISK FACTORS AND COSTS ASSOCIATED WITH HEMODIALYSIS AFTER LIVER TRANSPLANT

N. Cortolillo, A. Castillo, J. Parreco and S. Orloff
University of Miami, Lake Worth, FL, USA

Objective: Renal failure (RF) is a known complication after liver transplantation (LT), now seen more commonly in the MELD era. True incidence, cost and factors associated with it are not well known.

Methods: The Nationwide Readmission Database for 2013 was queried for patients over 18 years of age undergoing LT.

Results: 2,638 patients undergoing LT and 450 (17.1%) patients required dialysis during the initial admission. The weighted mean cost of admission for patients requiring dialysis was $462,250 (±325,877) versus $306,358 (±371,050) for all others (p < 0.01, 95% CI = −118,444). During the initial admission, 102 (3.9%) patients died. Of the survivors 43.6% had a nonelective readmission with 80 (7.2%) requiring dialysis. Factors associated with dialysis at the initial admission were Charlson comorbidity score >5 (OR 7.31, p < 0.01, 95% CI 5.49 to 9.74), LOS >30 days (OR 5.14, p < 0.01, 95% CI 4.04 to 6.55), and Hep C (OR 1.56, p < 0.01, 95% CI 1.20 to 2.01). Variables associated with reduced risk were primary hepatic malignancy (OR 0.20, p < 0.01, 95% CI 0.14 to 0.28) and hospital in the lowest quartile for transplant volume (OR 0.50, p = 0.02, 95% CI 0.28 to 0.90). The factors associated with an increased risk for dialysis at readmission were initial LOS >30 days (OR 3.61, p < 0.01, 95% CI 1.28 to 5.96) and dialysis at initial admission (OR 2.20, p < 0.01, 95% CI 1.29 to 3.75). The only protective factor was primary liver malignancy (OR 0.44, p = 0.03, 95% CI 0.22 to 0.91).

Conclusion: For the high MELD LT, careful monitoring renal protective interventions are warranted.

MO 142
IN VIVO STUDY ON THE FEASIBILITY OF A SINGLE NEEDLE ELECTRODE TO PERFORM IRREVERSIBLE ELECTROPORATION (IRE) IN HEPATIC TISSUE

Carolina Medical Center, Charlotte, NC, USA
Objectives: Irreversible electroporation (IRE) is an alternative to thermal tissue ablation in situ. Current irreversible electroporation (IRE) systems require cardiac synchronization and paralytics, and ≥ 2 electrodes to be placed using an open approach. We sought to develop a single needle high-frequency irreversible electroporation (H-FIRE) system, used in conjunction with external dispersive electrodes (grounding pads), to perform hepatic ablations in vivo.

Methods: Swine were anesthetized, a midline laparotomy performed, and the liver exposed. An H-FIRE electrode was inserted into the parenchyma and 2 dispersive electrodes were placed on the hind limbs. In the absence of paralytics or cardiac synchronization H-FIRE pulses (100 or 300) were delivered (2250 V, pulse length 0.5, 1, or 2 μs) for 50 or 100 μs (on-time). 6 Hrs later the animal was euthanized and tissue resected/analyzed.

Results: 16 independent H-FIREs were performed in 3 separate animals. No ECG abnormalities or changes in vital signs occurred during H-FIRE. Minor twitching of the rectus abdominis and muscles near the dispersive electrodes were recorded during H-FIRE. Average ablation diameter was 10.50 ± 0.35 mm, and histological analysis demonstrated absence of significant damage to vascular and biliary structures concomitant with a lack of coagulative necrosis. Immunohistochemical analysis demonstrated cell death was predominantly apoptotic, with minor necrotic cell death adjacent to the electrode.

Conclusion: H-FIRE can be safely delivered via a single electrode to create reproducible hepatic ablations in vivo, while preserving underlying hepatic architecture. Optimizing pulse delivery should increase ablation size and reproducibility, and a single electrode system opens the possibility for development toward laparoscopic use.

MO 144
A PROPENSITY MATCHED SURVIVAL ANALYSIS COMPARING TREATMENT STRATEGIES FOR STAGE B AND C HEPATOCELLULAR CARCINOMA

Alvaro Castillo, Joshua Parreco, Willscott E. Naugler, Kenneth J. Kolbeck, Khashayar Farsad, Susan L. Orloff, Kevin G. Billingsley and C. Kristian Enestvedt
Oregon Health and Science University, Atlantic, OR, USA

Objective: Contemporary analyses evaluating stage B and C patients have been limited by selection bias when deciding on treatment strategy. We proposed a propensity matched analysis to overcome this bias.

Methods: Patients presented at a tertiary referral center’s multidisciplinary liver tumor conference with HCC stage B and C were evaluated for years 2009 to 2014. Three propensity matched models were created with one to one matching. Model groupings included patients undergoing radioembolization with Yttrium 90 (Y90) and transcatheter arterial chemoembolization (TACE), another for Y90 alone and TACE alone. The propensity scores were calculated using age, gender, race, Barcelona Clinic liver cancer stage, Child-Pugh score, Eastern Cooperative Oncology Group performance status, alpha fetoprotein level, bilirubin level, platelet count, radiation treatment, and hepatic resection.

Results: There were 130 patients presented during the study period, 31 (23.8%) patients underwent Y90 and TACE, 17 (13.1%) patients underwent Y90 alone, and 57 (43.8%) underwent TACE alone. The mean follow up was 21.8 ± 17.1 months. After propensity matching, the odds ratio for mortality in patients undergoing Y90 and TACE was 0.21 (p < 0.01, 95% CI 0.07 to 0.68), Y90 alone was 0.24 (p = 0.10, 95% CI 0.04 to 1.43), and TACE alone was 4.00 (p = 0.02, 95% CI 1.15 to 13.95).

<table>
<thead>
<tr>
<th>Age</th>
<th>Priv INS</th>
<th>Male</th>
<th>HTN</th>
<th>DM</th>
<th>ASA</th>
<th>Obese</th>
<th>Cancer</th>
<th>1CU</th>
<th>Compns</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;70</td>
<td>50.9</td>
<td>59%</td>
<td>43%</td>
<td>50%</td>
<td>22%</td>
<td>2.8</td>
<td>26%</td>
<td>52%</td>
<td>39%</td>
</tr>
<tr>
<td>&gt;70</td>
<td>75.0</td>
<td>5%</td>
<td>52%</td>
<td>78%</td>
<td>37%</td>
<td>3.0</td>
<td>35%</td>
<td>79%</td>
<td>62%</td>
</tr>
</tbody>
</table>

| p-value | <0.001 | <0.001 | 0.059 | <0.001 | 0.001 | 0.001 | 0.036 | <0.001 | <0.001 | <0.001 |

MO 143
OUTCOMES OF LIVER RESSECTION IN THE ELDERLY POPULATION

A. Volk, D. Pointer, A. Hauch, L. Boehm, L. DeCesare, E. Wynter and J. Buell
Tulane University, New Orleans, LA, USA

Objective: Several small studies have examined the morbidity and mortality of liver resection in elderly patients over 70 years of age. Each has identified an increased rate of complications, however few have investigated the etiology of their morbidity and mortality.

Methods: Retrospective analysis of 703 liver resections identified 125 elderly patients 70 years or older. Their outcomes were compared to those younger than 70 years of age. Data was analyzed for complications and specifically to evaluate the impact of a laparoscopic approach using SPSS.

Results: The elderly cohort had an equivalent 90-day mortality rate (2.4% vs. 1.4%; p = 0.407) but a higher incidence and grade of complications (p = 0.001), particularly pulmonary (p = 0.006). Univariate analysis for complications identified age as a significant variable but this was lost in a stepwise multivariate regression. The final model identified ASA (p = 0.020), and transfusions (p < 0.001). An additional regression for mortality identified ASA (p = 0.014), varcies (p < 0.001), and ascites (p = 0.040) as significant variables. Similarly, laparoscopy was initially identified in univariate analysis but lost its significance in the final model and failed to identify a reduction in complications.

Conclusion: Hepatic resection in the elderly carries a significant morbidity arising from the patients’ chronologic and physiologic age. This is a surrogate for the patients’ comorbidities, including hypertension, diabetes and obesity that underlie their preoperative ASA score. This is only reinforced by the equivalence in complication rates between the open and laparoscopic group leading us to presume patient selection and in particular the patients’ “physiologic age” is the only method to reduce postoperative morbidity and mortality.
**Conclusion:** When controlling for patient and tumor characteristics, those undergoing both Y90 and TACE showed improved survival. Y90 alone showed no difference in survival when compared to TACE alone. This latter group had the poorest overall survival. While broader utilization of TACE with Y90 might be indicated, prospective studies are needed.

**MO 145**

**KINETIC ANALYSIS OF CONTRALATERAL LIVER HYPERTROPHY FOLLOWING RADIOEMBOLIZATION OF PRIMARY AND METASTATIC LIVER TUMORS**

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**Objective:** To examine and characterize the kinetics of contralateral liver regeneration following transarterial radioembolization (RE) of liver tumors.

**Methods:** A retrospective study (2010-2014) of treatment-naive patients with primary or metastatic liver disease undergoing single selective RE (yttrium-90 glass microspheres) to the entire right lobe was performed. Patients were followed prospectively with CT volumetry at 1, 3, and 6 months post-procedure. Outcomes of interest were left lobe (future liver remnant FLR) degree of hypertrophy (DH), kinetic growth rate (KGR), and the proportion of patients reaching an FLR > 40%. A mixed-effects model was used to calculate predicted means in the outcomes, based on each patient’s exact volumetry at corresponding time contributions. ANOVA was used to compare differences in means over time. Time to event analysis was performed to estimate proportion of patients reaching the goal FLR.

**Results:** 25 patients met inclusion criteria. Median dose of RE was 132 Gy (range 102-258). Mean DH and relative growth at 1, 3, and 6 months were 3%, 7%, and 12% (p < 0.01), and 12%, 29%, and 39% (p < 0.01), respectively. Mean KGR was 0.48% per week with no difference between time periods. With a median contribution time per patient of 6.3 months, the median time to reach goal FLR was 4.6 months (IQR 0–8.3), with 75% accomplishing FLR > 40% at 8 months.

**Conclusion:** RE induces hypertrophy of the contralateral lobe, although at a lower rate than existing methods. The role of RE as a neoadjuvant therapy and contralateral liver hypertrophy strategy for selected patients needs to be studied.

**MO 146**

**THE ASSOCIATION BETWEEN CONTINUATION OF SYSTEMIC CHEMOTHERAPY FOLLOWING PORTAL VEIN EMBOLIZATION AND ADVANCEMENT TO RESECTION IN PATIENTS WITH COLORECTAL CANCER LIVER METASTASES**

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**Objective:** To investigate the rate and risks for failure to proceed to curative-intent resection in patients with colorectal liver metastases (CRCLM) undergoing portal vein embolization (PVE).

**Methods:** Retrospective review of CRCLM patients undergoing PVE over a 5-year period (Aug 2011–July 2016). The primary outcome was failure to proceed to curative-intent resection. Logistic regression was applied to evaluate risk factors.

**Results:** 65 patients with CRCLM underwent PVE. Decision to proceed to resection was made by one of five hepatobiliary surgeons. Mean age was 62 years and 66.15% were male. 84.6% had synchronous disease, 66.15% had bilobar disease, and 18.5% had extrahepatic disease. 95.4% underwent pseudoneoadjuvant chemotherapy, with 52.3% receiving chemotherapy within a month following PVE.

29/65 (44%) patients did not proceed to resection: 11 (37.9%) due to intrahepatic progression, 6 (20.7%) due to extrahepatic progression, 6 (20.7%) due to inadequate functional liver remnant, and 6 (20.7%) for other reasons. On univariate analysis, patients undergoing chemotherapy post-PVE were more likely to proceed to curative intent resection (OR 1.72 [0.64–4.62]), however this association was not statistically significant (p = 0.28). There were no significant associations between advancement to resection and presence of synchronous disease (OR 0.8 [0.20–3.15], p = 0.75), extrahepatic disease (OR 0.33 [0.087–1.22], p = 0.098), or bilobar disease (OR 0.80 [0.28–2.25], p = 0.667).

**Conclusion:** In this cohort, there was a high rate of failure to proceed to resection following PVE. There was a trend towards advancing to resection when chemotherapy was continued following PVE, however this was non-significant. Further study of systemic and locoregional therapies in the peri-PVE period is warranted.

**MO 147**

**ASSESSMENT OF CONTROL, SURVIVAL, AND LIVER FUNCTION PRESERVATION FOR HEPATOCELLULAR CARCINOMA PATIENTS WITH CHILD PUGH-A CIRRHOSIS TREATED WITH definitive STEREOTACTIC BODY RADIOTHERAPY**

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**Objective:** Our retrospective data reflects the control, overall survival (OS), hepatic failure-specific survival (HFSS) and freedom from Child Pugh(CP) progression (FCPP) in CP-A patients treated with stereotactic body radiotherapy (SBRT) for non-metastatic Hepatocellular Carcinoma (HCC).

**Methods:** From 2009 to 2016, 38 patients with 47 HCC lesions and CP-A cirrhosis completed SBRT in this IRB approved study. Median dose was 45 Gy in 5 fractions. Local response via triple phase CT/MRI and CP scores were recorded every 3–6 months after SBRT. Median follow-up was 21 months.
MO 148
THE TREATMENT STRATEGY FOR INCIDENTAL GALLBLADDER CARCINOMA WITHOUT EXCESS AND INSUFFICIENCY

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Objective: Radical surgery is essential for the favorable result in patients with gallbladder cancer. From this point of view, the treatment strategy for incidental gallbladder carcinoma (IGBC) is a significant issue, however, it is still controversial.

The present study retrospectively analyzed the clinicopathological features upon the additional radical surgery without excess and insufficiency for IGBC.

Methods: From April 2000 to July 2016, 2,145 patients underwent cholecystectomy. In these, 19 cases were accidentally diagnosed as gallbladder cancer (0.88%). Operative and clinicopathological factors associated with prognosis were evaluated.

Results: The additional radical surgery was performed in 8 cases. In two T1 patients, T1a (m) patient received cystic duct resection, and T1b (mp) patient did liver bed resection with lymphadenectomy. In six T2 (ss) patients, cystic duct resection, cystic duct resection with lymphadenectomy, and cystic duct resection with liver bed resection and lymphadenectomy performed in each 2 cases. Three T2 patients without additional surgery and one T3a patient died of recurrence. In the other cases, there is no evidence of recurrence so far. In the cases that received additional liver bed resection, the margin of gall bladder resection was negative for cancer cells. These patients survived without recurrence. T1 or T2 with additional surgery cases showed a significant better survival rate compared with the other cases (P = 0.0181).

Conclusion: In T2 stage IGBC, the additional radical surgery is strongly recommended. However, additional liver bed resection should not be necessary, if the margin of gall bladder resection is negative for cancer cells.
MO 150
UTILIZATION OF IDIOPATHIC THROMBOCYTOPENIA PURPURA LIVER DONORS: CASE REPORT AND REVIEW OF THE LITERATURE
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Objective: Thrombocytopenia secondary to idiopathic thrombocytopenia purpura (ITP) resulting in intracranial hemorrhage and death is a source of potential liver allografts for transplantation (LTX). Transmission of donor-derived anti-platelet antibody resulting in recipient thrombocytopenia is termed Transplantation-Mediated Alloimmune Thrombocytopenia (TMAT). To date, no clear consensus has emerged on the appropriateness of these organs for transplantation. Our objective is to report a case of TMAT within the context of a 5 patient series we have obtained and provide an algorithm for the safe utilization of ITP donors based upon the current literature.


Results: An ITP donor (platelet count 2000/μl) was transplanted in a critically ill recipient (intensive care unit, MELD 33) who developed TMAT, as evidenced by thrombocytopenia (platelet count < 10,000/μl) and detection of serum anti-platelet antibody for glycoprotein IIb/IIIa, Ib/IX, and Ia/IIa antibodies. A heparin-induced thrombocytopenia assay was negative. Within 5 days post-LTX, the patient experienced thrombocytopenia, petechiae, and a small area of cerebral parenchymal hemorrhage on CT scan but was successfully treated with corticosteroids, gamma-globulin, basiliximab, and judicious platelet transfusion with resolution of thrombocytopenia and clearance of anti-platelet antibody within 21 days of LTX. A clonal origin, rather than passive antibody transfer, was suggested by early anti-platelet antibody screenings that were negative pre-LTX and immediately post-LTX. These results were expected based on our clinical series.

Conclusion: ITP donors can be used for LTX. We have developed a clinical algorithm, based upon the donor’s response to therapy, that predicts post-LTX success.

MO 48
EFFICACY OF NEGATIVE PRESSURE WOUND VACUUMS IN PREVENTING SURGICAL SITE INFECTIONS AFTER WHIPPLE PROCEDURES
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Objective: Surgical site infections (SSI) occur at an average rate of 19.8% after Whipple procedures per NSQIP data. In adherence to NSQIP recommendations wound protector use and glove change prior to closing is routine. This study seeks to evaluate the efficacy of using negative pressure wound vacuums (NPWV) over closed incision sites after a Whipple procedure to prevent SSI formation.

Methods: We retrospectively examined consecutive patients from January 2014-July 2016 who met criteria of completing single stage Whipple procedures with full primary closure performed by a single surgeon at a single institution. Data was analyzed with two-tailed t-test and multivariate logistic regression.

Results: 61 patients were included divided between two cohorts: Traditional dressing (n=36) and NPWV dressing (n=25). There was no difference (p>.05) between the cohorts in age, gender, BMI, and pre-operative ASA score. There was a significant difference (p=0.01) in SSI formation between the traditional dressing cohort (41%, n=15) and the NPWV cohort (12%, n=3). There was negative correlation between SSI formation and use of NPWV [OR = 0.15, p = 0.036]; there was positive correlation between SSI formation and length of hospital stay [OR = 1.21, p = 0.024]. Operative length, operative blood loss, units of perioperative blood transfusion, intraoperative GJ tube placement, preoperative stent placement, and postoperative antibiotic duration did not significantly impact SSI formation (p > .05).

Conclusion: NPWV dressing should be considered over traditional dressing for SSI prophylaxis particularly after surgeries highly associated with SSI formation such as the Whipple. Follow-up with RCT regarding this topic is warranted.