ALTERNATIVE MANAGEMENT OF A REPLACED COMMON HEPATIC ARTERY PSEUDOANNEURYSM

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A 35-year-old male with a past medical history significant for chronic alcoholic pancreatitis with pseudocyst presented with epigastric pain radiating to the back accompanied by nausea and vomiting. Physical examination and laboratory findings were consistent with acute pancreatitis. Contrast-enhanced computed tomography (CT) of the abdomen demonstrated multiple pseudocysts of the pancreas. CT also revealed a 1.0 cm pseudoaneurysm (PSA) of the replaced common hepatic artery adjacent to a pseudocyst in the pancreatic head. The patient was not a candidate for embolization therapy due to risk of hepatic ischemic injury. Alternatively, the PSA was excluded with a covered wall-stent (Figure 1). Completion angiogram showed persistent slow filling. Subsequent CT-guided percutaneous thrombin injection obliterated the PSA cavity and post-injection Doppler sonography confirmed exclusion. The patient tolerated the procedure well and was discharged within 48 hours. Subsequent CT surveillance at three months revealed resolution of the pseudoaneurysm. Hepatic arterial anatomy is highly variable, with “standard” anatomy reported in approximately 50 to 75% of patients. A replaced common hepatic artery arising from the superior mesenteric artery occurs in 2 to 5% of the population. Rupture of visceral aneurysms and pseudoaneurysms are associated with poor outcomes and symptomatic visceral aneurysms or aneurysms ≥2.0 cm should be repaired upon discovery. Sufficient evidence supports the management of visceral aneurysms by both open and endovascular techniques. Endovascular techniques can be used to manage visceral aneurysmal disease in the hostile abdomen. This case showcases a novel combination of both endovascular and image-guided management of a visceral pseudoaneurysm.

SIZE OF TUMOUR PREDICTS OUTCOME IN REDO RESECTION FOR COLORECTAL LIVER METASTASES

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Background: Seventy-five to 80% of patients undergoing liver resection for colorectal liver metastases develop recurrence. A significant number of these can be considered for re-do liver surgery. We examined the outcomes of re-do liver resection for the treatment of recurrent colorectal metastases confined to the liver.

Methods: Patients who underwent repeat liver resection in a single, tertiary referral, Hepatobiliary centre were identified from a prospective database. Clinico-pathological variables were analysed to assess factors predictive of survival using univariate/multivariate analysis. (PASW® version 17.0)

Results: A total of 173 patients underwent repeat resection between 1992 and 2009. Median age was 63 years and the median interval between 1st resection to repeat was 13.6 months. Disease-specific 1, 3 and 5 year survival was 89%, 44% and 25%. Thirty day mortality was 2.3% and morbidity 13.8%. Twenty-eight patients underwent completion hemihepatectomy with the remainder undergoing non-anatomical or segmental resection. Tumour size greater than 5 cm was the only independent predictor of overall survival (p = 0.001, RR 2.32, 95% CI 1.44–3.77). Neoadjuvant chemotherapy, blood transfusion, bilobar disease and multiple metastases were among factors which did not significantly influence survival.

Conclusion: With the advent of future liver remnant determination and advances in cytotoxic therapy re-defining resectability, re-do surgery should be considered for patients presenting with recurrent metastatic disease confined to the liver.
TREATMENT OUTCOMES AND MSKCC SCORING IN 1281 PATIENTS UNDERGOING RESECTION FOR COLORECTAL LIVER METASTASE

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Background: Hepatic resection remains the only curative option for patients with colorectal liver metastases (CRLM). Here, we report treatment outcomes for our large, single centre series of resections and assess the predictive value of the Memorial Sloan-Kettering Cancer Centre (MSKCC) scoring system in an independent cohort.

Methods: Patients who underwent liver resection for CRLM in a single, tertiary referral, Hepatobiliary centre were identified from a prospectively kept database. Clinico-pathological variables based on the MSKCC scoring system were analysed to assess factors predictive of survival using univariate/multivariate analysis. (PASW® version 17.0)

Results: A total of 1281 patients underwent hepatic resection between 1992 and 2009. Median age was 63 years. 1108 underwent primary hepatectomy with 173 undergoing repeat resection. Overall, disease-specific survival at 1, 3, 5 and 10 year survival was 87%, 52%, 36% and 21% respectively and median follow-up was 26.9 months. Thirty day mortality was 2.6% and morbidity 16.4%. Of the five MSKCC prognostic criteria, only node positive primary disease ($p \leq 0.001$ 95% CI 1.26–2.04) and tumour size greater >5 cm ($p \leq 0.05$ 95% CI 1.01–1.61) predicted poorer outcome in our group on multivariate analysis. The actuarial 5-year survival was 49% for those scoring 0 points and 21% for those scoring 5.

Conclusion: In our patient cohort the MSKCC prognostic score did not accurately predict survival and this highlights the importance of independent validation of scoring systems. Moreover, the contemporary focus on liver rather than tumour related factors in defining resectability means that prognostic scores may prove more useful in predicting response to adjuvant, cytotoxic therapy.

A COMPARISON OF MONOPOLAR TO BIPOLAR RADIOFREQUENCY ABLATION OF LIVER TUMORS

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Introduction: Recently, many hepatobiliary centers have abandoned monopolar radiofrequency ablation (M-RFA) and switched to other thermal energy devices such as bipolar radiofrequency ablation (B-RFA). Compared to monopolar devices, B-RFA does not require grounding pads, thereby avoiding skin burn injuries, and does not position probes directly into tumor but rather on the perimeter. Additionally, the broad surface area covered by the bipolar probes can be used to precoagulate parenchyma to assist in hepatic resection. Herein, we report our early experience using bipolar thermal ablation.

Methods: A retrospective review identified 68 patients who underwent M-RFA or B-RFA between June 2004 and September 2010 in an academic center. Perioperative metrics and recurrence rates were analyzed.

Results: M-RFA was used to treat 30 patients, while B-RFA was used for 17 patients. Seventeen other patients underwent B-RFA precoagulation prior to resection. Four patients with multiple tumors were treated by a combination of B-RFA and precoagulation. When compared to M-RFA, B-RFA showed no differences in perioperative metrics (see Table). B-RFA

<table>
<thead>
<tr>
<th></th>
<th>Bipolar RFA</th>
<th>Monopolar RFA</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong># Patients</strong></td>
<td>17</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td><strong>DEMOGRAPHICS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>63.2</td>
<td>56.6</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Sex (M:F)</td>
<td>15.2</td>
<td>30.0</td>
<td></td>
</tr>
<tr>
<td>Disease</td>
<td>Malignant (HCC)- 88.2%</td>
<td>Malignant (HCC)- 100%</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Benign (Adenoma)-11.8%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MELD</td>
<td>8.47</td>
<td>7.53</td>
<td>0.2</td>
</tr>
<tr>
<td>Tumor Size (cm)</td>
<td>3.2</td>
<td>3.2</td>
<td>0.9</td>
</tr>
<tr>
<td><strong>PERIOPERATIVE OUTCOMES</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Laparoscopic (%)</td>
<td>94.1%</td>
<td>83.3%</td>
<td>0.29</td>
</tr>
<tr>
<td>Cholecystectomy (%)</td>
<td>47.1%</td>
<td>16.6%</td>
<td>0.029</td>
</tr>
<tr>
<td>Time (min)</td>
<td>296.6</td>
<td>203.8</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Blood Loss (mL)</td>
<td>148.8</td>
<td>92.7</td>
<td>0.091</td>
</tr>
<tr>
<td>Hospitalization (days)</td>
<td>8.2</td>
<td>4.9</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Complications**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade 2 = 1 (PNA)</td>
<td>Grade 2 = 2 (arrhythmia)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade 3 = 2 (PTX)</td>
<td>Grade 3 = 2 (RFA burns)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade 4 = 1 (Hepatic insufficiency)</td>
<td>Grade 4 = 1 (GI bleed)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complication Rate (overall/major)</td>
<td>23.5%/17.6%</td>
<td>16.7%/13.3%</td>
<td>0.62</td>
</tr>
<tr>
<td><strong>FOLLOW-UP</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local Recurrence</td>
<td>11.8%</td>
<td>23.3%</td>
<td>0.34</td>
</tr>
<tr>
<td>Overall Recurrence</td>
<td>23.5%</td>
<td>46.7%</td>
<td>0.12</td>
</tr>
<tr>
<td>Time to Recurrence (mo.)</td>
<td>15.7</td>
<td>12.4</td>
<td>0.62</td>
</tr>
<tr>
<td>Follow-up (mo.)</td>
<td>16.6</td>
<td>35.9</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

*All data reported as mean unless otherwise indicated
**Based on Clavien-Dindo Classification system

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patients had lower local recurrence (11.8% vs. 23.3%) and overall recurrence rates (23.5% vs 46.7%). Precoagulation was used prior to isolated segmental resections in 11 patients and prior to multi-segmental resection or hemihepatectomies in 6 patients.

**Conclusions:** Compared to M-RFA, the early experience utilizing B-RFA demonstrates lower local and overall tumor recurrence rates, albeit over a shorter mean follow-up period. B-RFA is also equivalent to monopolar devices with regards to complication rates and perioperative outcomes. Moreover, it can be utilized to precoagulate tissue prior to a planned resection.

**STANDARD LIVER VOLUME FORMULA FOR THE MIDDLE EASTERN ARABIC ADULTS**

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**Aim:** To determine a formula estimating the standard liver volume (SLV) of Middle Eastern Arabic adults and to compare with the 12 formulae reported in the east and west populations.

**Methods:** The actual liver volumes (CTLV) were measured by computerized tomography in 351 Arabic adults without liver or body build abnormality, and were correlated with the body indices (age, gender, body height, weight, mass index and surface area). The new formula found by stepwise multiple linear regression analysis was compared with the 12 reported formulae.

**Results:** Body weight (BW) was the sole significant factor that correlated with the actual liver volume (CTLV) by 12.255 \times BW (kg) + 555.646 (R^2 = 0.372, p = 0.000). Only Vauthey formula (1267.28 \times BSA (m^2) – 794.41) could estimate SLV which did not differ significantly from the CTLV (p = 0.263,) and had the least mean error (underestimation of 15.7 mL) and the closest agreement (62.4% had lesser error). Yoshizumi’s simple formula was the second closest though the difference was statistically significant. Formulae of Chandramohan, Yuan and Chan also gave acceptable estimation. The Japanese formulae of Urata and Hashimoto and especially the Chinese Chengdu formulae underestimated while all autopsy studies (DeLand, Heinemann, Yu and especially Chouker) overestimated significantly.

**Conclusions:** The formulae of the present study and Vauthey could be used to estimate SLV of Middle Eastern Arabic adults. However, the moderate coefficient of determination (R^2 = 0.372) suggested wide individual variation. One should exercise caution when applying these formulae in preoperative planning.

**PRESENCE OF EXTRA-HEPATIC DISEASE SHOULD NOT PRECLUDE TRANSEPTERIAL CHEMOEMBOLIZATION FOR METASTATIC CARCINOID**


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**Background:** Transarterial chemoembolization (TACE) is the locoregional therapy of choice for the management of patients with inoperable carcinoid liver metastases. Often, metastatic disease is not limited to the liver. The impact of extra-hepatic metastases on response and outcomes following TACE has not been described.

**Objective:** We hypothesized that patients who have extra-hepatic disease would have similar tumor response and symptom control following TACE.

**Methods:** We reviewed 198 patients that underwent TACE for inoperable carcinoid liver metastases. Two groups were identified, those with (N = 129) and without (N = 69) evidence of extra-hepatic disease at the time of TACE. Demographics, clinicopathologic characteristics, response to TACE, complications, and survival were compared.

**Results:** The two groups were similar in demographics and histopathologic characteristics. Complications following TACE were similar. There was no difference between the groups with and without evidence of extrahepatic disease in symptomatic (76% vs 71%), biochemical (78% vs 90%) or radiographic response (35.0% vs 46%) to TACE. The group without extra-hepatic disease had a median survival of 88 vs 35 months with five-year survival of 65% vs 30% compared to patients with extra-hepatic disease at the time of TACE.

**Conclusions:** Patients with extrahepatic metastatic disease from carcinoid tumor experienced shorter overall survival following TACE compared to those without extrahepatic disease. However, patients with extra-hepatic disease had similar symptomatic, biochemical and radiographic response to TACE compared to those with disease confined to the liver. Although the long-term prognosis for patients with extrahepatic disease is worse than those with liver-only metastasis, meaningful response to TACE is possible and should be considered.

**Table 1. Response to TACE**

<table>
<thead>
<tr>
<th>Variables</th>
<th>No EHD N = 69</th>
<th>EHD N = 129</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Age (Range)</td>
<td>56 (16–83)</td>
<td>55 (27–87)</td>
<td>0.87</td>
</tr>
<tr>
<td>Gender M:F</td>
<td>27:42</td>
<td>67:62</td>
<td>0.1</td>
</tr>
<tr>
<td>Carcinoid Syndrome</td>
<td>62%</td>
<td>65%</td>
<td>0.75</td>
</tr>
<tr>
<td>Pre-TACE</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary Resected</td>
<td>58%</td>
<td>45%</td>
<td>0.1</td>
</tr>
<tr>
<td>Complications</td>
<td>16%</td>
<td>20%</td>
<td>0.56</td>
</tr>
<tr>
<td>Symptomatic Response</td>
<td>71%</td>
<td>76%</td>
<td>0.46</td>
</tr>
<tr>
<td>Serologic Response</td>
<td>90%</td>
<td>78%</td>
<td>0.25</td>
</tr>
<tr>
<td>Radiographic Response</td>
<td>40%</td>
<td>35%</td>
<td>0.17</td>
</tr>
<tr>
<td>Median survival</td>
<td>88 months</td>
<td>35 months</td>
<td>0.001</td>
</tr>
<tr>
<td>2 years</td>
<td>76%</td>
<td>69%</td>
<td>0.001</td>
</tr>
<tr>
<td>5 years</td>
<td>65%</td>
<td>30%</td>
<td>0.001</td>
</tr>
<tr>
<td>10 years</td>
<td>39%</td>
<td>11%</td>
<td>0.001</td>
</tr>
</tbody>
</table>

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POSTOPERATIVE MORTALITY FOLLOWING HEPATECTOMY FOR METASTATIC DISEASE IN THE ELDERLY

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Introduction: Postoperative mortality after hepatectomy for metastasis has not been well characterized in the elderly. Our aim was to examine the risk and predictors of mortality following liver resection in elderly patients with metastatic disease. We hypothesized that mortality in well-selected patients is comparable to that seen in younger patients.

Methods: Patients undergoing hepatectomy for liver metastases were identified from the National Inpatient Sample Database (2005–2008) using a validated algorithm. Patients were categorized into young (<65 y), old (65–74 y), and oldest (≥75 y) age groups. Clinical and outcome data were recorded. Univariate and multivariate analyses were performed.

Results: 4,026 hepatectomy cases were identified. Elderly patients (old + oldest) comprised 37% (n = 1,475) of the population. Increasing age was associated with a higher comorbidity index (CI); 41.8% in the oldest group had a CI ≥3 compared to 39.5% and 36.5% in the old and young groups, respectively (p < 0.001). Overall mortality rate was 1.8%; mortality was higher but still low in the oldest compared to the old and younger groups (3.3% vs. 2.2% vs. 1.2%, p = 0.005). On multivariate analysis, age ≥75 y (OR 2.5 [1.4–4.6]), CI ≥3 (OR 1.8 [1–3.1]), and major resection (lobectomy) (OR 1.7 [1.1–2.8]) were identified as independent predictors of postoperative mortality.

Conclusions: Well-selected elderly patients experience higher – yet acceptable – rates of mortality following hepatectomy for liver metastasis. Advanced age alone should not be considered a contraindication to liver resection; other predictors including comorbidities and extent of surgery should be examined to help select elderly patients most likely to benefit from hepatectomy.

ANTITUMOR ACTIVITIES OF SUNITINIB IN COMBINATION WITH GEMCITABINE IN EXPERIMENTAL PanCREATIC CANCer

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Background: Gemcitabine (Gem) has limited clinical benefits in pancreatic ductal adenocarcinoma (PDAC). Sunitinib (Su) is a novel, multitargeted receptor tyrosine kinase inhibitor that has antitumor activities against colon, lung, breast and pancreatic islet cell malignancies. We tested combination benefits of Gem with the antiangiogenic agent Su in PDAC.

Methods: In vitro cell proliferation was evaluated by WST-1 assay in human PDAC cells (AsPC-1), endothelial cells (HUVECs) and fibroblasts (WI-38). Animal survival and tumor growth studies were performed in murine xenografts.

Results: In AsPC-1 cells Gem and Su caused 28 and 22 percent inhibition in proliferation at 100 nM; combination of Su with Gem had additive effects and 48% inhibition was observed. In HUVECs, Gem and Su caused 49 and 32 percent inhibition in proliferation and 72% inhibition in combination. In WI-38 cells, Gem and Su caused 65 and 14 percent inhibition in proliferation and 79% inhibition in combination. In vivo, the relative net tumor growth compared to controls in Gem, Su and Su + Gem groups was 57, 6 and 0.8 percent. The median survival in controls, Gem, Su + Gem was 19, 26 and 37 days (p = 0.001 for Su + Gem over Gem alone).

Conclusions: In vitro, Sunitinib, either alone or in combination with Gem, had a strong antiproliferative effect. In vivo, sunitinib enhanced the Gem-related antitumor effects significantly. These findings support combinations of multitargeted antiangiogenic agents with standard Gem therapy for PDAC treatment.

LAPAROSCOPIC SPLEEN-PRESERVING DISTAL PanCREATOEctOMY IN THE ELDERLY: INITIAL EXPERIENCE AND LESSONS LEARNED

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The laparoscopic approach for distal pancreatic lesions has gained popularity in recent years and there has been a trend towards preservation of the spleen, with or without splenic vessel preservation (SVP). The response of elderly patients >70 years old to these approaches is not well defined.

Methods: Nine patients >70 years old underwent attempted spleen preserving laparoscopic distal or subtotal pancreaticectomy over an 18 month period. Age, ASA score, imaging findings, estimated blood loss, operative time, details on technique of splenic preservation, length of stay, morbidity and mortality were examined. Chi-Squared analysis evaluated the association between the operative technique (SVP or no SVP) and splenic infarct.

Results: Median age was 81. The median OR time was 150 min, and EBL was 100 cc. One spleen was not preserved due to carcinoma with hilar invasion. The other 8 patients had spleen preserving pancreaticectomies. Of these 8, SVP was performed in 5 and the vessels were stapled in 3, relying on short gastric collateral flow. All 3 patients undergoing vessel division developed splenic infarcts, and two required splenectomy (p = 0.012). These patients were 74, 84 and 92 years old. There were no mortalities and one pancreatic leak.

Conclusions: Spleen preserving laparoscopic distal and subtotal pancreatectomy can be performed safely in the elderly. The present data suggest that patients undergoing laparoscopic spleen preserving distal pancreatectomy without SVP are at a higher risk for splenic infarction requiring spleenectomy than otherwise reported for the younger aged population.

MINIMALLY INVASIVE PanCREATICODUODENECTOMY

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Stony Brook University Medical Center, Stony Brook, NY

Purpose: Surgical units continue to explore and improve minimally invasive pancreatic surgery. This video details our
current technique for combined laparoscopic and robotic pancreaticoduodenectomy.

Results: The video presents a 72-year-old woman who underwent MIPD for a 4.5 cm duodenal adenoma. Fifteen lymph nodes were harvested with the specimen and she was discharged home post-operative day 6 without complications. We review port placement, port choice and instrumentation, and key maneuvers for successful resection and reconstruction. Special attention is given to dissection along the pancreatic uncinate margin, transection, and duct identification. Optimal utilization of the surgical robot is discussed and demonstrated. The approach to minimally invasive pancreaticoduodenectomy (MIPD) has evolved over a learning curve of approximately 10–15 cases. Operative times have diminished significantly to a current median of 395 (range 340–454) minutes.

Conclusions: Laparoscopic and robotic MIPD is feasible and safe with operative time, completeness of resection, and short-term perioperative outcomes comparable to the open procedure. Further long-term study will determine if this becomes a preferred approach to pancreaticoduodenectomy.

A SINGLE CENTER COMPARISON OF OUTCOMES IN HEPATIC RESECTIONS USING TWO DIFFERENT DEVICES FOR PARENCHYMAL DIVISION

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1Thomas Jefferson University Hospital, Division of Transplantation, Philadelphia, PA; 2Thomas Jefferson University Hospital, Division of Biostatistics, Philadelphia, PA

Objective: The goal of this study was to evaluate safety and efficacy of two devices used in parenchymal division during hepatic resections.

Methods: We retrospectively compared 47 patients who underwent liver resection at our Institution from 2004 to 2010 using the TissueLink Monopolar Floating Ball (TL) with either the ultrasonic dissector (CUSA) or harmonic scalpel (HS). CUSA plus TL was used in 27 patients while HS plus TL was used in 20 patients. Demographics, intraoperative data, and postoperative outcomes were analyzed (Table 1). Wilcoxon rank sum and Fisher’s exact tests were used in statistical analysis.

Table 1. Patient Group Demographics and Outcomes

<table>
<thead>
<tr>
<th></th>
<th>CUSA/TL</th>
<th>Harmonic Scalpel/TL</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. Patients</td>
<td>27</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Female (%)</td>
<td>16 (59.3)</td>
<td>13 (65.0)</td>
<td>0.77</td>
</tr>
<tr>
<td>Age (range)</td>
<td>65 (63.0)</td>
<td>11 (55.0)</td>
<td>0.76</td>
</tr>
<tr>
<td>Median Number of lesions (range)</td>
<td>1 (1–3)</td>
<td>1 (1–3)</td>
<td>0.47</td>
</tr>
<tr>
<td>Median Operative Time in Minutes (range)</td>
<td>290 (117–533)</td>
<td>185 (63–681)</td>
<td>0.08</td>
</tr>
<tr>
<td>Median Estimated Blood loss in ml (range)</td>
<td>700 (0–5850)</td>
<td>250 (0–1500)</td>
<td>0.01</td>
</tr>
<tr>
<td>Patients transfused with banked blood (%)</td>
<td>8 (29.6)</td>
<td>2 (10.0)</td>
<td>0.15</td>
</tr>
<tr>
<td>Median LOS in days (range)</td>
<td>7 (6–27)</td>
<td>6 (4–29)</td>
<td>0.02</td>
</tr>
<tr>
<td>Patients with Complications (%)</td>
<td>9 (33.3)</td>
<td>4 (20)</td>
<td>0.35</td>
</tr>
<tr>
<td>Bile Leak (%)</td>
<td>5 (18.5)</td>
<td>1 (5.0)</td>
<td>0.63</td>
</tr>
<tr>
<td>Perioperative Mortality (%)</td>
<td>3 (11.1)</td>
<td>1 (5.0)</td>
<td></td>
</tr>
</tbody>
</table>

Results: The median estimated blood loss (EBL) of the HS and CUSA groups were respectively 250 and 1035 ml (p < 0.05). Two patients (10%) were transfused intraoperatively in the HS group and 8 (66.7%) in the CUSA group (p = 0.15) with banked blood while the remaining transfused patients received autologous blood. The median operative time of the HS and CUSA groups were respectively 185 and 290 minutes (p = 0.08). Length of stay (LOS) was shorter in the HS group at 6 days compared to 7 days in the CUSA group (p < 0.05). There were 4 morbidities (20%) including 1 bile leak (5%) and one perioperative death in the HS group, and 9 morbidities (33.3%) with 3 bile leaks (11.1%) and 1 intraoperative death in the CUSA group with no significant differences in these outcomes.

Conclusions: Our results show that HS with TL is a safe and effective method of parenchymal division with significantly less EBL and LOS.

HIGH GRADE DYSPLASIA AT CYSTIC DUCT MARGIN AFTER CHOLECYSTECTOMY

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Background: 750,000 cholecystectomies are performed each yearly in the United States. No data exist on patients with microscopic high grade dysplasia at the cystic duct margin and the associated incidence of cholangiocarcinoma.

Methods: A free text search of all pathology reports at our institution was performed for the following terms: “cholecystectomy”, “cystic margin”, and “dysplasia”. Pathology reports were reviewed for patients that had high grade dysplasia of the cystic duct margin but did not have invasive gallbladder cancer. Clinical data was obtained from chart review.

Results: The initial search identified 193 patients from 1992 to 2010 with the correct terms in pathology report. From this data set we identified 8 patients with high grade dysplasia at the cystic duct margin. One patient had a non-invasive papillary cancer and the remaining 7 patients had high grade dysplasia in the gallbladder and at the cystic duct margin. Three patients had their slides submitted for pathologic second opinion and were not treated at our institution. Of the 5 patients treated at our institution, radiologic imaging was abnormal in 2 of 5 (40%) patients. The cystic duct stump was abnormal in both patients. Four of the 5 patients have undergone exploration and bile duct excision. Of those, 3 (75%) had no evidence of malignancy. One patient was found to have a node positive cholangiocarcinoma.

Conclusion: High grade dysplasia at the cystic duct margin without evidence of invasive gallbladder cancer is a rare occurrence. Consideration should be given to the diagnosis of an underlying cholangiocarcinoma and re-exploration.
A COMPARATIVE STUDY OF OPERATIVE RESECTION VERSUS RADIOFREQUENCY ABLATION FOR THE TREATMENT OF METASTATIC COLORECTAL METASTASES TO THE LIVER FOR INITIALLY RESECTABLE DISEASE

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Introduction: Radiofrequency ablation (RFA) is a valuable treatment adjunct for selected patients with colorectal liver metastases (CRLM). The objective of this study was to compare local recurrence, DFS and OS between RFA and operative resection (OR) in patients with new onset and resectable CRLM.

Methods: Patients treated for CRLM between 1/2000 and 1/2007 at Mayo Clinic in Rochester, MN were reviewed (n = 581). Kaplan-Meier Survival and Cox proportional hazards models were used to examine the association between treatment group and OS and DFS.

Results: Of the 99 eligible patients 64% were male with a median age of 61 (28–81) years. Six of the 79 (7.6%) lesions treated with OR (n = 48) developed a local recurrence versus 19/51 (37%) treated with RFA alone (n = 12). Twelve of the 31 (38.7%) patients treated OR and RFA developed a recurrence, all at the ablation site. The 1-, 3-, and 5-year DFS in OR versus RFA treated lesions is 96%, 88%, 88%, and 74%, 36%, 36%, respectively. The 1-, 3-, and 5-year OS in patients treated with OR, combined OR/RFA and RFA alone was 85%, 71%, 66%; 96%, 71%, 53% and 83%, 69%, 46%, respectively. The mean size of the lesions treated with RFA with and without recurrence was 1.9 cm and 1.2 cm respectively. A 1 cm increase in size of an RFA treated lesion has a 2.3 increased recurrence risk, p < 0.001.

Conclusions: Surgical resection is superior to RFA in terms of local disease recurrence; however, there is no difference in OS when comparing the two modalities.

RESECTION OF A SYMPTOMATIC PORTAL VEIN ANEURYSM IN A PATIENT WITH PRIOR GASTRIC BYPASS

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1Emory University Hospital, Atlanta, GA; 2Beth Israel Deaconess Medical Center, Boston, MA

A 43-year-old women with a 5.4 × 4.4 cm extrahepatic portal vein aneurysm was referred for evaluation related to debilitating severe abdominal pain. She had prior laparoscopic gastric bypass in 2003 with subsequent pouch dilatations, C-sections, cholecystectomy, hysterectomy, and laparoscopic adhesiolysis ×3; the last lysis of adhesions was negative for adhesions. Due to her debilitating pain and no other identifiable source, she underwent exploratory laparotomy. The proximal portal vein was encircled, and the aneurysm was saccular with a normal posterior wall but densely adhered to a paper thin neck of the pancreas anteriorly. Thus transection of the pancreas (and duodenum) to the left of the aneurysm established excellent visualization. After heparinization, the SMV, splenic and portal veins were clamped. The aneurysm was opened, persistent feeding veins oversewn, the aneurysmal vein was resected, and the portal vein was repaired with a bovine pericardial patch. A pancreaticogastrostomy was performed in the first trimester, the obstetrical team was concerned that she would not be able to carry the pregnancy to term without surgical intervention. In addition, there was significant concern for malignancy. Laparotomy was performed at 20 weeks gestation. The mass originated from the body of the pancreas and measured 17 cm in diameter. A distal pancreatectomy with splenic preservation and resection of the mass was performed. An oophorectomy was performed for a 14 cm ovarian mass. The final histologic diagnoses were a mucinous cystic neoplasm with moderate dysplasia and a mature cystic ovarian teratoma. The patient had an uneventful postoperative course. There are a small number of published cases of mucinous cystic neoplasms associated with pregnancy. This is the first reported case of simultaneous cystic neoplasms discovered during pregnancy. We present the case and a brief review of the literature regarding the diagnosis and management of pancreatic neoplasms during pregnancy.
used for draining the body and tail of the pancreas, the duodenum was primarily anastomosed, and omentum was placed between the portal vein repair and the pancreaticogastrostomy. Postoperative complications include anemia requiring transfusion and superficial wound infection. At 4 month follow up, her wound has healed, and she is pain free. Postoperative surveillance shows a patent portal vein with normal flow. Portal vein aneurysms are rare and their symptomatology is often difficult to relate to the aneurysm itself, but after resection long term pain relief and portal vein patency are expected.

REPEAT HEPATECTOMY FOR RECURRENT COLORECTAL LIVER METASTASES IS ASSOCIATED WITH HIGH SURVIVAL RATE

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MD Anderson Cancer Center, Houston, TX

**Background:** Outcome after repeat hepatectomy for recurrent colorectal liver metastases (CLM) is not well defined.

**Methods:** Prospectively collected data on 115 consecutive patients operated for recurrent CLM at our Center were studied. Patients treated by radiofrequency ablation at any time were excluded. Outcomes were analyzed.

**Results:** Forty-three patients underwent repeat hepatectomy for CLM. At first resection of CLM, patients had a mean of 2.2 ± 2.2 lesions and mean tumor size was 3.1 ± 2.7 cm. At recurrence, patients had a mean of 1.2 ± 0.5 lesions and mean tumor size was 2.5 ± 1.1. The mean interval between first resection of CLM and recurrence was 16 ± 22 months. Postoperative morbidity and mortality rates were 12% and 0% respectively. After median follow-up of 34 months, 3- and 5-year overall survival rates were 82% and 73% respectively. Three- and 5-year disease-free survival rates were 22% and 22% respectively. Factors associated with worse overall survival included tumor size >5 cm (p = 0.004) and positive surgical margins (p = 0.04) at initial liver resection. Positive margins at repeat hepatectomy were associated with increased risk of further recurrence (p = 0.01). Among 29 patients with further recurrence after repeat hepatectomy, one-third (10/29) were retreated with curative intent, including third hepatectomy (5), radiofrequency ablation (3) or resection of lung metastases (2).

**Conclusion:** Repeat hepatectomy for recurrent CLM is associated with long-term survival in patients with negative margins. However, definitive cure of metastatic colorectal cancer remains a challenge in patients with hepatic recurrence.

HEALTH-RELATED QUALITY OF LIFE CHANGES FOLLOWING MAJOR LIVER RESECTION

University of Louisville, Louisville, KY

**Purpose:** To evaluate the health-related quality of life (QOL) changes experienced by patients following major liver resection (LR).

**Methods:** Following major (≥3 segments) LR, postoperative (90-day) complications were graded prospectively using a validated 5-grade scale. QOL parameters were recorded prospectively at baseline (pre-operative), and through 6-months follow-up using the EORTC QLQ-C30 instrument.

**Results:** QOL parameters were obtained after major LR for malignancy in 41 patients. Major (grade ≥3) complications occurred in 10 (24.4%) patients. Postoperative chemotherapy was administered in 17 (41%) patients. Early (<6 month) recurrence was noted in 7 (17.1%) patients. At the initial outpatient visit, patients reported decreased global QOL, physical functioning, role functioning, and social functioning, along with increased fatigue compared with baseline (all p < 0.05). These measures normalized at 6-weeks follow-up and remained stable at 6-months. When comparing patients with and without major complications, those with major complications reported increased severity of pain over baseline at initial follow-up (p = 0.031) and at 6 months (p = 0.047). No significant difference was noted in other QOL metrics between patients with or without major complications (p > 0.11). Using a repeated-measures model, neither age, complication occurrence, adjuvant therapy, nor early recurrence were predictive of decreased QOL at 6-months.
Conclusion: Overall, QOL metrics tend to normalize to pre-operative levels within 6-weeks after LR. However, major complications are associated with increased reporting of pain that persists at 6 months. Better attention to pain control, especially among patients with major complications, may improve QOL after major LR.

PANCREATITIS-INDUCED SPLENIC VEIN THROMBOSIS: A SYSTEMATIC REVIEW AND META-ANALYSIS OF ITS RATE OF OCCURRENCE AND FREQUENCY OF ASSOCIATED GASTROINTESTINAL BLEEDING

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Introduction: Pancreatitis-induced splenic vein thrombosis (PSVT) is an important anatomic abnormality impacting decision-making in pancreatic surgery. The frequency of PSVT and rate of associated gastrointestinal (GI) bleeding is unknown.

Methods: The Medline, EMBASE, Cochrane CRCT and Cochrane DSR databases were searched from their inception to June, 2010 for abstracts documenting PSVT in acute (AP) or chronic pancreatitis (CP). Two authors independently graded abstracts for inclusion in this study. Heterogeneity in combining data was assumed prior to pooling. Random-effects meta-analyses were performed to estimate percentages and 95% confidence intervals.

Results: After review of 241 abstracts, 47 studies and 52 case reports were graded as relevant. To date, 805 cases of PSVT have been reported in the literature. Across all case reports and studies, a meta-analysis of studies meeting inclusion criteria show a mean reported PSVT incidence of 10.8%, varying between AP (15.7%) and CP (8.2%). The incidence of associated splenomegaly was only 51.9%. Varices were identified in 53% of patients, 77.3% of which were gastric. The overall rate of GI bleeding was 19%.

Conclusions: While the incidence of PSVT varies widely between individual studies, an overall incidence of 10.8% in pancreatitis is reported. Splenomegaly is an unreliable sign of PSVT. Although the true natural history of PSVT remains unknown, the reported incidence of associated GI bleeding is 19%.

Table 1. Meta Analysis of PSVT Incidence and Associated Morbidity

<table>
<thead>
<tr>
<th>Condition</th>
<th>Proportion</th>
<th>95% confidence interval</th>
<th>Proportion</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSVT Incidence</td>
<td>0.108</td>
<td>0.067</td>
<td>0.150</td>
</tr>
<tr>
<td>PSVT Incidence for Ap</td>
<td>0.157</td>
<td>0.046</td>
<td>0.267</td>
</tr>
<tr>
<td>PSVT Incidence for Cp</td>
<td>0.082</td>
<td>0.044</td>
<td>0.120</td>
</tr>
<tr>
<td>Incidence of Varices</td>
<td>0.530</td>
<td>0.264</td>
<td>0.796</td>
</tr>
<tr>
<td>Incidence of Gastroesophageal Varices</td>
<td>0.410</td>
<td>0.116</td>
<td>0.703</td>
</tr>
<tr>
<td>Incidence of Gastroesophageal Varices</td>
<td>0.033</td>
<td>0</td>
<td>0.068</td>
</tr>
<tr>
<td>Bleed Rate</td>
<td>0.190</td>
<td>0.105</td>
<td>0.274</td>
</tr>
<tr>
<td>Bleed Rate for Ap</td>
<td>0.067</td>
<td>0</td>
<td>0.186</td>
</tr>
<tr>
<td>Bleed Rate for Cp</td>
<td>0.069</td>
<td>0</td>
<td>0.149</td>
</tr>
<tr>
<td>Splenomegaly</td>
<td>0.519</td>
<td>0.262</td>
<td>0.776</td>
</tr>
</tbody>
</table>

THE ROLE OF LAPAROSCOPIC RESTAGING IN PATIENTS WITH INCIDENTAL Gallbladder Cancer

Memorial Sloan-Kettering Cancer Center, New York, NY

Background: The role of laparoscopy as a staging method during re-exploration of patients with incidental gallbladder...
cancer is ill-defined. This study evaluates the yield and accuracy of staging laparoscopy, and to identify variables associated with disseminated disease during re-exploration.

Methods: Data from consecutive patients with incidental gallbladder cancer undergoing re-exploration between 1998 and 2009 were identified from a prospective database. The yield and accuracy of restaging laparoscopy were calculated. Demographics, tumor and treatment related variables were correlated with disseminated disease.

Results: One hundred-forty three patients with incidental gallbladder cancer underwent re-exploration for possible definitive resection, and staging laparoscopy was performed in 46. Twenty-nine (63%) were female and the median age was 66 years (41–90). Ten (21.8%) patients were diagnosed with disseminated disease during re-exploration (carcinomatosis = 6, liver metastases = 3, and retroperitoneal disease = 1); laparoscopy identified 2 of these patients (yield = 4.2%), while 8 were diagnosed after conversion to open surgery (accuracy = 20%). Thickening of gallbladder wall in pre-cholecystectomy ultrasound (p = 0.03), poorly differentiated tumors (p = 0.02), and perineural invasion (p = 0.02) were factors associated with disseminated disease on univariate analysis. Risk of disseminated disease during reexploration increased from 39% with 1 factor to 100% with 3 factors present.

Conclusions: Staging laparoscopy has a very low yield for identifying disseminated disease during re-exploration of patients with incidental gallbladder cancer. Gallbladder wall thickening, poorly differentiated histology, and perineural invasion may help select the small subset of patients who may benefit from this added procedure.

EVALUATION OF PROGNOSTIC INDICES AND OVERALL SURVIVAL OF RESECTABLE AMPULLARY ADENOCARCINOMA


Moffitt Cancer Center, Tampa, FL; University of South Florida, Tampa, FL

Introduction: Ampullary adenocarcinoma offers a better prognosis compared to other periampullary malignancies such as pancreatic or distal bile duct cancers. Different prognostic indices have been evaluated for periampullary tumors to aid in determination of adjuvant treatments. Here, we reviewed our experience with ampullary adenocarcinomas for prognostic indices and overall survival (OS). In our ampullary database, we found 72 patients who underwent a resection of ampullary adenocarcinoma from 1996 to 2010. Pathological data including tumor size, histological grade, nodal status, lymphovascular or perineural invasion were evaluated, and OS analysis was performed.

Results: Of 72 patients, 52% was male, and 48% was female. The median age at diagnosis was 70 yrs (38–86). The median follow up was 14.5 mo (1–106). 71 patients underwent a pancreaticoduodenectomy, and 1 patient had an ampullectomy. There were 32% stage I disease, 53% stage II, and 14% stage III. 19% of our patients had a recurrence with a median time to recurrence at 8 mo (2–25). Patients with N1 disease were more likely to develop a recurrence (p = 0.023). Lymphovascular or perineural invasion did not influence recurrence of disease. The 5 year OS was 39% for resectable ampullary adenocarcinoma. When comparing OS by tumor size, histological grade, nodal status, lymphovascular invasion and perineural invasion, N1 (p = 0.01) disease and poorly differentiated histological grade (p < 0.01) indicated worse OS on multivariate analysis.

Conclusions: Although patients with ampullary adenocarcinoma have improved OS, prognostic indices are similar to other periamillary malignancies. N1 disease and poorly differentiated histological grade indicate a worse OS.

ALTERED EFFICACY OF AT1R-TARGETED TREATMENTS FOR COLORECTAL CANCER LIVER METASTASIS RESULTING FROM AT1R UPREGULATION

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The Department of Surgery, Austin Health, Heidelberg, VIC

Background: Blockade of the angiotensin (ANG) II type 1 receptor (AT1R) or angiotensin converting enzyme (ACE) inhibition reduces tumour growth in a mouse model of colorectal cancer liver metastases (CRLM). ANG-(1–7), an antagonistically acting peptide, has also been identified as a potential anti-cancer agent.

Objective: To establish if combined RAS-targeting could result in greater inhibition of CRLM than either treatment alone.

Methods: Irbesartan at 50 mg/kg/day s.c., captopril at 250 mg/kg/day i.p., and ANG-(1–7) at 24 µg/kg/hr i.p minipump were administered for 21 days in a mouse model of CRLM either alone or in combinations of ANG-(1–7) with irbesartan/captopril. Tumour burden was assessed by stereology. Immunohistochemistry was used to assess tumour AT1R, iNOS, and VEGF levels.

Results: While irbesartan previously inhibited tumour growth in this model, in the current experiments irbesartan failed to affect tumour burden. Analysis of AT1R expression showed increased expression in tumour cells from irbesartan-sensitive compared to irbesartan-resistant tumours. In contrast to irbesartan, captopril retained its anti-tumour activity against the high AT1R-expressing tumours. Neither combined strategy improved treatment outcomes.

Conclusions: Although the results do not support increased efficacy with combined treatment, they provide intriguing evidence of the importance of RAS expression in determining patient response and suggest that components of the RAS could be used as biomarkers to determine optimal treatment strategies.

ROLE OF PANCREATIC DUCT STENT PLACEMENT PRIOR TO DISTAL PANCREATECTOMIES IN PREVENTION OF PANCREATIC LEAK

N. Chandolias, S. Lopez, P. Y. Parikh and A. Nigam

Albany Medical Center, Albany, NY

Background: Pancreatic leak represents a significant cause of morbidity and mortality after distal pancreatectomies. In
the role of preoperative pancreatic duct stent placement remains undefined. The objective of our study was to assess whether stenting of the ventral pancreatic duct prior to distal pancreatectomy reduces the rate of pancreatic leak.

**Methods:** Between February 2005 and June 2008 a total of 19 patients underwent distal pancreatectomy following ERCP and pancreatic duct stent placement. Clinical, perioperative and outcome data were retrospectively analyzed and compared with data of 42 patients after distal pancreatectomy without preoperative stent placement.

**Results:** No statistically significant difference was present in the pancreatic leak rate between the stented (S) and non-stented (NS) group. The S group had a pancreatic leak rate of 36% compared with 45% for the NS group (P > 0.05). The most common complications in both groups were manifestations of pancreatic leak (fistula, abscess, pseudocyst) with abscess rate being similar in the S group (26.3%) vs the NS group (26.2%). The wound infection rate was also similar in the two groups (S group 11% vs NS group 10%). Morbidity and mortality rates were equivalent in both groups. The S group had a median length of stay of 6 days compared to 7 days for the NS group.

**Conclusions:** Pancreatic duct stent placement offers no therapeutic benefit compared to no intervention in prevention of pancreatic leaks prior to distal pancreatectomies. It also does not affect the severity of complications, LOS, overall morbidity and mortality.

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**MICROWAVE ABLATION FOR HEPATOCELLULAR CARCINOMA IN PATIENTS WITH CIRRHOSIS AND PORTAL HYPERTENSION**

J. Chapochnick Friedmann1,2, M. Olaywi1, M. Kinkhabwala1,2, A. Lu1,2, S. Bellemare1,2, P. Gaglio1,2, J. Reinus1,2, H. Massoumi1,2 and H. Kalia1,2

1Montefiore Medical Center, Bronx, NY; 2Albert Einstein College of Medicine, Bronx, NY

**Background:** The purpose of this study is to analyze effectiveness and morbidity of microwave ablation (MW) of HCC in patients with cirrhosis and portal hypertension and to compare different modalities of liver directed therapy (LDT) in association with it.

**Methods:** From July 2009 to September 2010, 24 patients with cirrhosis and portal hypertension underwent 25 surgical MW for HCC. A total of 30 tumors were treated. Twenty-one patients had postoperative follow and were included in the analysis. The results were compared among patients previously treated with different modalities of LDT: transarterial chemoembolization (TACE), TACE + percutaneous radiofrequency ablation (RFA) or multiple combinations of these.

**Results:** The results are summarized in the table attached.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total</th>
<th>MWA</th>
<th>TACE+MW</th>
<th>TACE+RFA+MW</th>
<th>Multiple+MW</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
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<td>Patients, n</td>
<td>21</td>
<td>9</td>
<td>6</td>
<td>7</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Surgeries, n</td>
<td>22</td>
<td>9</td>
<td>6</td>
<td>7</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Tumors, n</td>
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<td>12</td>
<td>9</td>
<td>9</td>
<td>13</td>
<td></td>
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<tr>
<td>Age (mean ± SD), years</td>
<td>62 ± 8</td>
<td>63 ± 7</td>
<td>60 ± 9</td>
<td>63 ± 9</td>
<td>62 ± 8</td>
<td>0.89</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.41</td>
</tr>
<tr>
<td>Male</td>
<td>15 (71)</td>
<td>7 (78)</td>
<td>4 (67)</td>
<td>5 (71)</td>
<td>7 (70)</td>
<td></td>
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<tr>
<td>Female</td>
<td>6 (29)</td>
<td>2 (22)</td>
<td>2 (33)</td>
<td>2 (29)</td>
<td>3 (30)</td>
<td></td>
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<td>Etiology, n(%)</td>
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<td>&gt;0.99</td>
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<tr>
<td>HCV</td>
<td>19 (86)</td>
<td>8 (89)</td>
<td>5 (83)</td>
<td>6 (86)</td>
<td>9 (90)</td>
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<tr>
<td>HVB</td>
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<td></td>
<td>1 (17)</td>
<td>1 (14)</td>
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<td></td>
</tr>
<tr>
<td>Others</td>
<td>1 (5)</td>
<td></td>
<td>1 (11)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tumor size (mean ± SD), cm</td>
<td>2.7 ± 1.8</td>
<td>2.0 ± 1.4</td>
<td>3.6 ± 2.4</td>
<td>2.8 ± 1.3</td>
<td>3.5 ± 2.1</td>
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<tr>
<td>Child-Pugh score, n(%)</td>
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<tr>
<td>A</td>
<td>18 (82)</td>
<td>8 (89)</td>
<td>4 (67)</td>
<td>6 (86)</td>
<td>7 (70)</td>
<td></td>
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<tr>
<td>B</td>
<td>4 (18)</td>
<td>1 (11)</td>
<td>2 (33)</td>
<td>1 (14)</td>
<td>3 (30)</td>
<td></td>
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<tr>
<td>MELD (mean ± SD)</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Preop</td>
<td>11 ± 5</td>
<td>12 ± 6</td>
<td>9 ± 4</td>
<td>10 ± 5</td>
<td>11 ± 5</td>
<td>0.71</td>
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<tr>
<td>Postop</td>
<td>13 ± 5</td>
<td>14 ± 6</td>
<td>10 ± 4</td>
<td>12 ± 5</td>
<td>13 ± 4</td>
<td>0.46</td>
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<td>DMELD</td>
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<td>1</td>
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<td>Morbidity, n(%)</td>
<td>5 (23)</td>
<td>1 (11)</td>
<td>4 (67)</td>
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<td>1 (10)</td>
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<tr>
<td>Clavien II</td>
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<td>1</td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Residual tumor, n(%)</td>
<td>3 (10.7)</td>
<td>1 (10)</td>
<td>1 (11)</td>
<td>1 (11)</td>
<td>2 (15)</td>
<td>0.41</td>
</tr>
<tr>
<td>Recurrent tumor, n(%)</td>
<td>2 (9.5)</td>
<td>None</td>
<td>1 (17)</td>
<td>1 (11)</td>
<td>1 (7.7)</td>
<td>0.41</td>
</tr>
<tr>
<td>New Tumors, n(%)</td>
<td>3 (14)</td>
<td>None</td>
<td>3 (50)</td>
<td>None</td>
<td>1 (10)</td>
<td>0.75</td>
</tr>
<tr>
<td>Number of treatments (mean ± SD)</td>
<td>2.2 ± 1</td>
<td>1 ± 0</td>
<td>2.5 ± 0.5</td>
<td>3.1 ± 0.4</td>
<td>3.1 ± 0.3</td>
<td>&lt;0.0001</td>
</tr>
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</table>

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follow up were 10.7%, 9.5% and 14% respectively for the entire group and they were similar among all subgroups. The patients in the MWA group required significantly less treatments than the patients in any other group.

Conclusions: In our series, patients treated with MW alone achieve the same results that patients previously treated with combinations of LDT.

**AGGRESSIVE SURGERY FOR UNRESECTABLE PANCREATIC NEUROENDOCRINE TUMORS FOLLOWING CAPECITABINE-OXALIPLATIN-BEVACIZUMAB CHEMOTHERAPY**

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¹Department of Surgery, Stanford University Medical Center, Stanford, CA; ²Division of Medical Oncology, Department of Medicine, Stanford University Medical Center, Stanford, CA

**Background:** While neoadjuvant chemotherapy is used routinely for some gastrointestinal cancers with the intent of “downstaging”, there has been no effective chemotherapy regimen for pancreatic neuroendocrine tumors (PNET) that would allow this strategy. A single-institution phase II study using capcitabine-oxaliplatin-bevacizumab at our institution for advanced PNET has shown promising preliminary results. We evaluated the possibility of aggressive surgery following chemotherapy.

**Methods:** Nineteen patients with locally advanced and/or metastatic PNET not considered surgical candidates at presentation were enrolled in the study. All patients were reassessed on an ongoing basis by the multidisciplinary team for the possibility of surgical resection.

**Results:** Among the 19 patients, 7 were felt to be surgical candidates after an average of 11 cycles of chemotherapy (range 4–28) because of the response to chemotherapy or stable disease after prolonged therapy suggesting favorable biology. In two cases, portal vein tumor thrombus withdrew sufficiently to allow resection and vascular reconstruction. Six underwent subtotal pancreatectomy and 1 pancreaticoduodenectomy. Four had concurrent or staged hepatectomy and 3 had SMV/portal vein resection. There was no operative mortality. Postoperatively, 3 underwent liver radioembolization and 1 radiolabeled somatostatin therapy. With a median follow up of 13.5 months after surgery, 6 of 7 are alive. One died of brain metastases; 3 had slow progression of liver metastases, and 3 had stable disease. Two with progression of hepatic metastases have re-started chemotherapy.

**Conclusions:** This capcitabine-oxaliplatin-bevacizumab chemotherapy regimen has demonstrated very promising results. Selective patients with advanced PNET at presentation may be candidates for resection after “neoadjuvant” chemotherapy.

**THE ELEVATION OF ZINC-FINGER TRANSCRIPTION FACTOR ZBP-89 IN HEPATOCELLULAR CARCINOMA AND ITS CLINICAL VALUE**

G. G. Chen¹, C. Z. Zhang¹, Y. Cao², J. P. Yun² and P. B. Lai¹

¹The Chinese University of Hong Kong, Hong Kong; ²Sun Yat-Sen University, Guangzhou

ZBP-89, a Krüppel-type zinc-finger transcription factor, is universally expressed and participates in the regulation of cell growth and cell death. It has been shown to be elevated in some cancers, including gastric cancer, colorectal cancer and breast cancer. However, ZBP-89 expression in hepatocellular carcinoma (HCC) is not well documented. In this study, we examined ZBP-89 expressions in 6 types of HCC cell lines and in 14 pairs of HCC tissues and the adjacent hepatic tissues by RT–PCR, western blot and immunofluorescent staining. Another 182 paired tissues consisting of tumorous ones and their corresponding non-tumorous ones were used to measure expression of ZBP-89. Our results showed that ZBP-89 was expressed higher in HCC cancer cells than normal liver cells at both mRNA and protein levels. Furthermore, ZBP-89 expression was significantly higher in tumorous tissues than that in the nontumorous hepatocytes. ZBP-89 was localized in nucleus in most of the cases but presented in cytoplasm in 11.5% (21 of 182) of the HCC tissues. Altered ZBP-89 expression in HCC was significantly correlated with two clinicopathological parameters the histological grade and the status of HBV. Moreover, the high expression of ZBP-89 in HCC tissues was associated with better survival in patients. Over-expression of ZBP-89 in HCC cells dramatically decreased the colonies formation, likely via regulating p53 and p21. In conclusion, our data suggest that ZBP-89 has anti-tumor property and is a potential biomarker for prognosis of HCC.

**LYMPHADENEXCTION IN THE STAGING AND TREATMENT OF INTRAHEPATIC CHOLANGIOCARCINOMA – A POPULATION-BASED STUDY USING THE SEER DATABASE**

C. J. Clark, M. L. Kendrick and F. G. Que

Mayo Clinic, Rochester, MN

**Introduction:** Intrahepatic cholangiocarcinoma (ICC) is the second most common primary hepatic malignancy with a steady increase in incidence over the last two decades. Although lymphatic spread is common with ICC, lymphadenectomy is not a widely accepted component of surgical resection for ICC. The aim of this study was to characterize trends in lymph node assessment and the impact of lymphadenectomy on survival in patients with ICC.

**Methods:** We conducted a population-based study using patients with ICC identified in the Surveillance, Epidemiology, and End Results (SEER) registry from 1988 to 2007. Survival was assessed with Kaplan-Meier and Cox Regression analyses.

**Results:** 4946 patients with ICC were identified with 5.3% 5-year overall survival. Lymph node evaluation (N0 and N1) was available in 49% (n = 2432) of patients and nodal status (number removed and number positive) was available for
only 14% (n = 680) of patients. A median of two (1 to 33) nodes were removed during major hepatic resection. Positive lymph node status strongly predicted worse survival in resected patients (5-year overall survival 27% vs 5%, p < 0.001). Increasing number of positive nodes (hazard ratio, 1.13; 95% CI, 0.94 to 1.32; p = 0.17) or number of nodes removed (hazard ratio, 1.03; 95% CI, 0.99 to 1.07; p = 0.11) did not predict worse survival.

**Conclusion:** Nodal status remains an important prognostic factor in the survival of patients diagnosed with ICC and should be performed in the staging of ICC. However, the extent of lymph node evaluation does not significantly impact survival.

**Figure 1.** Survival based on lymph node status in patients with intrahepatic cholangiocarcinoma after major hepatic resection

**SMOKING HISTORY AFFECTS SURVIVAL IN HEPATOCELLULAR CARCINOMA PATIENTS UNDERGOING LIVER RESECTION BUT NOT OTHER TREATMENTS**

J. J. Clark and L. L. Wong

1Cancer Research Center of Hawaii, Honolulu, HI; 2Hawaii Medical Center-East, Honolulu, Hawaii; 3Department of Surgery, Honolulu, Hawaii

**Purpose:** Smoking is a risk factor in development of hepatocellular carcinoma (HCC), but little is known if smoking affects survival. Our objective was to examine the effect of smoking on survival of patients with HCC.

**Methods:** A retrospective review of an HCC database (1993–2009) identified 629 cases. Data collected included: demographics, hepatitis B (HBV), hepatitis C (HCV), diabetes, alcohol use, smoking history, amount of smoking in pack-years, tumor characteristics, treatment, recurrence and survival. Patients were divided into smokers (n = 354) and nonsmokers (n = 275).

**Results:** Smokers were more likely to be male (60.6% vs. 45.1%, p = 0.001), have HCV (63.8% vs. 36.2%, p = 0.005), drink alcohol (74.4% vs. 25.6%, p = 0.001) and have higher BMI (26.9 vs. 25.6, p = 0.009). There was no difference in age, ethnicity, HCC screening, diabetes, cirrhosis, tumor size, stage, MELD or treatment. Among smokers there was no difference in pack-years smoked by gender, race, diabetes, HBV or HCV, cirrhosis, or stage. Smoking was not associated with survival using Cox regression. Overall survival between smokers and nonsmokers did not differ using Kaplan Meier but when stratified by treatment, survival was better in nonsmokers. This effect was independent of the pack-years smoked and recurrence.

**Conclusions:** Smoking does not affect overall survival in HCC although smokers who undergo liver resection have worse survival compared to nonsmokers. This is independent of the amount of smoking, etiology of HCC, and recurrence. This effect may be due to the overall health of the surgical patient who smokes rather than HCC tumor biology.

<table>
<thead>
<tr>
<th>TREATMENT</th>
<th>Median survival smokers (days)</th>
<th>Median survival nonsmokers (days)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No treatment (180)</td>
<td>138 (n = 105)</td>
<td>115 (n = 75)</td>
<td>NS</td>
</tr>
<tr>
<td>Ablation (n = 232)</td>
<td>780 (n = 139)</td>
<td>824 (n = 93)</td>
<td>NS</td>
</tr>
<tr>
<td>Chemotherapy (n = 17)</td>
<td>113 (n = 8)</td>
<td>292 (n = 9)</td>
<td>NS</td>
</tr>
<tr>
<td>Resection (n = 126)</td>
<td>969 (n = 61)</td>
<td>1659 (n = 65)</td>
<td>0.028</td>
</tr>
<tr>
<td>Transplant* (n = 55)</td>
<td>&gt;1614 (n = 30)</td>
<td>&gt;1614 (n = 25)</td>
<td>NS</td>
</tr>
</tbody>
</table>

*Median survival not yet reached

**ROLE OF ENDOSCOPIC ULTRASOUND AND CYST FLUID ANALYSIS IN INITIAL EVALUATION AND FOLLOW UP OF INCIDENTAL PANCREATIC CYSTIC LESIONS**

A. Cocieru, S. Brandwein and P. Saldinger

Danbury Hospital, Danbury, CT

**Introduction:** To assess the role of endoscopic ultrasound (EUS) and cystic fluid analysis in the initial evaluation and follow up of incidental pancreatic cystic lesions (PCL).

**Methods:** Retrospective analysis of patients with incidental PCL and had minimal follow-up of 1 year.

**Results:** There were 62 patients. Mean patient age was 67.7 years (range, 30–89). Mean follow-up was 23 months (range, 12–72 months). Mean PCL size was 21.6 mm (6–51). Patients with findings suspicious of a malignant PCL were referred to surgery. Thirteen patients underwent surgery (20.9%). Diagnosis of neoplasm was confirmed in 11 patients and included mucinous cystic tumor (7), adenocarcinoma (2), intraductal papillary mucinous neoplasm (1) and cystic neuroendocrine tumor (1). Overall malignancy rate among patients who underwent surgery was 15.3% (2 patients). In 10 patients (16.1%) PCL increased in size. Repeated EUS was performed in all of them to rule out neoplasm. Mean PCL size was larger in the surgical group (27.8 mm) vs. stable group (18.8 mm) vs. enlarging PCL group (17.8 mm). Mean CEA level from PCL fluid analysis was also significantly higher in surgically treated group (7760) vs. stable group (18.8 mm) vs. enlarging PCL group (361.1).

**Conclusion(s):** EUS can be successfully used to rule out pancreatic neoplasms and to follow-up incidentally discovered PCL. High CEA levels >192 ng/ml can be used to
CONTINUOUS INFUSION WITH TIMP-3 PRESERVES LIVER HISTOLOGY BY PROMOTING A FAVORABLE CYTOKINE PROFILE DURING SUB-LETHAL TOTAL HEPATIC ISCHEMIA IN RATS

Ochsner Clinic Foundation, New Orleans, LA

Background: TNF-α Converting Enzyme (TACE) plays a critical role in the inflammatory cascade after ischemia/reperfusion (I/R) injury. TIMP-3 injected after injury inhibits hepatic TACE expression. In this report, we administered TIMP-3 as a continuous infusion 1 hour after the ischemic injury.

Methods: Male Wistar rats (n = 4/group) underwent our standard total warm ischemia model for 30 minutes. One hour after ischemia, all animals were cannulated for 1 hour with TIMP-3, a TACE-specific inhibitor at a dosage of either 0 (control group) or 1000 ng/Kg body weight (treatment group). After 6, 24, 48 hours or 7 days of reperfusion, blood and liver tissue samples were collected. Quantitative ALT levels and serum TNF-a, IL-6, and IL-19 levels were measured. Liver histology was undertaken.

Results: All animals survived sub-lethal hepatic ischemia. In control livers at 6 hours, there are notable early ischemic changes. TIMP-3 treated livers have intact cytoarchitecture for the first 6 hours post I/R. With a continuous TIMP-3 infusion, there was notable inhibition of TNF-α, IL-6, and IL-19 cytokine levels, as well as ALT enzyme activity.

Conclusion: A continuous infusion of TIMP-3 results in a cytokine profile that appears to promote favorable histology following sub-lethal total hepatic ischemia in rats. This study suggests that TIMP-3 administered as an infusion after I/R injury may have a clinical application in saving injured livers.

Table 1. Significant inhibition of inflammatory biomarkers by TIMP-3

<table>
<thead>
<tr>
<th></th>
<th>6 hours</th>
<th>24 hours</th>
<th>48 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>TNF-α (pg/ml)</td>
<td>137.2 C</td>
<td>59.5 C</td>
<td>35.1 C</td>
</tr>
<tr>
<td>IL-6 (pg/ml)</td>
<td>237.1 C</td>
<td>163.2 C</td>
<td>73.3 C</td>
</tr>
<tr>
<td>IL-19 (pg/ml)</td>
<td>360.8 C</td>
<td>177.9 C</td>
<td>24.5 C</td>
</tr>
<tr>
<td>ALT (u/l)</td>
<td>720.2 C</td>
<td>565.2 C</td>
<td>343.4 C</td>
</tr>
<tr>
<td>Caspases-3/7 (rlu)</td>
<td>129.5 T**</td>
<td>68.7 T**</td>
<td>16.1 T</td>
</tr>
<tr>
<td>TNF-α (pg/ml)</td>
<td>59.0 C</td>
<td>33.1 C</td>
<td>17.2 C</td>
</tr>
<tr>
<td>IL-6 (pg/ml)</td>
<td>135.6 C</td>
<td>68.4 C</td>
<td>49.9 C</td>
</tr>
<tr>
<td>IL-19 (pg/ml)</td>
<td>367.0 C</td>
<td>141.8 C</td>
<td>18.3 C</td>
</tr>
<tr>
<td>ALP (u/l)</td>
<td>198.7 T*</td>
<td>118.1 T*</td>
<td>59.3 T</td>
</tr>
</tbody>
</table>
| C = saline control; L = TIMP-3-treated
*p < 0.05
**p < 0.01

SALVAGE THERAPY WITH TIMP-3 PRESERVES LIVER HISTOLOGY BY PREVENTING APOPTOSIS DURING SUB-LETHAL TOTAL HEPATIC ISCHEMIA IN RATS

Ochsner Clinic Foundation, New Orleans, LA

Background: Prior research has proven the inhibition of Tumor Necrosis Factor-α Converting Enzyme (TACE) by TIMP-3 and the treatment’s protective role on liver biochemistry. We administered TIMP-3 as a bolus injection 1 hour after the ischemic injury to examine the drug’s effect on inflammatory cytokines and apoptosis.

Methods: Male Wistar rats (n = 4/group) underwent our standard total warm ischemia model for 30 minutes. One hour after ischemia, all animals were injected with TIMP-3, at a dosage of either 0 (control group) or 1000 ng/Kg body weight (treatment group). After 6, 24, 48 hours or 7 days of reperfusion, blood and liver tissue samples were assessed for ALT levels, hepatic Caspases-3/7, and serum TNF-a, IL-6, and IL-19 levels. Liver histology was undertaken.

Results: All animals survived sub-lethal hepatic ischemia. After 7 days, the control animals showed typical ischemic changes. The treated group showed near normal liver parenchyma. With TIMP-3 salvage therapy, there was significant inhibition of ALT and Caspases-3/7 enzyme activities. Also, levels of inflammatory cytokines TNF-a, IL-6 and IL-19 were significantly inhibited in TIMP-3-treated animals.

Conclusion: Salvage therapy with TIMP-3 results in an inhibited inflammatory cascade with decreased Caspase activity, which appears to promote favorable histology following sub-lethal total hepatic ischemia in rats. TIMP-3 administered after I/R injury may have a clinical application in rescuing injured livers.

Table 1. Significant inhibition of inflammatory biomarkers by TIMP-3

<table>
<thead>
<tr>
<th></th>
<th>6 hours</th>
<th>24 hours</th>
<th>48 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALT (u/l)</td>
<td>258.4 C</td>
<td>192.2 C</td>
<td>76.4 C</td>
</tr>
<tr>
<td>Caspases-3/7 (rlu)</td>
<td>1123.2 C</td>
<td>753.9 C</td>
<td>491.3 C</td>
</tr>
<tr>
<td>TNF-α (pg/ml)</td>
<td>59.0 C</td>
<td>33.1 C</td>
<td>17.2 C</td>
</tr>
<tr>
<td>IL-6 (pg/ml)</td>
<td>135.6 C</td>
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<tr>
<td>IL-19 (pg/ml)</td>
<td>367.0 C</td>
<td>141.8 C</td>
<td>18.3 C</td>
</tr>
</tbody>
</table>
| c = saline control; L = TIMP-3-treated
*p < 0.05
**p < 0.01

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REGIONALIZATION OF PANCREATIC RESECTION FOR MALIGNANCY IN NY STATE

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1Roswell Park Cancer Institute, Buffalo, NY;
2SUNY-University of Buffalo Department of Surgery, Buffalo, NY

Introduction: Regionalization of pancreatic resections for malignancy in New York State (NY) has shifted procedures to higher volume centers with a reduction in perioperative mortality. We examined the patterns of patient access and distances traveled for NY residents having pancreatic resections relative to the availability of a high volume facility (HVF) in their local Health Service Area (HSA).

Methods: Hospital discharge abstracts were obtained from NY Statewide Planning and Research Cooperative System for patients undergoing pancreaticoduodenectomy or total pancreatectomy for malignancy from 2002 to 2007. Hospitals were assigned to similarly distribute average annual volume tertiles. Travel distance to the hospital performing surgery was estimated by zip codes. Logistic regression analysis was used to model the probability of perioperative mortality and hospital access.

Results: NY residents underwent 2568 pancreatic cancer resections. Perioperative mortality was 2.2% in HVF, 4.7% in medium volume facilities (MVF), and 7.4% in low volume facilities (LVF), (p < 0.01). Patient travel distances were greater to HVF (24.7 mi) and MVF (21.5 mi) facilities compared to LVF (9.6 mi., p < 0.01). Patients without commercial insurance or Medicare were twice as likely to have surgery at a low volume hospital (p < 0.01).

Conclusion: Patients living near a high volume hospital are no more likely to have surgery at the high volume facility than a low volume one. Patients living close to a medium or low volume facility are most likely to have surgery at that facility. Local health care service practices and patient insurance status may limit access to high volume pancreatic cancer facilities.

LAPAROSCOPIC DISTAL PANCREATECTOMY, A SINGLE CENTRE EXPERIENCE

M. D’Hondt1,3, A. Roy1,2,3, M. Dagenais1,2,3, R. Letourneau1,2,3, M. Plasse1,2,3, R. Lapointe1,2,3 and F. Vandenbroucke-Menu1,2,3
1Hopital Saint Luc - CHUM, Montreal, QC;
2Centre de Recherche Du CHUM, Montreal, QC;
3Universite de Montreal, Montreal, QC

Introduction: Laparoscopic surgery for pancreatic diseases has gained in popularity during the last decade. We have been performing laparoscopic distal pancreatectomy (LDP) since 2005; therefore we report our current experience.

Materials and methods: This is a single centre retrospective study including 40 patients who underwent LDP between 2005 and 2010. Perioperative factors were analyzed as such operative time, blood loss, hospital stay, postoperative recovery and complications.

Results: There were 12 men and 28 women (mean age 52.6 years). Indications consisted of mucinous cystadenoma, (n = 16), endocrine tumors (n = 8), serous cystadenoma (n = 4) and chronic pancreatitis (n = 2), IPMN (n = 3), adenocarcinoma (n = 4), pseudopapillary tumor (n = 1), insulinoma (n = 1) and renal metastasis (n = 1). Ten patients (25%) had LDP with splenic preservation using Warshaw technique without any postoperative splenic ischemia or infarction. Mean blood loss was 125 ml (range 0–500 ml) and mean operating time was 283 min (range 135–460 min). Mean tumor size was 3.2 cm (range 0.8–7.0 cm). Conversion rate was 17.5% (7 cases). There was no postoperative mortality. Postoperative complications occurred in 10 patients (25.0%): pancreatic fistula (Grade A) in 9 patients (22.5%), hepatic abscess in 1 patient (2.5%) and gastroparesis in 3 patients. No patient needed surgical reexploration. The median hospital stay was 7 days.

Conclusions: Results of our study showed that LDP is a safe and effective procedure and a reasonable alternative to open distal pancreatectomy in selected patients. From our own experience, Warshaw technique is a good option for splenic preservation.
WHAT IS THE ROLE OF INTRAOPERATIVE ULTRASOUND IN THE DETECTION OF HEPATIC LESIONS IN THE ERA OF MODERN PREOPERATIVE IMAGING?

M. D’Hondt1,3, F. Vandenbroucke-Menu1,2,3, M. Plasse1,2,3, R. Letourneau1,2,3, A. Roy1,2,3, M. Dagenais1,2,3 and R. Lapointe1,2,3

1Hopital Saint Luc - CHUM, Montreal, QC; 2Centre de Recherche Du CHUM - CRCHUM, Montreal, QC; 3Universite de Montreal, Montreal, QC

Introduction: The role of intraoperative ultrasound (IOUS) is questioned because of recent progress in medical imaging. The aim of the study was to determine the accuracy of IOUS in detection of hepatic tumor (HT) compared to preoperative CT and MRI.

Material and methods: This is a retrospective study including 320 patients. One hundred seventy seven patients were evaluated using an 8-slice CT-scan (SCAN8), 85 using a 64-slice CT-scan (SCAN64) and 167 using an MRI with or without a CT-scan. Pathological result was used as gold standard.

Results: The number of HT found on pathology per patient was 0, 1, 2, 3 and more for 8, 190, 60, 22 and 40 patients respectively. Fifty-nine patients had a primary HT and 261 hepatic metastasis. The correlation rates for number of detected lesions compared to pathology results were 0.664 for the SCAN8, 0.761 for the SCAN64, 0.647 for MRI, and 0.895 for IOUS. All correlations were significant different from 0 (p < 0.001). IOUS concordance rate was significantly higher than with SCAN8 (p = 0.014), SCAN64 (p = 0.049) and MRI (p = 0.003). The planned hepatic resection was extended due to IOUS in 27 patients (15%) with a SCAN8, in 11 patients (13%) with a SCAN 64 and in 21 patients (12%) with an MRI (intergroup difference not significant).

Conclusions: Compared to more recent preoperative imaging, IOUS still remains superior for detection of HT. Planned hepatic resection was extended in 12 to 15% of patients. Then, IOUS remains mandatory as a routine procedure in patients having hepatic resections.

OUTCOMES OF MINIMALLY-INVASIVE DISTAL PANCREATECTOMY: SINGLE INSTITUTION COMPARISON OF ROBOTIC AND LAPAROSCOPIC METHODS


University of Pittsburgh Medical Center, Division of Surgical Oncology, Pittsburgh, PA

Background: Multicenter data indicate that laparoscopic distal pancreatectomy (LDP) has safety equivalent to open distal pancreatectomy (ODP). We hypothesized that improved dexterity and visualization during Robotic Assisted Distal Pancreatectomy (RADP) would create improved outcomes compared to LDP.

Methods: Outcomes of RADP for 12 benign lesions and 8 pancreatic ductal adenocarcinomas (PDA) were matched to a contemporaneous lap DP group with 28 PDA and 28 benign lesions, between January 2004 and September 2010. Perioperative outcomes and 30 days mortality were compared.

Results: The age, gender, and racial demographics of the cases/lap controls were statistically equivalent, and the groups were matched in terms of American Society of Anesthesiologists Score and tumor size (Table 1). RADP and

Table 1. Outcomes of laparoscopic versus robotic-assisted distal pancreatectomy

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Lap Distal (LDP)</th>
<th>Robotic Assisted (RADP)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (Mean, SD)</td>
<td>61 (15)</td>
<td>56 (14)</td>
<td>0.16</td>
</tr>
<tr>
<td>Race (Caucasian)</td>
<td>48 (90%)</td>
<td>18 (95%)</td>
<td>0.57</td>
</tr>
<tr>
<td>Gender (Female)</td>
<td>37 (66%)</td>
<td>12 (60%)</td>
<td>0.63</td>
</tr>
<tr>
<td>ASA Score</td>
<td>(I &amp; II) 44%</td>
<td>(I &amp; II) 55%</td>
<td>0.45</td>
</tr>
<tr>
<td>Size of primary tumor (Median, IQR)</td>
<td>3.5 (2.5)</td>
<td>2.5 (2)</td>
<td>0.16</td>
</tr>
<tr>
<td>OR time (Median, IQR)</td>
<td>300 (176)</td>
<td>312 (162)</td>
<td>NS</td>
</tr>
<tr>
<td>Conversion to open</td>
<td>12 (21%)</td>
<td>0 (0%)</td>
<td>0.02</td>
</tr>
<tr>
<td>Blood loss (Median, IQR)</td>
<td>200 (287, 20–1500)</td>
<td>150 (200, 30–700)</td>
<td>0.7</td>
</tr>
<tr>
<td>Transfusion</td>
<td>9 (17%)</td>
<td>0 (0%)</td>
<td>0.05</td>
</tr>
<tr>
<td>ICU Admission</td>
<td>20 (36%)</td>
<td>6 (30%)</td>
<td>0.46</td>
</tr>
<tr>
<td>30 days morbidity</td>
<td>25 (45%)</td>
<td>8 (44%)</td>
<td>0.99</td>
</tr>
<tr>
<td>Complications (Claviean Score)</td>
<td>Minor (1&amp;2) 19%</td>
<td>Minor (1&amp;2) 10%</td>
<td>0.22</td>
</tr>
<tr>
<td>Pancreatic Fistula (all grades)</td>
<td>18 (44%)</td>
<td>7 (35%)</td>
<td>0.51</td>
</tr>
<tr>
<td>ISGP grade</td>
<td>A (23%)</td>
<td>A (25%)</td>
<td>0.78</td>
</tr>
<tr>
<td>Readmission Rate</td>
<td>13 (24%)</td>
<td>7 (35%)</td>
<td>0.37</td>
</tr>
<tr>
<td>LOS (Median, IQR)</td>
<td>6.5 (4)</td>
<td>6 (3)</td>
<td>0.35</td>
</tr>
<tr>
<td>30 days Mortality</td>
<td>0%</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>Margin from the tumor</td>
<td>&gt; = 2 (81%)</td>
<td>&gt; = 2 (95%)</td>
<td>0.26</td>
</tr>
<tr>
<td>Lymph nodes harvested (median, IQR)</td>
<td>9 (11.0)</td>
<td>17 (17.3)</td>
<td>0.09</td>
</tr>
</tbody>
</table>

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SEVERE ACUTE PANCREATITIS AND ABDOMINAL COMPARTMENT SYNDROME – INCIDENCE AND OUTCOMES OF DECOMPRESSIVE LAPAROTOMY

P. J. Davis, M. Molinari, T. Topp and M. Walsh
Department of Surgery, Division of General Surgery, Dalhousie University, Halifax, NS

Objective: To determine the incidence and outcomes of decompressive laparotomy in patients with severe acute pancreatitis (SAP) and abdominal compartment syndrome (ACS).

Methods: Using our ICU database we identified patients presenting to our ICU with a diagnosis of pancreatitis (ICD 9 code 577.x) between July 1, 2005 and June 30, 2009. Charts were reviewed, and patients who did not meet the Atlanta criteria for SAP were excluded. A database was then compiled using our electronic medical record system (Horizon Patient Folder), to obtain demographic data (age, gender, obesity, Charlson comorbidity score), details of the admission (type of pancreatitis, Ranson and APACHE scores), whether ACS developed (intrabdominal pressure >20 mmHg with signs of organ failure), whether decompressive laparotomy was preformed, and the sequelae of this intervention. Descriptive and parametric statistics were then performed.

Results: In all, 72 patients were identified, of which, 27 were excluded. Of the remaining 45, 13 patients (28%) developed ACS, and 16 (36%) decompressive laparotomies were preformed. Overall mortality was 24% and was not altered by decompressive laparotomy. Decompressive laparotomy was associated with significant morbidity (dehiscence (19%), ventral hernia (50%), wound infection (63%), pancreaticocutaneous fistula (19%), enterocutaneous fistula (44%)). Multivariable analysis showed that mortality in patients with SAP was associated with obesity (p = 0.019) and Charlson comorbidity score (p < 0.001), while decompressive laparotomy was associated with male gender (p = 0.012).

Conclusion: Decompressive laparotomy does not alter mortality in patients with SAP and ACS, but is associated with significant morbidity.

UNDERSTANDING BARRIERS TO ACCESS IN THE MANAGEMENT OF COLORECTAL CANCER LIVER METASTASES: A QUALITATIVE APPROACH

K. S. Devitt1, M. E. Wiebe1, L. Sandhu1, E. D. Kennedy1,2, N. N. Baxter1, A. R. Gagliardi1, D. R. Urbach1 and A. C. Wei1
1University Health Network, Toronto, Ontario; 2Mount Sinai Hospital, Toronto, Ontario; 3St Michael’s Hospital, Toronto, Ontario

Background: Colorectal cancer (CRC) is the 3rd most common malignancy in North America. Liver resection is the standard treatment for CRC liver metastases but hepatectomy is often underutilized in Canada. Results from a physician self-reported survey demonstrated a knowledge gap
exists between current practice patterns and best available evidence. However, contributing factors are not well understood.

**Objective:** To explore the factors responsible for the underutilization of surgical management in CRC liver metastases.

**Methods:** Two focus groups were conducted using a moderated, semi-structured format with general surgeons and medical oncologists in Ontario. Three domains of interest were explored regarding the management of CRC liver metastases: processes of care, barriers and enablers of care. Responses were recorded and analyzed using standard qualitative methods. Themes were extracted by three coders using open and axial coding using a modified grounded theory approach.

**Results:** Themes emerged included: variability of the processes of care, barriers to accessing health care resources, and issues related to medical expertise and continuing medical education. Barriers identified included: economic and resource constraints, lack of physician engagement, and difficulty ensuring quality of local medical expertise. Multi-disciplinary Cancer Conferences were identified as a key enabler of clinical care and were a focal point for interdisciplinary communication and continuing medical education.

**Conclusions:** The quality of care for patients with CRC liver metastases can be optimized by reducing the knowledge gap between current practice patterns and evidence-based treatment. These study results identify opportunities for quality improvement interventions that will overcome these barriers to care.

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**EXTERNAL VALIDATION OF A PRE-OPERATIVE NOMOGRAM TO PREDICT RISK OF PERI-OPERATIVE MORTALITY FOLLOWING LIVER RESECTIONS FOR MALIGNANCY**

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\textsuperscript{1}University of Nebraska Medical Center, Omaha, NE; \textsuperscript{2}University of Pittsburgh Medical Center, Pittsburgh, PA

**Introduction:** We have recently developed a pre-operative nomogram by using a population based database (National Inpatient Sample–NIS) to predict the risk of peri-operative mortality following liver resections for malignancy. The aim of the current study is to undertake an external validation of this population dataset-based nomogram by using data derived from a single institute.

**Methods:** The NIS database (2000–2004) was used initially to develop the nomogram which included age, race, sex, liver primary, coagulopathy, renal failure, heart failure and other major co-morbidities. The dataset for external validation was obtained from a high volume single institute specializing in hepatobiliary surgery, and validation of nomogram was undertaken by using calibration plots and concordance index.

**Results:** A total of 794 patients who underwent liver resection from 2000 to 2010 at the single institute were included in the validation set with an observed mortality rate of 1.6%. The mean total point for this sample of patients was 124.9 (SE = 1.8, range = 0 to 383) which translates to a nomogram predicted mortality rate of 1.5%, which is similar to the actual observed overall mortality rate. The nomogram concordance index was 0.65 (95% confidence interval of 0.46 to 0.82) and calibration plots stratified by quartiles revealed good agreement between the predicted and observed mortality rates (Figure).

**Conclusions:** The current study provides external validation of the pre-operative nomogram to predict the risk of peri-operative mortality following liver resection for malignancy. The nomogram provides good prediction of peri-operative mortality for both population-based datasets as well as data derived from single institutes.

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**EARLY LIVER RECURRENCE AFTER ADJUVANT CHEMOTHERAPY FOR COLORECTAL CANCER IS ASSOCIATED WITH WORSE DISEASE-FREE SURVIVAL FOLLOWING HEPATIC RESECTION**


**Hospital A. C. Camargo, Sao Paulo, Sao Paulo**

**Aim:** The aims of this study are to determine prognostic factors of survival and to analyze the impact of chemotherapy prior to liver surgery for colorectal metastases in outcome.

**Methods:** This is a retrospective study that included 170 patients with liver metastases from colorectal tumors who were treated with curative intent between 1998 and 2009. They were divided in four groups: patients who had no chemotherapy prior to liver surgery; patients who had preoperative chemotherapy for liver lesions; patients who developed liver metastasis after adjuvant chemotherapy for the primary tumor up to and after six months.

**Results:** Preoperative chemotherapy for liver metastasis was performed in 81 patients, 28 had no chemotherapy and 61 received adjuvant therapy after resection of the primary tumor, 17 up to 6 months and 44 more than six months after surgery. Disease-free survival numbers of these groups were 25.2%, 67.9%, 29.4% and 48.6% (P = 0.002). Bilobar disease, extra-hepatic lesions and the primary tumor N stage
were also prognostic factors of disease-free survival. In multivariate analysis, these three factors remained as independent prognostic factors of disease-free survival. Chemotherapy as a factor was not an independent one. However, patients who had liver metastasis up to 6 months after adjuvant chemotherapy for the primary tumor had a HR for recurrence of 3.2 (P = 0.034).

Conclusion: Along with bilobar disease, extra-hepatic lesions and primary tumor N stage, patients who had liver metastasis up to six months after adjuvant chemotherapy for the primary tumor had worse prognosis, which suggests unfavorable tumor biology.

PANCREATIC RESSECTION FOR METASTATIC TUMORS TO THE PANCREAS: ANALYSIS OF 5 CASES AND REVIEW OF LITERATURE

Hospital A. C. Camargo, Sao Paulo, Sao Paulo

Aims: The aim of this study was to evaluate the outcome of patients who underwent pancreatic resection for metastatic tumors and review the literature concerning this topic.

Methods: Five patients underwent pancreatic resection for metastatic tumors from February 1999 to August 2003. Patients who had surgery for local tumor invasion to the pancreas were excluded.

Results: Primary tumors were: ovarian carcinoma (n = 2), melanoma (n = 1) and renal cell carcinoma (n = 2). Two patients underwent pancreatoduodenectomy; two a distal pancreatectomy and one had total pancreatectomy. Four patients had distant relapses and none had local recurrence. One patient is alive with 8 years of follow-up. She had a diagnosis of ovarian coriocarcinoma. Among the ones who recurred, a patient who also had the diagnosis of ovarian cancer had peritoneal relapse and died 15 months after surgery. The individual with the diagnosis of melanoma had brain metastasis and died 3 months after surgery. One patient with renal cell carcinoma (RCC) died of complications after a colonic resection for diverticulitis 26 months after pancreatic surgery. He had no signs of disease. The other one with RCC was alive but with pulmonary relapse after 50 months, but was lost to follow-up. Review of the literature identified a 5-year survival up to 72.6% in patients with renal cell carcinoma.

Conclusions: Pancreatic resection for metastatic disease should be reserved for extremely selected cases. It seems to be associated with good survival rates in patients with renal cell carcinoma and ovarian cancer who present with pancreatic-only disease relapse.

A RISK ASSESSMENT OF BILIARY COMPLICATIONS AFTER DECEASED DONOR LIVER TRANSPLANTATION

Oregon Health & Science University, Portland, OR

Background: Biliary complications cause significant morbidity following deceased donor orthotopic liver transplantation (OLT). We hypothesized that bile duct ischemia time (donor organ off-ice to hepatic artery reperfusion) significantly affects biliary complications. This study aimed to identify risk factors associated with biliary complications, including the bile duct ischemia time.

Methods: A retrospective review was performed on all OLTs from 2003 to 2009. Recipient and donor demographics, anastomosis type, stent or T-tube placement, bypass, brain death v cardiac death donors (DCD) and postoperative biliary complications were assessed. The latter were divided into biliary stricture, anastomotic stricture, and bile leak identified at ERCP or PTC. Univariate and multivariable regression analyses were performed.

Results: There were 354 liver transplants during the study period. The biliary complication rate was 21%. Overall bile duct stricture rate was 16%. There were 16 bile leaks (5%) and 36 anastomotic strictures (10%). Anastomotic strictures were more frequent with concomitant bile leak (p = 0.045). Predictors of biliary stricture included DCD donor and PSC and alcohol as causes of liver failure (Table). Bile duct, warm, and cold ischemia times, MELD score, T-tube or stent, and anastomosis type were not associated with biliary complications.

Table. Multivariate predictors of bile duct stricture following deceased donor OLT

<table>
<thead>
<tr>
<th></th>
<th>OR</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Donation after cardiac death (DCD)</td>
<td>21.49</td>
<td>5.07–116.05</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Primary Sclerosing Cholangitis (PSC)</td>
<td>4.93</td>
<td>1.23–19.91</td>
<td>0.023</td>
</tr>
<tr>
<td>Laennec’s cirrhosis</td>
<td>2.81</td>
<td>1.25–6.52</td>
<td>0.013</td>
</tr>
</tbody>
</table>

Conclusions: The rate of biliary complications in this series was similar to other published reports. Despite a theoretical relationship between arterial ischemia and biliary complications, bile duct ischemia time did not predict the presence of bile duct stricture or leak. Further research is required to identify the factors which contribute to bile duct morbidity after OLT.

FACTORS PREDICTIVE OF OUTCOMES FROM CAUDATE LOBE RESECTION

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Division of Surgical Oncology, Louisville, KY

Background: Despite the increasing frequency of liver resection for multiple types of disease, caudate lobe resection remains a rare surgical event. The goal of this study is to evaluate possible predictors of outcome in patients undergoing caudate resection.

Methods: We reviewed a 1712 patient prospective hepatopancreato-biliary database from January 2000 to September 2010, identifying 31 hepatectomy patients undergoing caudate lobe resection. Clinicopathologic characteristics and outcomes data were compared using Chi-Square, T-test,
Abstracts

ANOVA, Kaplan–Meier, and Cox Regression. Primary endpoints were complication and overall survival (OS).

**Results:** 31 patients underwent caudate lobe resection for cholangiocarcinoma (41.9%), metastatic colorectal cancer (38.7%), Hepatocellular cancer (9.7%), or benign disease (9.7%); 9 patients (29%) had further liver resection. Complications occurred in 54.8% (17/31) of patients with median grade of 2 (scale = 1 to 5). Tobacco abuse was associated with increased risk of operative complication (58.8% vs. 14.3%, p = 0.011) as was CEA > 34 for metastatic CRC patients (33.3% vs 66.7%, p = 0.022), and total number of lesions (mean 5.83 vs 1.80, median 2 vs 2, p = 0.001). Complication was decreased in patients undergoing concurrent 2nd and 3rd segmentectomies (0% vs. 28.6%, p = 0.018). Median OS was 19 months. The only factors noted to affect OS was inflammatory pathology on intraoperative liver biopsy (20% vs. 71.4%, p = 0.021), and CEA > 34 (16.7% vs. 83.3%, p = 0.036).

**Conclusions:** With appropriate patient selection, caudate lobe resection is an effective component of surgery for hepatic disease. Further investigation is needed to determine factors that will improve outcomes.

<table>
<thead>
<tr>
<th>Factor</th>
<th>No Complication</th>
<th>Complication</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tobacco Abuse</td>
<td>14.3%</td>
<td>58.8%</td>
<td>.011</td>
</tr>
<tr>
<td>CEA &gt; 34</td>
<td>5.83%</td>
<td>66.7%</td>
<td>.022</td>
</tr>
<tr>
<td>Mean # Lesions</td>
<td>1.80</td>
<td>1.80</td>
<td>.001</td>
</tr>
<tr>
<td>Inflammatory pathology</td>
<td>Alive</td>
<td>Dead</td>
<td>.021</td>
</tr>
<tr>
<td>CEA &gt; 34</td>
<td>16.7%</td>
<td>83.3%</td>
<td>.036</td>
</tr>
</tbody>
</table>

**MANAGEMENT ALGORITHM FOR HEPATIC ANGIOMYOLIPOMA**

M. Feinman\(^1\), S. Marcus\(^1\)\(^2\) and S. Joseph\(^1\)\(^2\)
\(^1\)New York Medical College, Valhalla, NY; \(^2\)St Vincent’s Medical Center, Bridgeport, CT

**Introduction:** Hepatic Angiomyolipoma (AML) is a rare entity with approximately 200 cases reported. Due to the limited experience with this disease no standard treatment algorithm exists. Since the recent discovery of malignant AML the treatment paradigm has changed. We set out to develop a simple management algorithm.

**Methods:** The largest case series contains 49 patients. There is a strong female predominance (60%). Most tumors are found incidentally. Tumors vary in size between 2 and 20 cm. These lesions are often found via abdominal CT, while Ultrasound and MRI have also been used. Preoperative diagnosis based on imaging was incorrect in greater than 50% of patients. The vast majority of patients underwent surgical resection. Of the few that were managed conservatively (n = 8), no progression of disease was noted. Recurrence after resection was reported in three patients; one died of their disease.

**Conclusions:** We have presented a simple algorithm for the management of hepatic AML. Due to the increasing incidence of HCC in non-cirrhotic patients, coupled with the inaccuracy of preoperative radiographic diagnosis, we advocate for surgical resection of hepatic AML greater than 5 cm. Final diagnosis of hepatic AML is only possible after immunohistochemical confirmation. However, we suggest that biopsy should not be performed as this has been shown to reduce survival for patients with HCC. Resection of the tumor results in minimal morbidity and mortality with improvement in quality of life. With the development of minimally invasive liver surgery, early referral to an advanced liver center for any questionable liver lesions is advised.

**Algorithm:**

**ANATOMIC LIVER RESECTIONS FOR THE TREATMENT OF HEPATOLITHIASIS**

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Pontificia Universidad Catolica de Chile, Santiago, Region Metropolitana

**Background:** Intrahepatic stones (IHS) can be associated to serious complications and its treatment is reason for controversy.

**Objectives:** To evaluate clinical data, peri-operative and long-term results of anatomic hepatic resections for IHS.

**Patients and methods:** Clinical data, immediate and long-term outcomes of a cohort of 50 consecutive patients who underwent anatomic hepatic resections for IHS between November 1986 and July 2010 were analyzed. Immediate outcomes included stone clearance rate (SCR), operative morbidity and mortality. Long-term results were focused on stone recurrence rate, with a median follow-up of 73.8 (range 6–274) months.
**Results:** Mean age was 49.1 years, 66% were women. Almost all patients (98%) were symptomatic, being abdominal pain (89.3%), cholangitis (34.7%) and jaundice (32.6%) the most frequent symptom. Abdominal ultrasound was diagnostic in 76.1%. ERCP was performed in 73.9%, MRI in 98% after year 2000. Twenty-nine patients (58%) had lithiasis in the left biliary tree, 17 (34%) in the right biliary tree and 4 patients (8%) had bilateral disease. Left lateral segmentectomy was done in 50%. Ninety four percent with right IHS had history of Cholecystectomy vs 59.3% in patients with left IHS (p = 0.027). The immediate SCR was 95.6%. Morbidity was 32%. Recurrent stones in 5 patients. There was no mortality in this series.

**Conclusions:** Anatomical hepatic resection is a safe and effective surgical treatment for IHS with a low rate of residual disease. There is a relationship between history of biliary surgery and development of IHS in the right biliary tree that may be explained by unsuspected right artery lesion during cholecystectomy.

**ROSIGLITAZONE ANTAGONIZES GEMCITABINE ACTIVITY IN PANCREATIC ADENOCARCINOMA VIA CELL-CYCLE ARREST**

M. A. Firpo1,2, J. D. Coursen1, B. R. White1, G. L. Livers1 and S. J. Mulvihill1,2

1Department of Surgery, Salt Lake City, UT;
2Huntsman Cancer Institute, Salt Lake City, UT

Gemcitabine has remained the standard of care for pancreatic cancer even though its clinical efficacy is limited. Gemcitabine is a nucleoside analog that incorporates into DNA during the synthesis phase, resulting in S-phase arrest and apoptosis. Since combination therapy may augment the activity of gemcitabine, we examined the potential to improve the gemcitabine effectiveness through combined treatment with rosiglitazone. However, we found that gemcitabine and rosiglitazone demonstrate antagonistic effects on pancreatic adenocarcinoma (PA) cell lines. PA cell lines BxPC-3 and PANC-1 were exposed to graded doses of gemcitabine and rosiglitazone, either alone or in combination, and proliferation was measured. The drug interaction was assessed using isobologram analysis (Figure 1) and the multiple drug effect equation of Chou-Talalay. At all drug combinations tested, combination index values were greater than 1, indicating antagonism between gemcitabine and rosiglitazone in both BxPC-3 and PANC-1. We further examined this antagonism using flow cytometry to assess cell cycle progression. As expected, gemcitabine alone resulted in S-phase arrest in BxPC-3 and PANC-1 cells, consistent with accumulation of DNA lesions. Treatment with rosiglitazone alone resulted in G1 arrest in both BxPC-3 and PANC-1 cells. In BxPC-3 cells co-treated with gemcitabine and rosiglitazone, S-phase arrest was reduced by 43%. In PANC-1, the rosiglitazone effect was delayed relative to gemcitabine, yet drug combination still resulted in 15% reduction of gemcitabine-dependent S-phase arrest. The data suggest rosiglitazone antagonizes gemcitabine activity via G1 arrest thereby blocking progression to S-phase. This antagonism should be considered when treating diabetic cancer patients with rosiglitazone.

**Figure 1.** Rosiglitazone (RGZ) and gemcitabine (GEM) act antagonistically in pancreatic adenocarcinoma cell lines. The interaction between rosiglitazone and gemcitabine was analyzed in BxPC-3 (A) and PANC-1 (B) cell lines. Cell viability was measured using resazurin reduction after 72 hours of drug exposure. Isobologram analysis shows the lines of additivity for ED25 (25% effective dose), ED50, and ED75. The actual drug concentrations required for ED25, ED50, and ED75 are represented by points on the graph. Antagonism is indicated by points falling above the line of additivity.
SERUM MMP-7 IS AN INDEPENDENT PREDICTOR OF SURVIVAL IN PATIENTS WITH PANCREATIC ADENOCARCINOMA
M. A. Firpo1,2, J. E. Shea1, K. A. Brown1, L. L. Emerson1, K. M. Boucher3,4, C. L. Scaife1,2 and S. J. Mulvihill1,2
1Department of Surgery, Salt Lake City, UT; 2Huntsman Cancer Institute, Salt Lake City, UT; 3Department of Pathology, Salt Lake City, UT; 4Department of Oncological Sciences, Salt Lake City, UT

Although serum MMP-7 has been proposed as a diagnostic biomarker for pancreatic adenocarcinoma (PA), its prognostic efficacy has not been evaluated. We assessed serum MMP-7 levels in 80 consecutive subjects with histologically or cytologically confirmed PA by ELISA. Survival analyses were performed using univariate and multivariate Cox models. MMP-7 levels ranged from 2 to 99 ng/ml with a median of 10 ng/ml and mean of 14 ± 14 (mean ± standard deviation). MMP-7 levels were a significant predictor of survival when MMP-7 was used as a continuous variable (P = 0.037). Serum MMP-7 was inversely related to survival, with higher levels corresponding to poorer prognosis. PA patients with MMP-7 serum levels below the mean had a median survival of 330 days, while those above mean MMP-7 serum levels had a median survival of 167 days, a difference of over 5 months. Diagnostic plots of serum MMP-7 showed a marked distribution change at a threshold of 20 ng/ml, which also showed prognostic significance when used as a discrete cut off in Cox models (P = 0.002). Subjects with MMP 7 above this threshold had higher than expected risk indicating that 20 ng/ml may be useful clinically. Serum MMP-7 remained a significant predictor of survival after stratifying for treatment and dissemination status in multivariate analysis. Serum MMP-7 levels may be useful for patient stratification and to direct treatment options in patients with pancreatic cancer. The mechanistic relationships between high MMP-7 levels and poorer outcomes require further study.

OUTCOMES ARE INFERIOR IN PATIENTS REQUIRING VENOUS RESECTION FOR LOCALLY ADVANCED PERIAMPU LLARY TUMORS
C. P. Fischer1, B. Fahy1, T. Aloia1, E. Jo2, C. H. Ahern1 and W. E. Fisher2
1The Methodist Hospital and Weill Cornell Medical College, Houston, Texas; 2Baylor College of Medicine, Houston, Texas

Background: Single-institution series suggest that patients with peripancreatic cancer who require portal venous resection (PVR) at the time of pancreaticoduodenectomy have similar outcomes to patients who undergo standard pancreatectoduodenectomy. We report the results of a multi-institutional data registry with contemporary cancer-specific and perioperative outcomes.

Methods: From 2002 to 2010, 621 consecutive patients with peripancreatic tumors underwent pancreaticoduodenectomy; 527 (85%) without and 94 (15%) with PVR at two high-volume academic medical centers. Outcomes for these two cohorts were recorded in a prospective institutional database. Categorical variables were examined with Chi Square/Fisher’s exact test, and continuous variables with the Wilcoxon rank sum test. Survival was calculated using the Kaplan-Meier method.

Results: No differences were noted between the two cohorts regarding demographic variables, or comorbidities. The addition of PVR to standard pancreaticoduodenectomy resulted in increased operative time, blood loss, and need for blood transfusion compared to patients who underwent standard pancreaticoduodenectomy. Patients who underwent PVR were more likely to have major complications (Clavien Grade ≥3) and had prolonged length of stay. Despite the use of neoadjuvant chemoradiation in patients requiring PVR for borderline resectable disease, patients requiring PVR were more likely to have incomplete (R1) resections and a shorter survival.

Conclusion:These data suggest that, contrary to prior reports, patients who require venous resection may not have perioperative or cancer-specific outcomes that are equivalent to patients who undergo standard pancreaticoduodenectomy.
A RANDOMIZED TRIAL OF GENOMIC DATA SHARING OPTIONS IN PANCREAS TISSUE DONORS

Baylor College of Medicine, Houston, Texas

Background: Although it has become possible to identify an individual from pooled DNA data, investigators are encouraged to comply with established data sharing policies. We conducted a single blind, randomized controlled trial of three different types of consent to assess the impact on research enrollment and participants’ data sharing choices. The three different consent types tested afforded different levels of control over the decision about data sharing.

Methods: Subjects were enrolled with an IRB-approved waiver of consent and randomized to one of three types of consent (traditional, binary, or tiered). After signing, participants were debriefed, given a detailed review of the data sharing options in all three consent forms, and an option to change their data sharing choice or opt out of the study entirely.

Results: There were no significant differences in demographic characteristics between the three consent arms. Most subjects initially chose public (internet) release of their personal genomic information but after debriefing, almost a third of the patients chose more restricted release. No patients opted out of the study (refused to donate tissue for genomic research).

Conclusion: Our findings suggest that most patients are willing to donate pancreatic tissue for DNA sequencing studies but, when well-informed, a significant portion prefer restricted release of their genomic data. Tissue donors being enrolled in DNA sequencing studies should be informed about genomic data sharing risk and provided with the option to restrict data sharing.

<table>
<thead>
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<th>Total (n = 101)</th>
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<th>Binary (n = 32)</th>
<th>Tiered (n = 34)</th>
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<tr>
<td>Public (Internet)</td>
<td>89(88)</td>
<td>35(100)</td>
<td>28(88)</td>
<td>26(77)</td>
</tr>
<tr>
<td>Restricted</td>
<td>7(7)</td>
<td>-</td>
<td>-</td>
<td>7(21)</td>
</tr>
<tr>
<td>No Release</td>
<td>5(5)</td>
<td>-</td>
<td>4(13)</td>
<td>1(3)</td>
</tr>
<tr>
<td><strong>Final Data Release Selection</strong></td>
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<tr>
<td>Public (Internet)</td>
<td>60(60)</td>
<td>23(66)</td>
<td>21(66)</td>
<td>16(47)</td>
</tr>
<tr>
<td>Restricted</td>
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<td>11(31)</td>
<td>9(28)</td>
<td>15(44)</td>
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<tr>
<td>No Release</td>
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<td>1(3)</td>
<td>2(6)</td>
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<td><strong>Changed Selection</strong></td>
<td>31(31)</td>
<td>12(34)</td>
<td>9(28)</td>
<td>10(30)</td>
</tr>
</tbody>
</table>

Data are #(%): of participants

*No significant difference in final data release selection based on original consent type P = 0.443

**No significant difference in number of patients that changed consent type based on original consent type P = 0.845

PANCREATIC RESECTION WITHOUT ROUTINE INTRAPERITONEAL DRAINAGE

Baylor College of Medicine, Houston, TX

Background: Due to the high incidence of pancreatic leak, most surgeons routinely place intraperitoneal drains at the time of pancreatic resection, however, this practice has recently been challenged.

Objective: To evaluate clinical outcomes when pancreatic resection is performed without operatively placed intraperitoneal drains.

Methods: 227 consecutive patients underwent pancreatic resection (153 pancreaticoduodenectomy, 74 distal pancreatectomy) and outcomes were recorded in a prospective database. In the first cohort (179 patients) drains were routinely
placed at the time of surgery and removed when output decreased to <20 mL/day and amylase concentration was <360 IU/mL. In the second cohort (48 patients) no intraoperative drains were placed. Outcomes were compared with Chi-square/Fisher’s exact test for categorical variables, and the Wilcoxon test for continuous variables (median, interquartile range).

**Results:** Demographic, surgical, and pathologic details were similar between the two cohorts. The rate of clinically significant pancreatic fistula was also similar between the two cohorts. There was an increased need for readmission and percutaneous drainage in the cohort without intraoperative drainage. However, elimination of intraoperative drains did not change the rate of intra-abdominal abscess, overall morbidity, or mortality, and decreased the rate of wound infection (Table 1).

**Conclusion:** This study suggests that abandoning the practice of routine intraperitoneal drainage after pancreatic resection may not increase the severity of postoperative complications.

<table>
<thead>
<tr>
<th></th>
<th>Intraoperative Drain (n = 179)</th>
<th>No Intraoperative Drain (n = 48)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pancreatic Fistula (ISGPF A, B, or C)</td>
<td>81 (45%)</td>
<td>6 (13%)</td>
<td>0.0001</td>
</tr>
<tr>
<td>Clinically Significant Pancreatic Fistula (ISGPF B, C)</td>
<td>19 (11%)</td>
<td>6 (13%)</td>
<td>0.712</td>
</tr>
<tr>
<td>Post-Operative Percutaneous Drain</td>
<td>2 (1%)</td>
<td>6 (13%)</td>
<td>0.001</td>
</tr>
<tr>
<td>Intra-abdominal Abscess</td>
<td>6 (3%)</td>
<td>2 (4%)</td>
<td>0.677</td>
</tr>
<tr>
<td>Wound Infection</td>
<td>19 (11%)</td>
<td>0 (0%)</td>
<td><strong>0.020</strong></td>
</tr>
<tr>
<td>Readmission</td>
<td>6 (3%)</td>
<td>8 (17%)</td>
<td><strong>0.003</strong></td>
</tr>
<tr>
<td>Reoperation</td>
<td>8 (4%)</td>
<td>0 (0%)</td>
<td>0.208</td>
</tr>
<tr>
<td>Morbidity</td>
<td>50 (28%)</td>
<td>16 (33%)</td>
<td>0.119</td>
</tr>
<tr>
<td>Mortality (30-Day)</td>
<td>1 (1%)</td>
<td>1 (2%)</td>
<td>0.379</td>
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</tbody>
</table>

**Routine Nasogastric Suction is Unnecessary After Pancreatic Resection**
Baylor College of Medicine, Houston, TX

**Background:** Most surgeons routinely place a nasogastric tube (NGT) at the time of pancreatic resection.

**Objective:** To evaluate clinical outcome when pancreatic resection is performed with and without routine postoperative nasogastric suction.

**Methods:** 227 consecutive patients underwent pancreatic resection (153 pancreaticoduodenectomy [141 (92%) pylorus-sparing], 74 distal pancreatectomy). In the first cohort (n = 179), an NGT was placed in all patients at the time of surgery and removed in the postoperative period at the surgeon’s discretion. In the second cohort (n = 48), the NGT was removed in the operating room in all patients and replaced only if the patient developed gastric distension or emesis. Outcomes for these two cohorts were recorded in a prospective database and compared using Chi-Square/Fisher’s exact test and the Wilcoxon rank sum test.

**Results:** Demographic, surgical, and pathologic details were similar between the two cohorts. In the first cohort, the median day for NGT removal was postoperative day 2 (interquartile range, 1–4). After removal of the original NGT, 5 patients (3%) required reinsertion of another NGT later during their hospital stay. Among the group without routine postoperative nasogastric suction, 4 patients (8%) required insertion of an NGT postoperatively and this was accomplished without any complications. There were no statistically significant differences between the two cohorts with respect to the incidence of delayed gastric emptying (ISGPs A, B,C), pneumonia, overall morbidity or mortality (Table 1).

**Conclusion:** Our data suggest that elimination of routine postoperative nasogastric suction after pancreatic resection may not be associated with any adverse outcomes.

<table>
<thead>
<tr>
<th></th>
<th>Routine NGT (n = 179)</th>
<th>No NGT (n = 48)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delayed Gastric Emptying (ISGPs)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>7 (4%)</td>
<td>4 (8%)</td>
<td>1.000</td>
</tr>
<tr>
<td>B</td>
<td>6 (3%)</td>
<td>0 (0%)</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>2 (1%)</td>
<td>0 (0%)</td>
<td></td>
</tr>
<tr>
<td>NGT Reinsertion</td>
<td>5 (3%)</td>
<td>4 (8%)</td>
<td>0.078</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>19 (11%)</td>
<td>6 (13%)</td>
<td>0.712</td>
</tr>
<tr>
<td>Morbidity</td>
<td>50 (28%)</td>
<td>16 (33%)</td>
<td>0.119</td>
</tr>
<tr>
<td>Mortality (30-Day)</td>
<td>1 (1%)</td>
<td>1 (2%)</td>
<td>0.379</td>
</tr>
</tbody>
</table>
IN-VITRO SENSITIVITY PROFILE OF LOCALIZED AND METASTATIC PANCREATIC CANCER

J. Franko1, M. M. Bilimoria2, S. Chalikonda1, D. A. Iannitti1 and C. Tian1
1Mercy Medical Center, Des Moines, IA; 2Northwestern Community Hospital, Arlington Heights, IL; 3Cleveland Clinic, Cleveland, OH; 4Carolina’s Medical Center, Charlotte, NC; 5Precision Therapeutics, Pittsburgh, PA

Background: Gemcitabine and 5-fluorouracil represent mainstay of chemotherapy for pancreatic cancer. Efficacy is limited and chemotherapeutic alternatives are poorly defined. Moreover, differential activity in localized versus metastatic cancers has been identified among other gastrointestinal cancers. We tested the hypothesis that in vitro sensitivity of pancreatic cancer is the same among localized/resectable versus metastatic cases.

Methods: 93 pancreatic cancer cases with complete testing for 5-FU and gemcitabine using an in vitro chemosensitivity assay (ChemoFx, Precision Therapeutics, Pittsburgh, PA) were included. Sensitive/resistant status was determined based on in vitro dose response curves.

Results: There were 68 resected and 25 metastatic cases (total 93). Resistance to both 5-FU and gemcitabine was seen in 68 cases (73%), 11 were sensitive to 5-FU or gemcitabine, and 14 were sensitive to both agents. Proportion of sensitive tumors was similar among localized/resected versus metastatic cases for 5-FU, gemcitabine and their combination, but different for oxaliplatin and docetaxel (Table). A total of 42 (45%) tumors were resistant to all tested drugs (31/68, 46% localized versus 11/25, 44% metastatic; p = 0.891).

<table>
<thead>
<tr>
<th>Drug</th>
<th># sensitive / # tested (%)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Resected</td>
<td>Metastatic</td>
</tr>
<tr>
<td>5-FU</td>
<td>13/68 (19%)</td>
<td>5/25 (20%)</td>
</tr>
<tr>
<td>gemcitabine</td>
<td>14/68 (21%)</td>
<td>7/25 (28%)</td>
</tr>
<tr>
<td>5-FU + gemcitabine</td>
<td>27/58 (47%)</td>
<td>7/16 (44%)</td>
</tr>
<tr>
<td>irinotecan</td>
<td>20/59 (34%)</td>
<td>6/17 (35%)</td>
</tr>
<tr>
<td>oxaliplatin</td>
<td>3/63 (5%)</td>
<td>5/18 (28%)</td>
</tr>
<tr>
<td>carboplatin</td>
<td>13/55 (24%)</td>
<td>8/22 (36%)</td>
</tr>
<tr>
<td>5-FU + oxaliplatin</td>
<td>25/58 (43%)</td>
<td>5/16 (31%)</td>
</tr>
<tr>
<td>gemcitabine + cisplatin</td>
<td>14/56 (25%)</td>
<td>5/17 (29%)</td>
</tr>
<tr>
<td>docetaxel</td>
<td>0/52 (0%)</td>
<td>5/24 (21%)</td>
</tr>
</tbody>
</table>

NOTE: Not all tumors were tested for all drugs. * denotes statistical significance p < 0.05

Conclusions: In vitro resistance rate to traditional chemotherapy is high (73%). Chemosensitivity to 5-FU, gemcitabine, and their combination is similar between localized and metastatic cases. Chemosensitivity to oxaliplatin and docetaxel is significantly higher among metastatic as compared to localized cases. Clinical outcome correlation is planned to determine clinical value of the ChemoFx assay.

SOLID PSEUDOPAPILLARY TUMOR OF THE PANCREAS: SURGICAL OUTCOMES AT A SINGLE TERTIARY CENTER

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Mayo Clinic College of Medicine, Rochester, MN

Background: Solid pseudopapillary tumor of the pancreas (SPT) is a poorly defined, uncommon neoplasm with known malignant potential. Current data is limited to case reports and small series. Our aim was to characterize the presentation, surgical treatment and outcomes of a single, tertiary center specializing in pancreatic disease.

Methods: A retrospective review of all patients undergoing surgical treatment of SPT from 1990 to 2010 was performed. All data is presented as mean ± standard deviation or median with range.

Results: We identified 25 patients with a mean age of 27; all but two were female. Common presenting signs included abdominal pain (60%) and nausea/vomiting (20%). Surgical resection included distal pancreatectomy in 16 (64%) and pancreaticoduodenectomy in 8 (32%). Mean operative time and blood loss were 212 (±87) minutes and 336 (±300) ml respectively. Median tumor size and lymph nodes harvested were 5.7 (2–11) cm and 6 (0–19) respectively. No patient had lymph node involvement and all patients underwent an R0 resection. Tumor recurrence developed in 2 patients (8%) 13 and 19 months postoperatively, presenting as liver metastasis in one and carcinomatosis in another.

Conclusion: SPT is an uncommon neoplasm affecting predominantly women. Surgical resection should continue to be the mainstay of treatment. Tumor recurrence occurs in 8% of patients. Surveillance after resection may be indicated although chemotherapeutic or surgical treatment options for these patients remains undefined.

FACTORS ASSOCIATED WITH RECIDIVISM FOLLOWING PANCREATICODUODENECTOMY

S. S. Grewal1,2, R. J. McClaine1,2, D. J. Hanseman1,3, J. J. Sussman1,2, N. Schmulewitz1,2, M. Smith1,2, K. A. Choe1,2, O. O. Olowokure1,2, M. Mierzwa1,2 and S. A. Ahmad1,2
1The Pancreatic Disease Center, Cincinnati, Ohio; 2The University of Cincinnati Medical Center, Cincinnati, Ohio; 3Center For Sustainment of Trauma and Readiness Skills (C-STARS), United States Air Force, Cincinnati, Ohio

Introduction: Few reports have delineated factors associated with recidivism following pancreaticoduodenectomy. Factors related to readmission may include post-operative morbidity and/or functional status of the patient. This study aims to retrospectively review our institutional experience with readmission following the Whipple procedure.

Methods: After IRB approval, the UC pancreatic surgery database was retrospectively analyzed. Recidivism was defined as readmission to the primary or a secondary hospital within 1 month and 1–3 months. The associations between recidivism, perioperative factors and patient characteristics were evaluated by multivariate analysis.

Results: During the past five years, 124 patients underwent pancreaticoduodenectomy. The 30-day, 1–3 month and 90...
GALLBLADDER CARCINOMA: EXPERIENCE AT A NON-URBAN REFERRAL CENTER

D. R. Hall,1 J. W. Jones1,2 and J. R. Lee1,2

1East Tennessee State University James H. Quillen College of Medicine Department of Surgery, Johnson City, TN;
2Blue Ridge Surgical Associates, Johnson City, TN

Background: Gallbladder carcinoma is a rare but aggressive malignancy. Aggressive operative intervention by hepatobiliary surgeons is the key to patient survival. We present ten cases of gallbladder carcinoma referred to our non-urban tertiary care center over a three-year period.

Methods: Ten patients with gallbladder carcinoma were referred to our center from 2007 to 2010. Patients were referred by physicians located in Tennessee and Virginia (total population 275,150).

Results: Nine patients underwent radical cholecystectomy with segment 4b and 5 hepatectomy. Eight patients underwent portal lymphadenectomy. Pathologic examination revealed two patients with stage 1A, three patients with stage 1B, one patient with stage 2A, one patient with stage 2B, and three patients with stage 4 carcinoma. Follow-up time ranged from 6 to 44 months, with a mean of 30 months. Overall patient survival was 60%, with 100% disease-free survival amongst patients with stage 1A, 1B, and 2A gallbladder carcinoma. Aggressive disease progression and early mortality were seen in the patients with stage 2B and 4 carcinoma.

Conclusions: Early diagnosis and aggressive hepatobiliary surgical treatment remain the best hope for survival in patients with gallbladder carcinoma. Our non-urban tertiary care center is managed by two surgeons with hepatobiliary fellowship training. Patient survival in our center is comparable to survival at urban tertiary care centers. SEER data shows the nationwide incidence of biliary malignancies like gallbladder cancer is increasing. More hepatobiliary surgeons and hepatobiliary centers in non-urban areas are necessary to meet the growing needs of patients.

HEALTH CARE DELIVERY FOR HEPATOCELLULAR CARCINOMA IN MISSISSIPPI: DO DISPARITIES EXIST?

T. S. Helling
University of Mississippi Medical Center, Jackson, MS

Health care delivery represents the final pathway converting advances in science to better outcomes. Disparities in delivery may impact eventual patient outcomes for many public health concerns, including cancer. Mississippi (MS) has been characterized as one of the most underprivileged states in the union. It is the intent of this study to determine outcomes for hepatocellular carcinoma (HCC) across the state compared to national (US) data. ACS NCDB, SEER, and Mississippi Cancer Registry data was used. From 2000 to 2007 it was extrapolated that 1,272 Mississippians developed HCC. The age-adjusted rate trended lower than US rates. There was no difference in MS rates from rural versus urban or Delta versus non-Delta counties. Only 549 patients were treated in ACS CoC hospitals in the state (n = 14). There was no difference in age distribution, but more MS patients presented with stage III or IV disease. Fewer MS patients received surgery for HCC (15.85% vs. 25.88%, p < 0.0001) and fewer received additional treatment (12.02% vs. 18.14%, p < 0.0001). Overall survival in MS was lower than US (9.4% vs. 15.0%), including stage III (4.9% vs. 18.2%) and IV (5.2% vs. 15.0%) disease. Fifty-seven percent of patients were treated outside ACS CoC hospitals or not treated at all. When treated, patients more often had advanced stage disease and were less likely to receive surgical therapy. Outcomes for advanced stage disease may reflect these disparities. In an underprivileged state delivery of health care may be a significant obstacle to advanced, coordinated cancer care.

ROBOTIC-ASSISTED MINIMALLY-INVASIVE CENTRAL PANCREATECTOMY: VIDEO AND OUTCOMES

University of Pittsburgh Medical Center, Pittsburgh, PA

Background: Central pancreatectomy is debated for low grade tumors of the central pancreas to preserve parenchyma and the spleen. We present a video and outcomes of the largest series of robotic-assisted minimally-invasive central pancreatectomies (RACP) to date.

Methods: Eight RACP were performed between August 2009 and June 2010 at a high-volume center. The da Vinci® Surgical System was used for all eight cases (Intuitive Surgical, Sunnyvale California).

Results: The indications for surgery were benign cystic neoplasm (5) and pancreatic neuroendocrine tumor (3). The average age of the study population was 60 (range 32–75 years), and all but two were women. The average tumor size was 3.3 cm (range 1.9–6.0 cm). All patients achieved R0 status, although the first patient was converted to open to control bleeding. The spleen was preserved in all eight. The pancreatic remnant was drained via pancreaticogastrostomy in six cases and pancreaticojunostomy in two. Surgical drains and pancreatic duct stents were placed routinely. The average operative time was 425 minutes (range 305–506 min), with mean blood loss of 187 ml (range 50–350 ml). The mean hospital length of stay was 10 days (range 7–19). Seven day recidivism rates were 14.5%, 18.5%, and 27.4%. The most common reasons for readmission included dehydration and/or malnutrition (37% of readmissions), and pain (12%). Patients who underwent pancreaticoduodenectomy for chronic pancreatitis were more likely to be admitted within 3 months of surgery when compared to patients that underwent surgery for malignancy (p < 0.01). Intraoperative transfusion was also associated with 1–3 month and 90-day recidivism (p < 0.01). Pre-operative comorbidities, including the Charleston Co-morbidity Index, number of pre-discharge complications, type of Whipple reconstruction, pre-operative biliary stenting, need for vascular reconstruction and patient BMI were not associated with recidivism.

Conclusion: Our data confirms previous reports indicating high re-admission rates following pancreaticoduodenectomy. To our knowledge, our report is the first to demonstrate chronic pancreatitis as an independent risk factor for re-admission. Patients that are debilitated and need significant pain control may require prolonged hospital stays. Further studies need to be performed to confirm these results.
patients developed pancreatic fistula (88%). There were two clinically significant leaks and one required percutaneous drainage (ISGPF Grade C). None of the patients required insulin at discharge or the 30 day postoperative visit.

Conclusions: RACP is a complex minimally invasive operation that can be performed safely in experienced hands. In this early experience non-clinically significant pancreatic fistula rates were high, but endocrine function was highly preserved.

VARYING CLINICAL AND RADIOLOGICAL PRESENTATION OF DUODENAL GASTROINTESTINAL STROMAL TUMORS

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¹University of Utah, Salt Lake City, U; ²Brown University, Providence, RI

Objective: Duodenal gastrointestinal stromal tumors (GISTs) account for 6% of GISTs. We describe the wide variation in clinical and radiological presentation, the approach to surgical management and outcomes.

Methods: Retrospective chart review of eight consecutive patients with duodenal GIST, from 1/1/2001 to 3/1/2010.

Results: The average age was 56 years (42–73). The most common presentation was anemia (75%), followed by gastrointestinal bleeding (62.5%), abdominal pain (25%), weight loss (25%) and diarrhea (12.5%). Tumors ranged from 3–11.5 cm and were distributed in the second portion (4), third portion (3), and fourth portion (1) of the duodenum. Only 3/8 tumors were correctly identified pre-operatively. Wide variability on cross sectional imaging led to tumors being incorrectly identified as neuroendocrine tumor (2), mucinous cystic neoplasm (1), duodenal sarcoma (1) and not visualized (1).

Conclusions: Our study highlights the wide variability in the clinical and radiographic presentation of duodenal GISTs. Only 38% of cases are correctly diagnosed pre-operatively. An improved understanding of the varying clinical and radiographic appearance of duodenal GIST may lead to improved pre-operative diagnosis and treatment planning. Long-term results following surgical resection can be excellent, with 100% disease free survival in our series. An approach to surgical management is proposed.

Figure 1a. reveals a duodenal GIST which has intense enhancement in the arterial phase (arrow) similar to a typical pancreatic neuroendocrine tumor. b. shows a duodenal GIST also in second portion of the duodenum, that is hypoattenuated (arrow) and has an appearance similar to a cystic neoplasm of the pancreas

patients who had surgical resection are alive and disease free, with an average follow-up of 943 days (23–2212 days). One patient received no intervention and was lost to follow up.

Conclusions: Our study highlights the wide variability in the clinical and radiographic presentation of duodenal GISTs. Only 38% of cases are correctly diagnosed pre-operatively.

An improved understanding of the varying clinical and radiographic appearance of duodenal GIST may lead to improved pre-operative diagnosis and treatment planning. Long-term results following surgical resection can be excellent, with 100% disease free survival in our series. An approach to surgical management is proposed.
THE MCGILL BRISBANE PRE-OPERATIVE CLINICAL SCORE IS A BETTER PREDICTOR OF RESECTABILITY AT PANCREATICODUODENECTOMY THAN IMAGING

M. Jamal1, J. Abou Khalil1, E. Simonneau1, P. Chaudhury1, M. Hasanain1, J. Tchervenkov1, S. Doi2 and J. Barkun1

Purpose: The goal for surgical resection of pancreatic adenocarcinoma (PA) is to achieve an R0 resection but this is not reliably predicted by use of conventional imaging modalities. We have previously described and validated the McGill-Brisbane scoring system (MBSS), which predicts survival in palliative PA patients based on 4 clinical variables recorded at the time of first clinical encounter. The aim of the current study is to determine the value of MBSS in predicting postoperative margin status.

Methods: We conducted a retrospective study of 84 consecutive patients diagnosed with PA who had a pancreaticoduodenectomy at our institution from January 2001 to August 2009. Multivariable analyses were performed to determine predictors of margin status on pathology.

Results: Based on radiology 32.5% were inaccurately thought to be amenable to an R0 resection (See patient characteristics Table). The preoperative MBSS was superior to imaging and significantly discriminative of margin status on ROC analysis with optimal cutoff at MBSS > 12: the odds of a non-R0 margin with 77% specificity and 52% sensitivity of a non-R0 margin was 3.56 (95% CI 1.34–9.46) times those predicted with a MBSS ≤ 12: the odds > 20% increased chance of this outcome.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Median (range)</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>65 y</td>
<td>83</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Men</td>
<td>44 (53)</td>
<td></td>
</tr>
<tr>
<td>Women</td>
<td>39 (47)</td>
<td></td>
</tr>
<tr>
<td>Tumor size</td>
<td>3.1 cm</td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>23–88 y</td>
<td></td>
</tr>
<tr>
<td>Missing</td>
<td>N = 4</td>
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<tr>
<td>Presenting symptoms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight loss (any)</td>
<td>56 (67.5)</td>
<td></td>
</tr>
<tr>
<td>Weight loss &gt; 10%</td>
<td>40 (48.2)</td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td>21 (25.3)</td>
<td></td>
</tr>
<tr>
<td>Pain</td>
<td>47 (56.6)</td>
<td></td>
</tr>
<tr>
<td>Jaundice</td>
<td>65 (78.3)</td>
<td></td>
</tr>
<tr>
<td>Margin status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R0</td>
<td>56 (67.5)</td>
<td></td>
</tr>
<tr>
<td>R1</td>
<td>27 (32.5)</td>
<td></td>
</tr>
<tr>
<td>1 year Survival</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall = 85.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recurrence free = 66.5%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R0</td>
<td>Overall = 68.4%</td>
<td></td>
</tr>
<tr>
<td>Recurrence free = 42.8%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Conclusion: The MBSS is a preoperative predictor of margin status in patients undergoing pancreaticoduodenectomy and can be used as an additional tool to stratify patients in a clinical or trial setting.

MAJOR HEPATIC RESECTION COMBINED WITH PORTAL VEIN OR HEPATIC ARTERY RECONSTRUCTION FOR ADVANCED BILIARY CARCINOMA IN THE HEPATIC HILUM


General Surgery, Graduate School of Medicine, Hokkaido University, Sapporo, Hokkaido

Purpose: We evaluated whether hepatectomy with vascular reconstruction (VR) for biliary carcinoma is justified in terms of complications and outcome.

Patients: Patients with hilar cholangiocarcinoma (n = 39) and gallbladder carcinoma (n = 6) who underwent over bi-sectionectomy and biliary reconstruction were enrolled. Right hemihepatectomy (n = 29; two with pancreaticoduodenectomy), left hemihepatectomy (n = 10), right trisectionectomy (n = 4), left trisectionectomy (n = 1) and right anterior and left medial sectionectomy (n = 3) were performed. Preoperative portal vein embolization was performed on 27 of 31 patients underwent right side hepatectomy. VR was required on 14 of these 45 (31.1%) patients (portal vein reconstruction, n = 9; hepatic artery reconstruction, n = 4; portal vein and hepatic artery reconstruction, n = 1).

Result: There were no significance differences between non-VR and VR group in operation time (non-VR vs. VR: 614 ± 127 vs. 720 ± 201 min) and blood loss (non-VR vs. VR: 1316 ± 775 vs. 1705 ± 834 ml). Postoperative liver failure (serum T.bil >5 mg/dl after 7POD) occurred in 8 patients (non-VR, n = 7; VR, n = 1) but not resulted in lethal. Early and late vascular complications as thrombosis and stenosis were not observed. Mortality case include hospital death was not recorded. Pathological surgical margins negative/positive rates were 58/42% in non-VR group, and 50/50% in VR group (N.S.). The 3- and 5-year survival rates were 58/42% in non-VR group, and 50/50% in VR group (N.S.). The 3- and 5-year survival rates were 58 and 44% in the non-VR group and 41 and 0% in the VR group, respectively (p = 0.06, log-rank test).

Conclusion: We conclude hepatectomy with VR for biliary carcinoma is acceptable operative procedure and has benefits considering its 3-year survival rate. Effective adjuvant therapies should be established to improve survival.
ANALYZE OF THE RISK FACTORS OF DEATH FROM CANCER PROGRESSION WITHIN 1 YEAR AFTER HEPATECTOMY FOR THE PATIENTS WITH HEPATOCELLULAR CARCINOMA (HCC)

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Objective: The long survival must be hoped when hepatectomy was performed for the patients with hepatocellular carcinoma (HCC). Unfortunately, some patients are died from cancer progression within 1 year after hepatectomy. We analyzed the risk factors of early cancer-death.

Methods: Between 1997 and 2009, consecutive 522 patients who underwent hepatectomy were classified to Group A (dead from cancer progression within 1 year after hepatectomy) and Group B (alive over 1 year after hepatectomy). Risk factors were analyzed.

Results: The cause of death were cancer progression (150; 78.1%), operation related (1; 0.5%), hepatic failure (15; 7.8%) and other (26; 13.5%). Group A and Group B included 55 cases and 466 cases. The significant factors related with early cancer death by univariate analysis were albumin level, Child-Pugh classification, AFP level, AFP-L3 level, PIVKA-II level, anatomic resection, tumor number, tumor size, differentiation, portal vein invasion, hepatic vein invasion, distant metastasis and curability. Multivariate analysis revealed that AFP level >1000 ng/ml, tumor number >4, tumor size >5 cm, differentiation; poor, portal vein invasion. Of the preoperative risk factors as AFP level, tumor number and tumor size, 3 (1.1%) of 280 patients with no risk factors, 12 (7.8%) of 153 patients with one risk factor, 24 (32.9%) of 73 patients with two factors, and 9 (60.0%) of 15 patients with three risk factors died within 1 year (p < 0.0001).

Conclusion: Hepatectomy should be carefully selected for large and multiple HCC with high AFP level because patients with these preoperative risk factors tended to died within 1 year after hepatectomy.

RESECTION AND RFA IN THE TREATMENT OF HCC

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1Department of Endocrine Surgery, Endocrinology and Metabolism Institute, Cleveland Clinic, Cleveland, Ohio; 2Department of HPB and Transplant Surgery, Digestive Disease Institute, Cleveland Clinic, Cleveland, Ohio

Background: We have been approaching hepatocellular cancer (HCC) in a multidisciplinary fashion and triaging patients to resection or radiofrequency ablation (RFA) based on certain criteria. The aim of this study is to describe patient characteristics and outcome from a single institution.

Methods: Medical records of all HCC patients who underwent resection (N = 91) or laparoscopic RFA (N = 92) between April 1997 and May 2010 were reviewed. Univariate Kaplan-Meier and multivariate Cox Proportional Hazards model were used to analyze overall and disease-free survival.

Results: The characteristics and outcomes of two groups are summarized in the Table. In general patients with normal liver function and larger tumors were resected and those with liver dysfunction, multiple tumors and portal hypertension ablated. On univariate analysis, the number of tumors (p = 0.02), alpha fetoprotein level (p = 0.05), type of surgery (p = 0.02), Barcelona Clinical Liver Cancer (BCLC) staging (p < 0.0001), and Child classification (p < 0.0001) were predictors of overall survival. On multivariate analysis, Child class was the only independent predictor of overall survival (p = 0.007). For Child’s A patients, there was no difference in overall survival between the Resection and RFA groups when subgroup analyses were performed based on tumor size <3 cm, 3–5 cm or >5 cm.

Conclusion: To our knowledge, this is the largest North American series reporting on RFA and resection for HCC from a single institution. Although the groups were not comparable, the patterns of recurrence were similar for resection and laparoscopic RFA. Survival was determined by the underlying liver function and not the type of surgical intervention.

PARAGANGLINOMA OF THE PANCREAS: CASE SERIES AND REVIEW OF LITERATURE

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Providence Hospital and Medical Centers, Southfield, MI

Paragangliomas are rare tumors that derive from cells coming from the neuronal crests in the embryo. They are most frequently found in the para-aortic retroperitoneum, adrenal glands, carotid body or along any areas where sympathetic chains are present. More rarely they can be seen in the lung, larynx, thyroid, bladder and pancreas. Their infrequency as pancreatic tumor has not allowed them to be extensively studied. We report two cases of confirmed pancreatic gangliocytic paragangliomas. Both patients had shown on CT-scan a hypervascular exophytic mass arising from the head of the pancreas. The patients’ main complaints were abdominal pain and early satiety. Decision to take to surgery was based of the potential malignancy appearance seen on CT-scan. Both patients had surgical resections with curative intent. Intra-operative findings showed an encapsulated and highly vascularized mass with its blood supply pedicle deriving from the pancreas. One patient had pancreaticoduodenectomy and simple excision was performed in another. No further adjuvant therapy given. Pathology showed a highly vascularized mass with staining positive for chromogranin A, synaptophysin and neuron specific enolase. One of patients had single positive lymph node metastasis and has not exhibited recurrence based on surveillance. The intimate relationship of the pancreas with other retroperitoneum organs makes it possible for aberrant migration of neuroendocrine cells to occur and transform into tumors in the pancreas. Surgery has so far demonstrated to be the only effective treatment. It is still debated which type of resection should be performed and close surveillance warranted.
THE INTERACTION OF LOW STANDARD LIVER VOLUME, HIGH PACKED CELL VOLUME, PORTAL HYPERTENSION AND RISK OF PORTAL VEIN THROMBOSIS IN CLINICAL ISLET TRANSPLANTATION

T. Kawahara, T. Kin, S. Kashkoush, D. L. Bigam, N. M. Kneteman and J. Shapiro

University of Alberta, Edmonton, Alberta

Islet transplantation improves glycemic control in type1 diabetes complicated by refractory hypoglycemia. Percutaneous transhepatic portal access avoids surgery, but is rarely associated with bleeding or portal venous thrombosis. Here, we evaluate factors affecting portal pressure and thrombosis after islet infusion. 116 patients underwent 256 percutaneous intraportal islet-alone transplant procedures (mean 2.16 infusions/patient). The mean islet mass was 407,221 IE (5,908 IE/kg) with mean packed cell volume (PCV) of 4.1 ml (1.5–7.9). Univariate analysis revealed that standard liver volume had a negative correlation with portal pressure elevation (r = −0.257, P < 0.01), and those with larger liver volume had less perturbation in portal venous pressure. PCV correlated positively with elevated portal pressure (r = 0.463, P < 0.01).

10 patients (3.9%) developed partial thrombosis of peripheral segmental branches of the intrahepatic portal vein. None had complete portal thrombosis. Multivariable logistic regression revealed that only elevated portal pressure was associated with portal thrombosis (Odds Ratio 1.16, P = 0.045), but not PCV nor actual number of islets infused. Of note, we have not encountered this complication in the past 5 years, since institution of full heparin anticoagulation protocols combined with effective avitene-paste plugging of the transhepatic tract, and limitation in PCV to less than 5 ml. We conclude that in patients with low standard liver volume, islet PCV should be kept below 5 ml and full anticoagulation given, if risk portal vein thrombosis is to be mitigated. Portal thrombosis is a completely avoidable complication.

FACTORS INFLUENCING RECURRENCE PATTERNS AFTER RESECTION FOR HEPATOCELLULAR CARCINOMA


¹University of Wisconsin, Madison, Wisconsin; ²Emory University, Atlanta, Georgia; ³University of Louisville, Louisville, Kentucky

Introduction: Hepatocellular carcinoma (HCC) frequently recurs after surgical resection. Intrahepatic (IH) and extrahepatic (EH) recurrence may occur by different mechanisms.
Although many studies have assessed predictors of recurrence at any site, none have separately analyzed predictors of different patterns of recurrence. We examined patient and tumor factors for their associations with recurrence patterns following resection for HCC.

**Methods:** A prospectively-collected multi-institutional database of patients who underwent resection for HCC was retrospectively analyzed for recurrence patterns. Clinicopathologic factors associated with different sites and patterns of recurrence were identified by univariate (UV) and multivariate (MV) analyses.

**Results:** Of 230 patients submitted to partial hepatectomy for HCC (median FU, 16 months), 116 (50%) experienced postoperative recurrence at a median time to recurrence of 7 months. Of these, 82% experienced IH and 40% EH recurrence. Sites of EH recurrence included lungs (50%), peritoneum (28%), adrenals (17%), and other (bone/lymph nodes, 5%). There were no variables that predicted IH recurrence. After multivariate analysis controlling for multiple factors (including microvascular invasion, satellite lesions, and cirrhosis), independent predictors of EH recurrence, and of specific EH recurrence patterns, were identified (Table).

**Conclusion:** Recurrence is a significant problem after resection for HCC. Identification of variables that predict specific patterns of recurrence could allow for optimization of treatment of primary lesions, focused surveillance, and identification of patients who may benefit most from adjuvant therapies.

<table>
<thead>
<tr>
<th>EH Recurrence</th>
<th>Independent Predictors</th>
<th>OR (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any Site EH</td>
<td>Positive Lymph Nodes</td>
<td>9.47 (1.47 – 60.93)</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>Estimated Blood Loss</td>
<td>2.18 (1.05 – 4.50)</td>
<td>0.04</td>
</tr>
<tr>
<td></td>
<td>Intrahepatic Recurrence</td>
<td>6.58 (1.39 – 31.26)</td>
<td>0.02</td>
</tr>
<tr>
<td></td>
<td>Perforation</td>
<td>6.43 (1.32 – 31.45)</td>
<td>0.02</td>
</tr>
<tr>
<td>Pulmonary</td>
<td>Intrahepatic Recurrence</td>
<td>4.39 (1.15 – 16.71)</td>
<td>0.03</td>
</tr>
<tr>
<td></td>
<td>Estimated Blood Loss</td>
<td>0.19 (0.04 – 0.97)</td>
<td>0.05</td>
</tr>
<tr>
<td>Peritoneal</td>
<td>Preoperative Biopsy</td>
<td>65.29 (5.09 – 837.46)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Adrenal</td>
<td>None</td>
<td>8.25 (1.19 – 57.21)</td>
<td>0.03</td>
</tr>
</tbody>
</table>

**MAJOR VENOUS RESECTION DURING TOTAL LAPAROSCOPIC PANCREATICODUODENECTOMY**

M. L. Kendrick and G. M. Sclabas

*Mayo Clinic College of Medicine, Rochester, MN*

**Background:** The feasibility of total laparoscopic pancreaticoduodenectomy (TLPD) has recently been established. Laparoscopic major venous resection during pancreaticoduodenectomy has not previously been described. Our aim was to describe the technique and outcomes of patients undergoing TLPD with major venous resection.

**Methods:** Of 120 patients undergoing TLPD, laparoscopic major venous resection was performed in 10 patients with a mean age of 69 years. Indication for venous resection included expected or presence of venous malignant invasion. Median operative time and blood loss was 405 (301–653) minutes and 475 (75–900) ml respectively. Major venous resection included portal vein (n = 4), superior mesenteric vein (n = 3), or both (n = 3). Reconstruction included patch venorrhaphy (n = 5), primary suture venorrhaphy (n = 3), and tangential stapling (n = 2). Median mesoportal clamp time was 31 (10–72) minutes. An R0 resection was obtained in all patients. Postoperative complications occurred in 5 patients including pancreatic leak (n = 3), DGE 1, postoperative anemia/hemorrhage (n = 2) and arrhythmia (n = 1). No patient required reoperation. Median length of hospital stay was 7 (4–35) days. Postoperative imaging was available in 9 patients. No patient had thrombosis at the site of major venous resection.

**Conclusions:** Laparoscopic major venous resection during TLPD is feasible in selected patients and outcomes appear similar to those reported for open approaches. Extensive experience with complex laparoscopic pancreatic resection and reconstruction is advocated prior to attempting this complex procedure.

**CONDITIONAL SURVIVAL IN PANCREATIC CANCER: BETTER THAN EXPECTED**

T. S. Kent, T. Sachs, N. Sanchez, C. M. Vollmer and M. P. Callery

*Beth Israel Deaconess Medical Center, Boston, MA*

**Background:** Traditional survival estimates following resection for PDAC are based on clinicopathologic variables at the time of diagnosis, and are often grim. Thus far, estimates have not reflected time accrued following resection, as has been investigated for other malignancies. We sought to understand whether survival estimates following pancreatic resection for cancer change based on time already survived (conditional survival).

**Methods:** Pancreatic resections performed for pancreatic ductal adenocarcinoma (PDAC) between 2001 and 2010 were reviewed. Clinicopathologic variables were evaluated to identify predictors of survival. Expected survival according to a validated nomogram for pancreatic cancer as well as conditional survival estimates were calculated and compared to actual survival.
**Results:** 188 patients underwent pancreatic resection for PDAC (156 Whipple, 26 Distal, 6 Total). Median survival was 22 months (3.4–107.3 m). Predictors of overall survival were: absence of nodal disease (OR 8.8), age >67 (OR 8.4), and lower stage (OR 4.3). Survival according to the nomogram was 70% (1 y), 39.5% (2 y), and 24% (3 y). As time accrued, and overall and predicted survival decreased, conditional survival increased (Table 1).

<table>
<thead>
<tr>
<th>survival</th>
<th>Predicted survival</th>
<th>Actual survival</th>
<th>Survival conditional on initial:</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 m</td>
<td>-</td>
<td>93.6</td>
<td>6 mos</td>
</tr>
<tr>
<td>12 m</td>
<td>70</td>
<td>78.5</td>
<td>12 mos</td>
</tr>
<tr>
<td>18 m</td>
<td>-</td>
<td>60.9</td>
<td>18 mos</td>
</tr>
<tr>
<td>2y</td>
<td>39.5</td>
<td>42.3</td>
<td>24 mos</td>
</tr>
<tr>
<td>3y</td>
<td>24</td>
<td>26.2</td>
<td>36 mos</td>
</tr>
<tr>
<td>4y</td>
<td>-</td>
<td>24.7</td>
<td>48 mos</td>
</tr>
<tr>
<td>5y</td>
<td>-</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>6 mos</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>12 mos</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>18 mos</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>24 mos</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>36 mos</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>48 mos</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

**Discussion:** The available prognostic scoring system for PDAC underestimated survival compared to actual survival in this study. Conditional survival estimates, based on accrued lifespan, were better than either predicted or actual survival, suggesting that survival is a dynamic, rather than static, concept. Conditional survival may therefore be a useful tool to allow patients and clinicians to project subsequent survival based on time accrued since resection.

### SURGICAL MANAGEMENT OF RENAL CELL CARCINOMA METASTATIC TO THE PANCREAS

A. S. Khan\(^1\), J. Mitchem\(^2\), M. Haseebuddin\(^2\), D. Sanford\(^4\), S. M. Strasberg\(^2\), W. G. Hawkins\(^2\) and D. C. Linehan\(^2\)
\(^1\)Baylor Regional Transplant Institute, Dallas, TX;
\(^2\)Washington University School of Medicine, St Louis, MO

The pancreas is an uncommon site of metastasis from Renal Cell Carcinoma (RCC). Rarely metastatic disease is localized to the pancreas and resection can be considered. This study is a retrospective review of our experience and outcomes with pancreatic resection for metastatic RCC over past 15 years (1995–2010). During the study period, 18 patients underwent 19 pancreatic resections for metastatic RCC. Average age was 68 years (range 55–81). Seventeen of the eighteen patients were white and 61% were female. The mean time since index nephrectomy was 12.2 years (range 0–42). Nine patients were asymptomatic, 5 presented with upper gastrointestinal bleeding, 2 with abdominal pain, 1 with obstructive jaundice and presentation in 2 was unknown. All imaged lesions had a hyper-vascular appearance. Ten patients had preoperative biopsy performed, which was diagnostic in 6 (60%). The choice of operation was pancreatectoduodenectomy (Whipple) in 8 (42%), distal-pancreatectomy in 8 (42%) and 2 required total-pancreatectomy. There was no correlation between side of index nephrectomy and type of resection. All patients had negative margins. One patient had positive lymph nodes in resection specimen and died from recurrent disease. Mean follow up was 43.8 months with 11 (61%) patients remaining alive at last follow up. The median survival after resection was 66 months. Metastatic RCC to pancreas is rare and becomes apparent years after treatment of primary tumor. Long-term surveillance for metastatic disease is essential. Aggressive surgical resection of isolated pancreatic metastasis can result in excellent long-term survival and should be performed when possible.

### PANCREATICODUODENECTOMY (PD) COMPLICATES MULTIVISCERAL RESECTIONS IN HEPATOPANCREATOBILIARY SURGERY

A. Khithani, K. Lowe, D. Christian, A. Mejia and D. Jeyarajah
Methodist Dallas Medical Center, Dallas, Texas

**Background:** Multivisceral resections (MVR) in major hepatopancreatobiliary surgery (HS) are not common. HS may involve additional organs resections to achieve complete resection. We report our experience of MVR with HS, specifically comparing MVR with a PD and MVR without a PD.

**Methods:** Records of patients with simultaneous MVR and HS were analyzed. We defined a MVR as one in which additional viscera were resected, not a part of the routine resection. The outcomes of MVR with PD were compared to those without PD.

**Results:** Nine patients underwent MVR with HR (6 had MVR with PD, 3 had MVR without PD). The median blood loss was 650 ml in the PD group and 450 ml in the non PD group. All patients with MVR in PD group required ICU stay whereas 1 ICU admission was seen in the non PD group. The median operating time was 237 min in the PD group and 237 min in the non PD group. The median length of stay was 15 days in both groups. One patient with PD had a 30 day mortality. All patients (100%) with MVR in the PD group developed morbidity whereas 1 patient (30%) developed morbidity in the non PD group. Three patients (50%) in the PD group had positive margins whereas 1 patient (30%) in the non PD group had a positive margin.

**Conclusions:** MVR involving PD is associated with increased morbidity compared with MVR without a PD. These cases must be taken on with extreme caution.
PANCREATICOJEJUNAL ANASTOMOTIC STRICTURES: WHY REVISE WHEN THERE'S A PANCREATICOGASTROSTOMY
A. Khithani, K. Lowe, D. J. Christian and D. Jeyarajah
Methodist Dallas Medical Center, Dallas, TX

Background: As long-survival following pancreaticoduodenectomy (PD) improves, complications due to PD including pancreaticojejunal anastomotic strictures (PJS) are increasingly seen. Some centers propose revision of the PJ anastomosis. This approach is technically challenging in a scarred abdomen and was associated with high morbidity. We propose a safe technique of managing a post PD duct obstruction.

Methods: All patients with PJS were treated by with a pancreaticogastrostomy (PG). Intraoperative and postoperative data were collected.

Technique: Using a midline laparotomy, the stomach is mobilized off the pancreatic remnant carefully staying away from the prior PJ. Pancreatic duct is identified using ultrasound and then confirmed using a 21 g needle. The duct is incised from the PJ towards the tail. A posterior gastrotomy is created and a single layer, running anastomosis is created between the stomach and the pancreatic duct.

Results: Four patients underwent PG for PJS. Three patients presented with acute abdominal pain and hyperamylasaemia. The median operating time was 154 mins. The median estimated blood loss was 250 ml. There was no mortality within the 30 days. Morbidity (DVT) was seen in one patient. None of the patients needed a reoperation. The mean length of stay was 9 days. All patients remain asymptomatic over a median follow up of 6 months. Two patients were lost to follow up one patient died due to terminal lung cancer and one patient is asymptomatic at 18 months.

Conclusions: Side – side Pancreaticogastrostomy is a durable technique for treating PJS and appears to result in excellent postoperative outcome.

Table showing Indications of MVR in major hepatopancreatobiliary surgery

<table>
<thead>
<tr>
<th>Primary procedure</th>
<th>Indication</th>
<th>Additional resection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colectomy</td>
<td>Ca Colon</td>
<td>PD, Liver resection</td>
</tr>
<tr>
<td>Colectomy</td>
<td>Ca Colon</td>
<td>PD, Nephrectomy</td>
</tr>
<tr>
<td>Colectomy</td>
<td>Ca Colon</td>
<td>PD</td>
</tr>
<tr>
<td>Partial gastrectomy</td>
<td>Ca Stomach</td>
<td>PD</td>
</tr>
<tr>
<td>Radical cholecystectomy</td>
<td>Ca Gall Bladder</td>
<td>PD, Colectomy, Gastroctomy, Colectomy</td>
</tr>
<tr>
<td>Radical cholecystectomy</td>
<td>Ca Gall Bladder</td>
<td>PD</td>
</tr>
<tr>
<td>Liver resection</td>
<td>Cholangio Ca</td>
<td>Adrenalectomy, Diaphragmatic excision</td>
</tr>
<tr>
<td>Liver resection</td>
<td>HCC</td>
<td>Distal pancreatectomy with splenectomy, Colectomy</td>
</tr>
<tr>
<td>Liver resection</td>
<td>Hepatoid Carcinoma</td>
<td></td>
</tr>
</tbody>
</table>

RIGHT HEPATECTOMY WITH PORTAL VEIN TUMOR THROMBECTOMY FOR HCC
Asan Medical Center, Ulsan University, Seoul

Recent progress in imaging techniques has allowed the diagnosis of HCC at an early stage. However, portal venous invasion is still found in 12.5–39.7% of patients with HCC. A median survival is only 9.7 weeks for untreated patients with HCC and main portal vein tumor thrombus. According to our data, a hepatectomy with portal vein tumor thrombectomy gave help to increase the survival rate in selected patients with acceptable hepatic functional reserve. In here I report my case by a video clip. 51-year-old male patient with HBV and HCC was admitted for surgery. The patient's 3D CT scan showed about 10 sized mass involving right posterior section and right portal vein tumor thrombus reached the bifurcation area. The important thing of this surgery was to remove the portal vein tumor thrombus safely and prevent going into the left portal vein of tumor thrombus during hepatectomy. The left glissonean pedicle and hepatoduodenal ligament were identified and taped and the right portal vein was dissected and taped selectively. The exposed right portal vein was incised in order to remove tumor thrombus around the bifurcation area after tightening of the left glissonean pedicle and hepatoduodenal ligament. The opened right portal vein was closed on both sides using Prolene 6–0 and the hepatic parenchyma were transected using a Pringle's maneuver, exposing middle hepatic vein. The operative time was 225 mins and estimated blood loss was less than 800 ml. There was no complication and the patient was discharged on postoperative day 12.

SUB-CENTIMETER COLORECTAL CANCER LIVER METASTASES ARE EFFECTIVELY TREATED BY ABLATION
T. Kingham1, M. Tanoue2, A. A. Eaton1, F. G. Rocha1, M. D’Angelica1, P. Allen1, R. P. DeMatteo1, Y. Fong1 and W. R. Jarnagin1
1Memorial Sloan-Kettering Cancer Center, New York, NY; 2Creighton University School of Medicine, Omaha, Nebraska

Liver metastases are common in patients with colorectal cancer (CRC). Ablative therapies are frequently utilized, but
recurrence rates vary. We hypothesized that ablation is a reasonable treatment for small (sub-centimeter) tumors. A retrospective review of all patients with CRC liver metastases that were treated with ablation from 4/96 to 3/10 was performed. Kaplan-Meier analysis and Cox models were used to analyze ablation site recurrence rates and significance on a per-lesion basis.

**Results:** 158 patients had 315 tumors ablated. 36 tumors (11%) recurred at the site of ablation. Median follow-up was 1.6 years (range 11 days to 9 years). Mean tumor size was 1.6 cm (±1.3). Treatments consisted of RFA (70%), cryo-therapy (16%), and microwave (13%). 77% of ablations (n = 243) were performed in conjunction with a resection. On univariate analysis there were no significant differences in ablation recurrence rates with age, method of ablation, or tumor location. Postoperative chemotherapy was associated with a higher 2-year ablation site recurrence free survival (RFS; 88% vs. 67%, p < 0.001). There was a significant difference in 2-year ablation site RFS between small (≤1 cm) and large (>1 cm) tumors (92% vs. 78%; HR 2.4(1.249–4.664; p = 0.01). Tumor size remained significant (HR 2.3; p = .01) after adjusting for the use of pre- and post-op chemotherapy in multivariate analysis. The estimated 2-year ablation site RFS for tumors >3 cm was 41%.

**Conclusion:** Patients are at high risk for additional metastases after ablation of CRC liver metastases. The majority of ablated tumors >3 cm recur locally. Ablation of tumors ≤1 cm, however, results in a low local recurrence rate.

<table>
<thead>
<tr>
<th>Tumor size (cm)</th>
<th>N</th>
<th>Median ablation zone size (range)</th>
<th>Recurrence rate</th>
<th>1 year ablation zone recurrence free survival</th>
<th>2 year ablation zone recurrence free survival</th>
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</thead>
<tbody>
<tr>
<td>≤1</td>
<td>168</td>
<td>3 cm (1–5)</td>
<td>8%</td>
<td>0.95</td>
<td>0.92*</td>
</tr>
<tr>
<td>&gt;1</td>
<td>147</td>
<td>3.5 cm (1.5–9)</td>
<td>17%</td>
<td>0.89</td>
<td>0.78</td>
</tr>
</tbody>
</table>

*= HR 2.4(1.249–4.664; p = .009)

**IS THE EVER-EXPANDING SCOPE OF ROBOTICS SAFE FOR HEPATOBILIARY SURGERY TOO?**

K. Kitisin1, V. Packiam1, S. Celinski1, S. Chalikonda2, J. Pingpank1, H. Zeh1, D. Bartlett1 and A. Tsung1

1University of Pittsburgh Medical Center, Pittsburgh, PA; 2Cleveland Clinic, Cleveland, OH

**Background:** Robotic-assisted surgery is a valuable minimally invasive treatment due to the inherent limitations of laparoscopic surgery. The purpose of this study was to assess the outcomes of robotic-assisted technology in hepatobiliary surgery.

**Methods:** A retrospective analysis assessed 46 robotic-assisted hepatobiliary surgeries performed at the University of Pittsburgh Medical Center from November 2007 to September 2010.

**Results:** 45 patients, 61.3% male, underwent robotic-assisted hepatobiliary surgery with a median age of 61 (39–86) years. Indications for surgery included malignant disease in 30 patients (6 hepatocellular carcinoma, 5 cholangiocarcinoma, 19 metastatic liver cancers), and benign disease in 8 patients (1 hepatic hamartoma, 1 hepatic hemangioma, 2 benign biliary strictures, 1 choleodochal cyst, 1 choledocholithiasis, 2 gallstone pancreatitis). 23 patients received cholecystectomy as part of complex hepatopancreaticobiliary, gastric, and adrenal surgeries. 25 liver resections were performed; 24% major hepatectomies involving more than 3 segments, 16% anatomical left lateral segmentectomies, and 60% non-anatomical liver resections. 96% of tumor resections had negative margins, with a mean tumor size of 3.8 ± 2.3 cm. 6 patients (13.3%) received robotic-assisted placement of hepatic arterial infusion pumps. 4 cases (8.7%) were converted to open operations. Mean operative time was 251 ± 154 min, median blood loss was 248 (30–3600) ml, and mean length-of-stay (LOS) was 6.1 ± 3.2 days. Major morbidity occurred in 1 patient with no 30-days mortality.

**Conclusion:** Robotic-assistance for hepatobiliary surgery is feasible based on reasonable operative time, blood loss, LOS, and morbidity/mortality. Future prospective studies should compare outcomes of robotic surgeries with other treatments.

**PRESENTATION AND OUTCOMES OF HEPATOCELLULAR CARCINOMA (HCC) PATIENTS AT A WESTERN CENTER**

K. Kitisin1, V. Packiam1, J. Steel1, A. Humar1, T. C. Gamblin2, D. A. Geller1, J. W. Marsh1 and A. Tsung1

1University of Pittsburgh Medical Center, Pittsburgh, Pennsylvania; 2Medical College of Wisconsin, Milwaukee, Wisconsin

**Introduction:** Hepatocellular cancer (HCC) incidence is rising in the United States. This study examines the presentation and outcomes of HCC at a Western center over the last decade.

**Methods:** 1,025 cases of HCC were managed at a single institution between 01/2000 and 09/2009. We performed a retrospective review and defined four main groups: no treatment (NT), Sorafenib therapy (ST), hepatic artery-based therapy (HAT), and surgical intervention (SI) including radiofrequency ablation, hepatic resection and transplantation. Kaplan-Meier and Cox regression analysis analyzed survival and its predictors.

**Results:** HCC patients managed were 76% male, 87% Caucasian, and 84% cirrhotic. 52% had viral hepatitis, predominantly hepatitis C. AFP was diagnostic in 34% of cases (>400 ng/ml). 169 patients (16.5%) received NT, 25 (2.4%) received ST alone, 529 (51.6%) received HAT alone, and 302 (29.5%) received SI. Overall median survival in NT, ST, HAT, and SI was 3.6, 5.6, 8.8, and 83.5 months, respectively (p = 0.001). Performing transplantation to patients with TACE-bridging therapy increased median survival from 8.3
though most patients are managed with HAT alone.

Methods: We retrospectively reviewed our clinical experience over time with regard to: 1) nature of neoplasm (malignant, benign), 2) operative approach [pure laparoscopic (PLR), pedicle laparoscopic resections (HyLR), 3) vascular infl ow/outflow (PLR), hand-assisted laparoscopic (HALR), or hybrid laparoscopic resections (HyLR)], 4) parenchymal transection techniques. Of 11 patients, 2 patients (18.2%) had HCC recurrence after PLR. The median interval from PLR to HCC recurrence was less than 2 years, and the tumors exhibited portal invasion microscopically at PLR. The combination of prior liver resection and Salvage LDLT is feasible for the patients with HCC. Salvage LDLT for the patients whose HCC reveals portal invasion at PLR and recurs within 2 years after PLR appears to show poor prognosis.

Conclusions: This study illustrates the presentation and outcomes of HCC at a Western center. Surgical intervention, especially transplantation, yields the greatest survival benefit, though most patients are managed with HAT alone.

LAPAROSCOPIC HEMIHEPATECTOMY: EVOLUTION OF APPROACH AND TECHNIQUES OVER AN EXPERIENCE OF 252 CASES

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Beaumont Hospitals, Royal Oak, MI

Background: Minimally-invasive liver resection (MILR) has become an integral part of the management of hepatic neoplasms both benign and malignant. While segmentectomy and sectionectomy have been utilized by many groups, hemihepatectomy remains rare because of the technical challenges and limited experience associated with laparoscopic resections of this magnitude.

Objective(s): Review and describe the evolution of approaches and techniques of laparoscopic hemihepatectomy encountered during a large clinical series, in order to 1) advance the understanding of minimally-invasive major liver resection and 2) highlight the pivotal technical and clinical nuances to shorten the surgical learning curve in centers embarking on major resection.

Methods: We retrospectively reviewed our clinical experience over time with regard to: 1) nature of neoplasm (malignant, benign), 2) operative approach [pure laparoscopic (PLR), hand-assisted laparoscopic (HALR), or hybrid laparoscopic resections (HyLR)], 3) vascular infl ow/outflow (PLR), hand-assisted laparoscopic (HALR), or hybrid laparoscopic resections (HyLR), 4) parenchymal transection techniques.

Results: Included in this analysis are 99 left and 159 right hemihepatectomies. The Figure shows trends depicted in percentages.

Conclusions: Over this series, greater percentage of malignant lesions, lesion size, and increased intrahepatic vascular management has led to conversion away from PLR. Pedicle management has evolved from exclusively extrahepatic to equal utilization of Glissonian approaches, based on lesion location and anatomy. Parenchymal transection has evolved towards coaptive devices as experience intrahepatic dissection has increased. This evolution has resulted in 80% of patients are now able to have MILR hemihepatectomy at our center.

FEASIBILITY AND PROGNOSTIC FACTORS OF SALVAGE LIVING DONOR LIVER TRANSPLANTATION FOR HEPATOCELLULAR CARCINOMA

Y. Konishi1, M. Taniguchi2, T. Shimamura1, T. Suzuki2, K. Yamashita1, K. Nakanishi2, H. Kamachi1, H. Yokoo1, M. Tahara1, T. Kamiyama1, M. Matsushita1, H. Furukawa1 and S. Todo1
1Department of General Surgery, Graduate School of Medicine, Hokkaido University, Sapporo, Hokkaido; 2Department of Organ Transplantation and Regeneration, Graduate School of Medicine, Hokkaido University, Sapporo, Hokkaido; 3Division of Organ Transplantation, Graduate School of Medicine, Hokkaido University, Sapporo, Hokkaido; 4Department of Molecular Surgery, Graduate School of Medicine, Hokkaido University, Sapporo, Hokkaido; 5Department of Gastroenterologic and General Surgery, Asahikawa Medical College, Asahikawa, Hokkaido

It is reported that the outcome of Salvage liver transplantation (SLT) is comparable with that of primary liver transplantation in hepatocellular carcinoma (HCC) patients. However, the prognostic factors of SLT are still unclear. This study retrospectively investigated the feasibility and prognostic factors of salvage living donor liver transplantation (LDLT). From October 1997 to January 2010, 206 patients underwent LDLT at our institution, including 51 patients with HCC. Of 51 cases, Salvage LDLT was performed in 11 cases. Recipient demographics, tumor characteristics at Primary liver resection (PLR) and Salvage LDLT, the duration from PLR to both HCC recurrence and Salvage LDLT, and the prognosis were analyzed. All patients but one were received LDLT for HCC. The median interval from PLR to HCC recurrence was 11 months (range 4–78), and 34 months (range 8–128), respectively. The median follow up time after Salvage LDLT was 69 months (range 3–120). Of 11 patients, 2 patients (18.2%) had HCC recurrence after Salvage LDLT, and 3 patients (27.3%) were died of transplant-related complication. The over all survival and the recurrence rate at 5 years were 72.7% and 18.2%. In patients with HCC recurrence, the interval from PLR to HCC recurrence was less than 2 years, and the tumors exhibited portal invasion microscopically at PLR. The combination of prior liver resection and LDLT is feasible for the patients with HCC. Salvage LDLT for the patients whose HCC reveals portal invasion at PLR and recurs within 2 years after PLR appears to show poor prognosis.
RADIOEMBOLIZATION FOR TREATMENT OF METASTATIC OCULAR MELANOMA TO THE LIVER: AN INITIAL EXPERIENCE

Virginia Piper Cancer Institute; Abbott Northwestern Hospital, Minneapolis, MN

Introduction: Purpose of this study was to evaluate the clinical outcomes of liver-directed radioembolization (LR) in treatment of metastatic ocular melanoma (OM) to liver (MOML).

Methods: Patients treated with LR with Yttrium-90 microspheres for MOML were identified from a prospectively maintained database. Primary outcome was survival from time of initial LR. Secondary outcomes were efficacy of LR as measured by follow-up liver axial imaging and treatment toxicity as measured by NCI Common Toxicity Criteria v2.0. Pearson Chi-Square was used to compare correlations.

Results: Among 144 patients (153 LRs), 4 women underwent 15 LRs for MOML (Table). Median interval from diagnosis of OM to MOML was 5.4 yrs and from MOML to first LR was 5.5 months (33 days from first LR consult to first LR). Median of 61% of recommended dose was deliverable. In 4 treatments, LR was done to both lobes of the liver in one session. Median follow up was 18.4 months. There were no major complications. Grade-1 toxicity occurred after 53% of treatments and resolved within the first 48 hrs. Intrahepatic disease burden improved after 73% of LRs while extrahepatic disease worsened after 45% of LRs. Median survival from diagnosis of MOML was 18.4 months, and from time of first LR was 12.5 months. There was no correlation between survival and how early LR was done with respect to time of diagnosis of MOML (p = 0.21).

Conclusion: LR treatment is safe in management of patients with MOML and can result in intrahepatic improvement of disease burden.
REPEAT CURATIVE INTENT SURGERY FOR COLORECTAL LIVER METASTASIS – AGGRESSIVE MULTI-DISCIPLINARY MANAGEMENT ALLOWS EXCELLENT OUTCOMES

Section of Surgical Oncology, Department of Surgery, Penn State College of Medicine, Hershey, PA

Background: Following liver resection/ablation for colorectal liver metastasis (CRLM), the outcome after subsequent curative-intent treatment for recurrence is not widely reported.

Methods: A retrospective chart review of 125 consecutive patients with CRLM treated in a single institution was performed.

Results: Median follow-up for all patients was 17 months. 8 patients had persistent disease and 63 patients developed a recurrence after initial liver surgery. The disease was confined to the liver in 24 patients, to the lungs in 5 patients, and to the peritoneum in 3. The remaining patients had recurrent disease in more than one location. Median progression-free survival (PFS) after the initial liver surgery was 16 months [1–64]. Repeat curative-intent surgery was possible in 26 patients, who underwent 35 subsequent procedures. 13 out of 26 patients then recurred after repeat curative intent treatment. Seven patients underwent a 3rd or 4th procedure. The complication rate and the length of stay after a repeat curative intent surgery were similar to the initial liver surgery. At the end of the study, 15 patients among the 26 treated with curative intent for recurrence after liver surgery were alive without evidence of disease (median f/u 33 months [8–59]). Repeat curative intent surgery results in a median progression free survival of 11 months after the repeat operation.

Conclusions: An aggressive approach to recurrence after liver surgery for CRLM, including iterative curative intent surgery is safe and effective.

EFFECTS OF SORAFENIB ON THE EARLY LIVER REPAIR RESPONSE FOLLOWING PARTIAL HEPATECTOMY IN MICE

P. C. Kurniali1,2, P. Somasundar1,2, N. J. Espat1,2, V. Falanga1,2 and S. C. Katz1,2
1Roger Williams Medical Center, Providence, RI; 2Boston University School of Medicine, Boston, MA

Background: Sorafenib is approved for the treatment of hepatocellular carcinoma, but its effects on liver repair and regeneration are not clear. We studied the effects of sorafenib on the early repair process in a murine partial hepatectomy (PH) model.

Materials and methods: We performed PH in C57Bl/6 mice and liver repair response was assessed at 48 hours. Mice were treated with sorafenib (30 mg/kg or 60 mg/kg) or vehicle (CTRL). 5-bromo-2-deoxyuridine (BrDU) and Ki67 staining among hepatocytes and liver sinusoidal endothelial cells (LSEC) was determined, with values expressed as percentage of cells positive relative to the CTRL group.

Result: Treatment with sorafenib did not result in any deaths following PH. Mean explanted liver: total body mass ratios were similar in the CTRL (5.1 ± 0.2%), 30 mg/kg (4.7 ± 0.2%), and 60 mg/kg (4.9 ± 0.2%) groups (p = 0.38). When we measured BrDU uptake to assess DNA synthesis, we found that hepatocytes were unaffected by the 30 mg/kg (0.82 ± 0.12, p = 0.29) or 60 mg/kg doses (0.99 ± 0.23, p = 0.96). BrDU uptake by LSEC was also similar to the CTRL group for mice treated with 30 mg/kg (0.91 ± 0.19, p = 0.71) and 60 mg/kg (1.0 ± 0.21, p = 0.99) of sorafenib. Ki67 staining to quantify cell proliferation revealed that hepatocytes were not impaired by 30 mg/kg (0.86 ± 0.32, p = 0.71) or 60 mg/kg (1.0 ± 0.13, p = 0.84) of the drug. LSEC Ki67 expression was also not hindered by the 30 mg/kg (1.0 ± 0.33, p = 0.89) or 60 mg/kg (0.84 ± 0.12, p = 0.33) doses.

Conclusion: Sorafenib did not alter the early repair response of the liver to PH as measured by changes in liver weight, DNA synthesis, and cellular proliferation. These initial findings should be extended by analyzing the further time points and additional measures of repair and eventual regeneration.
THE SCIENCE OF PAINLESS JAUNDICE: ELUCIDATING THE MECHANISM OF BILE ACID INDUCED ANALGESIA

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Introduction: Ludwig Courvoiseier’s 1890 treatise first described the observation of “painless jaundice.” TGR5 is a membrane-bound G protein-coupled receptor responsive to bile acids (BAs) that is ubiquitously expressed in human tissue. We hypothesize that elevated levels of BAs during cholestasis activate TGR5, which mediates its analgesic effect through an endogenous opioid pathway.

Methods: TGR5 immunoreactivity in mouse spinal cord and dorsal root ganglia (DRG) was detected by immunofluorescence. The common bile duct was ligated/divided to induce cholestasis in C57BL/6 mice. Pain scores were measured using VonFrey (VF) filaments every two days for ten days. C57BL/6 wild-type (WT) mice were injected subcutaneously in the plantar hindpaw with 10 uL normal saline (NS), deoxycholic acid (DCA) 2.48 mg/ml, ursodeoxycholic acid (UDCA) 2.48 mg/mL, or capsaicin 0.6 mg/mL. TGR5 overexpressing-transgenic mice (TG) were also injected with DCA. Pain scores were measured following injection.

Results: TGR5 immunoreactivity was detected in DRG neurons and spinal cord, with localization mainly in lamina I, II, IV , and X. VF scores were significantly increased for ligated animal compared to sham-operated mice, indicating a marked anti-nociceptive effect in the cholestatic group. WT and TG mice injected with DCA had significantly higher VF scores compared to mice injected with NS, UDCA (weak TGR5 agonist), and capsaicin. TGR5 overexpressing-transgenic mice (TG) were also injected with DCA. Pain scores were measured following injection.

Conclusion: The distribution of TGR5 in the nervous system correlates with established pain pathways. Cholestatic mice have a decreased mechanical pain response. Local paw injections with DCA in WT and TG mice induce an analgesic effect mediated by TGR5. Therefore, bile acid-activation of TGR5 in cholestasis may be the underlying mechanism of “painless jaundice.”

BRUNNER’S GLAND HAMARTOMA: A CASE REPORT AND META-ANALYSIS

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Purpose: Brunner’s gland hamartomas (BGH) are rare, benign lesions. First described by Cruveilhier in 1835, there are fewer than 200 cases reported in the English literature and no characterizing studies larger than 27 cases.

Methods: We describe a patient who presented with abdominal pain, nausea, vomiting, melena, and jaundice found to have a 6 cm hamartoma just distal to the pylorus. We also include a meta-analysis of 93 cases of BGH dating from 1952 to 2010.

Results: In 93 patients with BGH, 64.5% were male and the mean age was 52.6 years. The average lesion size was 4.2 cm and ranged from 0.5 to 12 cm. 52.7% were pedunculated. 63.4% of hamartomas were in the first part of the duodenum, 23.7% were in the second, and the rest were distributed between the remaining duodenal segments, pyloric ring, stomach, and jejunum. The most common presenting symptom was abdominal pain/discomfort, which 56.6% of patients experienced. 53% of patients reported melena, while 22.9% of patients reported fatigue, dizziness, weakness, or syncope and 21.7% were found to be anemic. Nausea and vomiting were found in 14.5 and 26.6 percent of patients, respectively. 25.8% of lesions were removed endoscopically, while 65% were removed at laparotomy. There were no adverse outcomes reported.

Conclusions: Brunner’s gland hamartomas are most often found in men and between the ages of 36 and 69. They often come to physician attention through physical complaints of abdominal discomfort and/or GI bleeding and can be removed endoscopically or surgically with excellent outcomes.
WHICH IS MORE COST-EFFECTIVE UNDER THE MELD SYSTEM—LIVER TRANSPLANTATION, PRIMARY LIVER RESECTION, OR LOCO-REGIONAL THERAPY AND SALVAGE TRANSPLANTATION FOR HCC WITHIN MILAN CRITERIA?

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Introduction: Hepatocellular Carcinoma (HCC) is one of the most common tumors worldwide and its incidence is increasing in the western world. The best strategy for dealing with HCC in patients with compensated cirrhosis has long been debated. Prior to implementation of the MELD system, wait times were prohibitively long and many patients died on the wait list secondary to tumor progression. Therefore, despite a high recurrence rate primary hepatic resection was often the preferred treatment. Under the MELD system, candidates with tumors within Milan Criteria are preferentially transplanted and drop outs from the wait list for tumor progression are fewer. The aim of this study is to evaluate the cost effectiveness of primary hepatic resection or loco-regional therapy versus liver transplantation for HCC within Milan Criteria.

Methods: A Markov-based decision analytic model was created to simulate outcomes for patients undergoing primary hepatic resection or loco-regional therapy versus liver transplantation for HCC with Milan Criteria. Baseline values and ranges were determined from literature review. Sensitivity analyses tested model strength and parameter variability.

Results: Patients undergoing primary hepatic resection had earlier recurrence and increased costs and decreased quality of life. Patients undergoing primary liver transplantation had decreased recurrence and increased quality of life. Primary hepatic resection and loco-regional therapy yielded 6.0 QALYs at a cost of $80,000/QALY, whereas primary liver transplantation yielded 7.5 QALYs at a cost of $60,000/QALY.

Conclusion: Primary liver transplantation is more cost-effective than primary hepatic resection or loco-regional therapy for HCC within Milan Criteria.

IMPACT OF MULTIVISCERAL RESECTION IN PATIENTS WITH PANCREATIC CANCER: PERIOPERATIVE MORBIDITY AND SURVIVAL

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Purpose: To evaluate outcomes after multivisceral resection for primary pancreatic malignancies.

Methods: We identified patients who required multivisceral resection for primary pancreatic malignancies and compared outcomes to patients who underwent standard pancreaticoduodenectomy (PD) or distal pancreatectomy (DP) for similar pathology.

Results: Of 1139 patients who underwent PD or DP, a total of 23 (2%) patients required multivisceral resection. Stomach, colon, adrenal gland, small intestine, kidney, and liver were resected in 43%, 39%, 26%, 13%, 4%, and 4% of patients, respectively. Patients who required multivisceral resection during PD had similar morbidity (43% vs. 51%, p = 0.72) and decreased mortality (0% vs. 4%, p < 0.01) compared to patients who underwent standard PD. Those who had multivisceral resection during DP had similar morbidity (44% vs. 44%, p = 0.99) and mortality (0% vs. 1%, p = 0.99) compared to standard DP. Median survival was similar between patients with pancreatic ductal adenocarcinoma who underwent multivisceral resection and those who underwent standard PD or DP (17.8 vs. 17.4 months, p = 0.30) and increased compared to patients whose PD or DP was aborted due to advanced disease (17.8 vs. 8.0 months, p < 0.01).

Conclusion: Multivisceral pancreatic resection can be performed with similar morbidity and mortality rates compared to standard PD or DP. Survival after multivisceral pancreatic resection is comparable to that after standard PD or DP and improved when compared to resections that were aborted due to advanced disease. In select patients, an aggressive surgical approach to cure advanced tumors is safe and feasible.
LEFT-SIDED GALLBLADDER WITH INTRAHEPATIC PORTAL VEIN ANOMALIES: A SINGLE CENTER EXPERIENCES (4 CASES)

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Hanyang University College of Medicine, Seoul

Purpose: The goal of this article was to characterize and explain the etiology of left-sided gallbladder with intrahepatic portal vein anomalies encountered at a single center.

Methods: We reviewed surgical recording movies, database information, and preoperative radiologic examinations of 1141 patients who underwent cholecystectomies in our institution from between August 2007 and July 2010 to assess the presence of left-sided gallbladder and combined anomalies.

Results: Four of 1141 patients (0.35%) were diagnosed with left-sided gallbladder. In all cases, the gallbladder was located on the left side of the falciform ligament, under the left lobe of the liver, typical abnormal intrahepatic portal venous branching. The right posterior portal vein came directly from the main portal vein, and the right anterior portal vein originated from the left portal vein, but the ligamentum teres joined to the left branch of the portal vein in the liver.

Conclusion: Left-sided gallbladder with intrahepatic portal venous branching anomaly resulted from the defective development of the central portion of the liver rather than abnormal regression of the left umbilical vein with persistence of the right umbilical vein.

Table. Organ Space Infection Rates (%)

<table>
<thead>
<tr>
<th>Procedure</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2006–09</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pancreatectoectomy n = 6210</td>
<td>9.7</td>
<td>12.0</td>
<td>11.4</td>
<td>10.4</td>
<td>11.0*</td>
</tr>
<tr>
<td>Distal Pancreatectomy n = 3272</td>
<td>10.4</td>
<td>10.8</td>
<td>9.3</td>
<td>8.8</td>
<td>9.6</td>
</tr>
<tr>
<td>Pancreatic Enteric Anastomosis n = 629</td>
<td>9.0</td>
<td>4.3</td>
<td>8.7</td>
<td>6.5</td>
<td>6.8*</td>
</tr>
<tr>
<td>Enucleation n = 248</td>
<td>7.9</td>
<td>7.8</td>
<td>7.5</td>
<td>10.1</td>
<td>8.5</td>
</tr>
<tr>
<td>All Operations n = 10359</td>
<td>9.9</td>
<td>11.0</td>
<td>10.4</td>
<td>9.7</td>
<td>10.2</td>
</tr>
</tbody>
</table>

*p < 0.01 when compared to all other operations

Conclusions: While ACS-NSQIP is capturing a large proportion of the pancreatic surgery being performed in the United States, organ space infection (OSI) rates are not decreasing in participating hospitals. Since pancreatic fistula is likely a large contributor to OSI after pancreatic surgery, pancreatic surgeons should devise new strategies, such as early drain removal, to improve this ongoing problem.

NOVEL 3-D IMAGING TECHNIQUE IMPROVES ACCURACY OF HEPATIC VOLUMETRIC ASSESSMENT

Washington University School of Medicine, St. Louis, MO

Purpose: With preoperative prediction of liver volume becoming increasingly important to safely carry out complex hepatic resections, we aimed to validate the accuracy of a 3-D liver resection planning software (Planisight TM) in assessing hepatic volumetrics.

Methods: Between 1999 and 2006, we performed 32 live donor liver resections for transplantation. Analysis of eleven patients who had preoperative volumetrics by the Radiology department and documented operative weights was performed. Retrospectively, images were uploaded to generate 3-D hepatic models from interactive software. Volumetrics were assessed based on the corresponding resections. Predictions by radiologists and the 3-D system were compared to the actual volumes, which were calculated using a standardized liver density (1.05 g/ml). Accuracy of each group was measured followed by a means test to establish significant differences.

Results: Overall accuracy was significantly improved by 3-D planning software (84.4% ± 10.7 vs. 76.4% ± 11.1, p = 0.0057). The 3-D system significantly improved CT-based

ORGAN SPACE INFECTION AFTER PANCREATIC SURGERY: ARE WE IMPROVING?

Indiana University Department of Surgery, Indianapolis, IN

Background: In pancreatic surgery mortality has improved, but morbidity remains high. Organ space infection (OSI) is a major complication which is likely a surrogate for clinically significant pancreatic fistula. Participation in the American College of Surgeons-National Surgical Quality Improvement Program (ACS-NSQIP) has been shown to improve many outcomes. The aim of this analysis is to determine whether OSI has improved after pancreatic surgery.

Methods: The ASC-NSQIP database was analyzed from 2006 to 2009 for pancreatic operations at risk for pancreatic fistula.

Results: Over the 4-year period, 10359 pancreatic operations were performed in ACS-NSQIP hospitals, and the number of operations increased each year from 1496 in 2006 to 3449 in 2009. Pancreatoduodenectomy (60%) and distal pancreatectomy (32%) were the most common operations, followed by pancreatic-enteric anastomosis (PEA) (6%), and enucleation (2%). OSI rates for each operation are listed by year in the Table. OSI rates were higher for pancreaticoduodenectomy (10.8%, p < 0.001) and lower for PEA (6.5%, p = 0.002) when compared to all other operations. No changes in OSI rates were observed over the 4-year period for all pancreatic surgery or for any of the individual operations.
assessments (82.3% ± 11.2 vs. 74.3% ± 11.3, p = 0.031), whereas MR-based assessments were not different (90.0% ± 8.2 vs. 81.6% ± 10.3, p ≥ 0.05). Assessment of the left lateral section was significantly improved by the 3-D system (89.9% ± 7.2 vs. 79.1 ± 9.5, p = 0.0127), whereas right hepatectomies were not (83.2% ± 8.9 vs. 76.3% ± 12.7, p ≥ 0.05).

Conclusions: The overall accuracy of hepatic volumetric assessment is significantly improved using 3-D planning software. The significance of the software is greatest for CT-based assessments of the left lateral section. This approach gives surgeons the ability to actively plan resections and assess volumetrics with relative ease.

<table>
<thead>
<tr>
<th>Technique</th>
<th>Overall accuracy</th>
<th>CT-based accuracy</th>
<th>MR-based accuracy</th>
<th>Left lateral section accuracy</th>
<th>Right hepatectomy accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-D planning (Planisight TM)</td>
<td>84.4%</td>
<td>82.3%</td>
<td>90.0%</td>
<td>89.9%</td>
<td>83.2%</td>
</tr>
<tr>
<td>Standard radiologic reconstruction</td>
<td>76.4%</td>
<td>74.3%</td>
<td>81.6%</td>
<td>79.1%</td>
<td>76.3%</td>
</tr>
</tbody>
</table>

GENERATION OF A RECOMBINANT HEME OXYGENASE TO PROTECT TRANSPLANTED STEATOTIC LIVERS FROM REPERFUSION INJURY

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Objective: The development of a cell penetrating heme oxygenase-1 (HO1) protein for the treatment of steatotic livers ex vivo to improve resistance to reperfusion injury.

Methods: Cell penetrating enhanced green fluorescent protein (CPP-EGFP) and HO1 (CPP-HO1) clones were generated by PCR amplification of cDNA using primers with an incorporated cell penetrating peptide (CPP) sequence. Products were cloned into an expression vector, transformed into E. coli; and protein synthesis induced with Isopropyl-β-D-1-thiogalactopyranoside (IPTG). Proteins were nickel column purified and identified by western blot analysis. CPP-HO1 function was confirmed by quantifying bilirubin production from treated HEK293T cells supplemented with the necessary cofactors. Cell penetrating ability was confirmed by examining treated cells for the presence of intracellular CPP-HO1 and CPP-EGFP using immunohistochemistry and fluorescence microscopy.

Results: Generated CPP-EGFP and CPP-HO1 clones were confirmed by sequencing. Protein expression resulted in a color change of the media and bacterial pellet of CPP-HO1 expressing E. coli due to the production of biliverdin. Western blot analysis confirmed successful protein purification. Bilirubin was generated by CPP-HO1 treated, but not untreated HEK293T cells. Both CPP-HO1 and CPP-EGFP were found to penetrate hepatoma cells in vitro.

Conclusions: The successful generation of a functional HO1 protein that is able to penetrate hepatoma cells in vitro. Further work will determine if 1) CPP-HO1 can protect cells in an in vitro model of reperfusion injury 2) if CPP-HO1 can penetrate hepatocytes of ex vivo treated livers and 3) if CPP-HO1 treatment is able to protect steatotic livers from reperfusion injury.

DOES THE PRESENCE OF METASTATIC LYMPH NODES PREDICT MARGIN POSITIVE RESECTION IN PANCREATIC CANCER?

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Methodist Dallas Medical Center, Dallas, TX

Introduction: The presence of lymph node metastases (LNM) in pancreatic cancer is a marker of advanced disease and is associated with decreased survival. As imaging techniques become more sensitive, patients discovered to have LNM pre-operatively will likely undergo neoadjuvant
chemoradiotherapy to reduce disease burden pre-operatively and increase rates of R0 resection. Herein, we test the hypothesis that LNM predict margin status of the pancreatoduodenectomy specimen.

**Methods:** Charts of 120 patients who underwent pancreatoduodenectomy for head of pancreas, periduodenal, or bile duct cancers were reviewed. LNM and margin status were recorded. Sensitivity, specificity, negative predictive value and positive predictive value were calculated to assess the potential of LNM for predicting margin status.

**Results:** Of lymph node positive specimens, 29 had positive margins while 53 had negative margins. Of lymph node negative specimens, 8 had positive margins, while 30 had negative margins. Sensitivity (Sn) of lymph node metastasis for detecting positive margins was 78% and negative predictive value (NPV) was 79%, while specificity (Sp) and positive predictive value (PPV) were 36% and 35% respectively.

**Conclusion:** Patients with pancreatic cancer who have metastatic lymph nodes are more likely to have positive margins on final pathology than those without lymph node involvement. The sensitivity and negative predictive value of LNM are sufficient to allow preoperative stratification of patients with pancreatic cancer. Preoperative chemoradiation should be considered in patients with known lymph node metastasis to potentially increase R0 resection rate.

<table>
<thead>
<tr>
<th>Margin+</th>
<th>Margin−</th>
</tr>
</thead>
<tbody>
<tr>
<td>LN + (%)</td>
<td>29 (24%)</td>
</tr>
<tr>
<td>LN − (%)</td>
<td>8 (6%)</td>
</tr>
</tbody>
</table>

Sn 78% Sp 36%

NPV 79%

**GALL BLADDER CANCER DIAGNOSED WITHOUT CHOLECYSTECTOMY: AUTOMATIC REFERRAL TO A HEPATOBILIARY SURGEON?**


Methodist Dallas Medical Center, Dallas, TX

**Introduction:** Pessimism concerning outcomes in gall bladder cancer (GBC) and lack of understanding of its operative treatment have led to under treatment of GBC. Increasing use and sensitivity of pre-operative imaging may lead to increased referral of GBC patients to hepatobiliary centers. Herein, we evaluate the hypothesis that patients referred to tertiary centers based on pre-operative imaging without cholecystectomy have more advanced disease than those who have incidental diagnosis after cholecystectomy.

**Methods:** Charts of all GBC patients from 2005 to 2010 were reviewed. Reason for referral, curative resections, R0 and R1 resection were recorded.

**Results:** Of 35 patients with GBC, two groups were identified: The imaging group (IG) included 15 patients referred after imaging suggested malignancy, but did not undergo cholecystectomy. The cholecystectomy group (CG) included 20 patients referred on finding malignancy after cholecystectomy. In IG, 53% (8 pts) were not candidates for resection while in the CG only 27% (5 pts) were not candidates for surgery. In IG, only 37% (6 pts) had R0 resections while in CG, 65% (13 pts) had R0 resections. R0 resections occurred in patients with jaundice and with multivisceral resection. Historically, both have suggested advanced disease which has gone unrectified.

**Conclusion:** Patients with gall bladder cancer diagnosed by imaging have advanced disease. They are less likely to undergo resection for curative intent and less likely to undergo R0 resection. Decisions concerning resectability of gall bladder cancer found by imaging are best undertaken by surgeons who frequently encounter this disease.

**MARGIN STATUS AFTER PANCREATODUODENECTOMY FOR PERIAMPULLARY AND HEAD OF PANCREAS TUMORS: ANATOMY OR TUMOR BIOLOGY?**

K. Lowe, A. Khithani, D. Christian and R. Jeyarajah

Methodist Dallas Medical Center, Dallas, TX

**Introduction:** Cancers of the periampullary (AMP) region have better outcomes than those of the head of pancreas (HOP). Previous reports suggest that this reflects either a difference in tumor biology or earlier diagnosis due to biliary obstruction in AMP cancers. Herein, we test the hypothesis that AMP tumors are more amenable to margin negative resection than HOP cancers.

**Methods:** Charts of 109 patients diagnosed from 2005 to 2010 with either AMP or HOP were reviewed. These included 27 AMP and 82 HOP cancers. Results were analyzed by Fisher’s exact test.

**Results:** Of the 27 AMP cancers 3 (11%) were margin positive, while in 82 HOP cancers 32 (39%) were margin positive (P = 0.004). In addition to this difference in margin status between the groups, the percent of PD specimens with lymph node metastasis was fewer in AMP cancers than in HOP cancers (50% versus 77%). However, the lymph node ratio was not different between the two groups (0.22 in both groups). There was no significant difference in average total number of lymph nodes recovered in AMP and HOP cancers (20 and 19).

**Conclusion:** AMP cancers are more likely to be resected with negative margins than HOP lesions. AMP cancers have fewer lymph node metastases at surgery than HOP cancers, but when lymph node metastases are present, ratios are equal. These findings suggest that earlier detection of disease rather than differences in tumor biology are responsible for better outcomes of AMP versus HOP cancers.

**CORRECT UTILIZATION OF HEPATITIS B CORE ANTIBODY POSITIVE DONOR LIVER GRAFTS**


Department of Surgery, Section of Transplant Surgery, St. Louis, Missouri

**Background:** Inclusion of hepatitis B core antibody positive liver donors (HBcAb) is a strategy utilized to increase organ availability. This study examined HBcAb transplantation practices to identify specific factors influencing outcome.
Methods: Twenty-five recipients of HbcAb grafts were identified retrospectively from 868 adult transplants between 1/1/1997 and 12/31/2009. Twelve (48%) recipients had hepatitis C and 5 (20%) had hepatitis B. Patient and donor demographics, preoperative morbidity, transplant data and outcomes were examined. Statistical analysis used Student-T, Chi-Square test as appropriate and Log-Rank test for Kaplan-Meier curves with p < 0.05 considered significant.

Results: There was no difference in age, BMI or co-morbidities between HbcAb and control groups. Interestingly, MELD scores >30 were significantly more frequent in HpbAb recipients (32% vs 15%, p = 0.04). All patients received immunoglobulin and antiviral therapy long-term as prophylaxis against graft hepatitis B resurgence. No patients receiving HbcAb grafts developed Hep B infection on follow-up. Overall survival at 30 days, 1 year and 5 years in HbcAb recipients was 92%, 74% and 74% compared to 96%, 89% and 76% in the control group (p = NS, Log-Rank Test). All deaths in the HbcAb group, except one recipient, occurred within 90 days post-operative, and in patients with MELD > 30. Conclusion: The practice of transplanting HbcAb grafts incurs low risk for infection using current prophylaxis treatments. The highest mortality risk was in the early postoperative period, specifically in patients with very high MELD scores and likely reflects the practice of using HbcAb grafts in emergent situations.

PURE LAPAROSCOPIC RIGHT HEPATECTOMY USING INTRAHEPATIC GLISSONIAN TECHNIQUE

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University of Sao Paulo, Sao Paulo, SP, Brazil

Aim: To present a video of a new purely laparoscopic right hepatectomy using intrahepatic glissonian technique.

Patient and method: A 75-year-old male with hilar cholangiocarcinoma and jaundice underwent preoperative biliary drainage and right portal vein embolization. CT scan performed after 4 weeks showed adequate compensatory hypertrophy of the future liver remnant (segments 2 and 3). Results: Operation began with hilar lymphadenectomy. Common bile duct is sectioned. Right hepatic artery is ligated. Left hepatic artery is encircled. Portal vein is dissected and encircled. Right liver is mobilized and detached from retrohepatic vena cava. Right and middle hepatic veins are divided. Right trisectionectomy along with segment 1 is performed, leaving specimen attached only by the portal vein. Portal vein is severed above and below the tumor and specimen was extracted through suprapubic incision. Intraoperative cholangiography confirmed a 2 cm common bile duct stone which was immediately removed by endoscopy (ERCP). Falciform ligament was sutured to main-
Cystic Pancreatic Neoplasm Removed by Central Pancreatectomy Through Lesser SAC Approach

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1Department of Surgery, University of Michigan, Ann Arbor, MI; 2Department of Surgery, Providence Hospital and Medical Centers, Southfield, MI

Introduction: Central Pancreatectomy is an operation described for lesions located at the neck of the pancreas and serve as an alternative to a Near Total Distal Pancreatectomy. The purpose of this video is to demonstrate the surgical techniques involved in a segmental resection at the neck of the pancreas for a cystic neoplasm followed by a pancreatico-jejunostomy of the distal stump.

Methods: Midline supraumbilical laparotomy was performed. The lesser sac was entered through the gastrohepatic ligament. The neck of the pancreas was segmentally mobilized superiorly and inferiorly exposing the Superior Mesenteric Vein and Portal Vein. The segment of pancreas containing the cystic tumor was resected with an adequate margin. Proximal stump was suture re-enforced and the distal stump was drained with a duct to mucosa end to side pancreaticojejunostomy. All anastomotic lines were buttressed with a falciform flap.

Results: Operative time was close to two hours with reasonable blood loss (150 ml). Postoperative course was uncomplicated and upon return to the office there was no evidence of pancreatic fistula or pancreatic exo/endocrine insufficiency. Conclusion(s): Tumors lying at the neck of the pancreas can be resected safely with a Central Pancreatectomy, thus avoiding the sequelae of a more radical resection.

Isolated Resection of Caudate Liver Lobe by Hanging Technique

D. A. Machado-Aranda1, L. Bolo-Schreuder2 and M. J. Jacobs2
1Department of Surgery, University of Michigan, Ann Arbor, Michigan; 2Department of Surgery, Providence Hospital and Medical Centers, Southfield, Michigan

Purpose: Single lesions to the caudate lobe of the liver necessitate the resection of this lone segment but represent a challenge. We describe a technique that achieves easy vascular identification and control of the caudate lobe of the liver, without requiring a major hepatectomy.

Methods: Our series involved two patients with single lesions confined to segment 1 of the liver. After initial mobilization of the organ as a whole by dividing major ligaments a retrohepatic avascular plane was developed just bellow that drainage of the hepatic veins into the Inferior Vena Cava (IVC). In the front and underneath the ligamentum venosum following Arantius canal this same avascular plane can be found and connected to the superior part. Using an umbilical tape the caudate lobe can be suspended and branches of the Portal vein, bile ducts will be found laterally and of the caudate caval drainage medially, all of which were easily controlled and divided.

Results: R0 resections were achieved successfully. Our average blood loss was less than 150 cc, with a mean operative time of 220 minutes. Patients’ postoperative course was uneventful with a mean length of stay of 4 days. No complications were reported within 30 days of follow-up.

Conclusion: An easy and safe resection of the caudate lobe can be achieved without requiring of a major hepatectomy. The suspension technique allows adequate tissue handling and exposure of the vascular infl ow and outflow of the caudate lobe facilitating its resection within acceptable operative times.

An Aggressive Multi-Disciplinary Approach to Advanced Neuroendocrine Tumors

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Virginia Piper Cancer Institute, Minneapolis, Minnesota

Background: Advanced Neuroendocrine tumors continue to be difficult to treat, with a <70% 5-year survival. A 53-year-old female with jaundice, presents with a 13 cm pancreatic head tumor. The unresectable tumor occluded the portal vein and incased the hepatic artery. Neoadjuvant therapy included external beam radiation and chemotherapy. Subsequent, radioactive octreotide (In111) was used to decrease the tumor size. The well-differentiated neuroendocrine tumor was resected with a pancreaticoduodenectomy, requiring a portal vein and a hepatic artery reconstruction (no peri-operative complications; blood loss = 400 cc; operative time = 636 min; LOS = 9 days). The pathology revealed islet cell tumor with microscopic islands of tumor in the peri-aortic tissue. The patient is well without clinical recurrence at 18 months, with a planned 3rd cycle of radioactive octreotide. A 41-year-old female with abdominal pain, presents with a 24 cm neuroendocrine liver tumor. Imaging reveals tumor replacement of the right lobe and additional left liver lesions. The patient underwent radioactive octreotide (In111) treatment to control the systemic disease. Surgery included resection of the primary jejunal lesion and a right hepatectomy (no peri-operative complications; blood loss = 250 cc; LOS = 6 days). During a staged liver resection the left lobe of liver was cleared. A 3rd round of radioactive octreotide was utilized. The patient is well with stable disease at 18 month follow up. Additional treatment options include Selective Internal Radiation Therapy (SIRT) and/or liver transplantation.

Conclusions: An aggressive multi-disciplinary approach to neuroendocrine tumors can be performed safely and may provide a survival benefit.
INFERIOR VENA CAVA RESECTION WITH HEPATECTOMY: CHALLENGING BUT JUSTIFIED

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Introduction: The objective of this study was to evaluate the clinical significance of hepatectomy combined with IVC resection and reconstruction for treatment of invasive liver tumours.

Methods: From 1995 to 2010, 35 patients underwent hepatic resection with IVC resection. They had a mean age of 58 years (range 32–84). Resections were carried out for colorectal liver metastasis (n = 21), hepatocellular carcinoma (n = 6), cholangiocarcinoma (n = 3) and other (n = 5). Resections were carried out with total vascular occlusion in 34 cases and without in one. Intraoperative hypothermic perfusion was performed in 4, ante situm in 2 and Ex-vivo in 6 cases.

Results: There were 3 (8.6%) early deaths from multiple organ failure. Post operative complications occurred in 14 (40%) cases with 3 (8.8%) requiring reoperation. Median operative time was 255 minutes (range 90–660) and median post operative hospital stay was 12 days (range 6–45). Transfusion was necessary in 19 (55.8%) patients (median 5 units). All vascular reconstructions were patent at last follow up. The overall median survival was 20 months and median disease free survival was 16 months (5-year survival 14.7%). The 1-, 2- and 5-year survival was 76.2%, 38.1% and 9.5% for colorectal liver metastasis. The 1-year survival for HCC and Cholangiocarcinoma was 80% and 33% respectively.

Conclusion: Aggressive surgical management of liver tumours with IVC involvement offers the only hope for cure or palliation in selected cases. Resection by specialist teams affords acceptable peri-operative morbidity and mortality.

OVER-EXPRESSION OF AQUAPORIN 8 (AQP8) INHIBITS TUMOR FORMATION IN A RAT MODEL OF HEPATOCELLULAR CARCINOMA (HCC)

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Cells undergoing apoptosis exhibit apoptotic volume decrease necessitating rapid, AQP-dependent water loss from the cell. Human and animal models of HCC are characterized by decreased AQP expression and diminished apoptotic responsiveness. This study sought to determine whether AQP8 over-expression in HCC cells alters tumor growth in vivo. Rat H4IIE cells were stably transfected with a dual plasmid Tet-On system expressing rat AQP8 and hemaglutinin (HA) CNDA. Transfected cells were isolated, expanded, and (~10^6 cells) inoculated into the parenchyma of ACI rats. 16-days later HCC cells from these tumors were isolated, cultured, and reinoculated into animals fed diets containing doxycycline. Successful cell transfection was determined using selective medium and detection of HA mRNA. In the absence of dietary doxycycline, transfected and non-transfected cells reproducibly formed intrahepatic tumors after 15 days. Non-transfected cells from these masses subsequently formed hepatic tumors in animals on doxycyclin-containing diets. Conversely, cells transfected to express AQP8 failed to form tumors in 50% of animals maintained on doxycycline-containing diet. Furthermore, in those animals in which HCC formed, tumors were significantly smaller compared to non-transfected cells (24 ± 9 vs 408 ± 82 mm³, transfected vs non-transfected, p < 0.05, n = 4). Over-expressing AQP8 in vitro significantly inhibits rate and size of intrahepatic tumor formation in vivo. These data may have significant future application when used in conjunction with irreversible electroporation as a means to selectively increase AQP expression within targeted regions.

REFINING THE DEFINITION OF PERI-OPERATIVE MORTALITY FOLLOWING HEPATECTOMY

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¹The Johns Hopkins Hospital, Baltimore, MD; ²The Johns Hopkins Bloomberg School of Public Health, Baltimore, MD

Background: Peri-operative mortality is commonly defined as death within 30-days of surgery. However this definition...
may underestimate “true” peri-operative mortality among patients undergoing hepatic resection (HR). To better define peri-operative mortality, we assessed trends in risk of death during the first 90-days after HR.

**Methods:** Using Surveillance, Epidemiology and End Results (SEER)-Medicare linked data, we identified 2597 patients (colorectal liver metastasis [CRLM] = 1903; hepatocellular carcinoma [HCC] = 694) who underwent HR between 1991 and 2007. Data on clinicopathologic characteristics, surgical management, and peri-operative mortality were collected and survival was assessed at 30-, 60-, and 90-days.

**Results:** HR included wedge resection (60%), hemi-hepatectomy (35%), or extended hepatectomy (5%). Median length of hospitalization was 7 days for both CRLM and HCC patients ($P = 0.35$). Overall, 6% patients died within the first 30 days, 78% of whom died during the same hospitalization. Post-operative mortality at 60- and 90-days was 8% and 10%. In-hospital mortality after HR was greater among patients with HCC compared with CRLM (9% vs 4%) ($P < 0.001$). For CRLM patients, mortality increased from 4% to 8% from 30- to 90-days, whereas mortality for HCC patients increased from 10% to 15% (both $P < 0.05$) (Figure). After controlling for other factors, patients with HCC were twice as likely to die within 30-days (OR = 2.4), 60-days (OR = 2.0), and 90-days (OR = 1.9) vs CRLM patients (all $P < 0.001$). Differences in 30- and 90-day mortality were greatest among HCC patients undergoing major hepatic resection ($P < 0.05$).

**Conclusions:** Only reporting deaths within 30-days of surgery underestimates the mortality associated with HR. Traditional 30-day definitions of mortality are inaccurate and surgeons need to report all peri-operative outcomes within 90-days of HR.

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**BILE DUCT INJURY REPAIR: TRANSITION TO A HIGH VOLUME CENTER IMPACTS IN OUTCOME**

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_Instituto Nacional de Ciencias Medicas Y Nutricion, Mexico City, Distrito Federal_

Bile duct injury associated to laparoscopic cholecystectomy remains constant (0.1–0.3%) and their impact in survival and quality of life has been studied. It has been shown that operative and long term results are better in interested HPB hospitals. Here in we analyze the distribution and growth of the number of cases referred to our hospital as well as the technical variants of repair and long term results.

**Methods:** In a 20 years period, 510 complex circumferential injuries have been referred to our team for repaired at the INN Hospital Mexico City and 198 elsewhere (private and other cities). The record at the third level Academic University Hospital were analyzed and divided in three periods of time: 1990–1999 (33 cases), GI, 2000–2004 (139 cases), 2004–2008 (140 cases) GIII.

**Results:** All patients were treated with a Roux en Y hepa-toeyunostomy. A decrease for using transanostomotic stents was observed. Partial segment IV and V resection was done more frequently (to obtain a high bilioenteric anastomosis). Operative mortality, postoperative cholangitis, Anastomosis strictures, short and long term complications and need of reoperation were significantly better in the last period.

**Conclusions:** Transition to a high volume center with interested HPB surgeons has improve dramatically operative and long term results of bile duct injury repair. Even interested and tertiary care centers have a learning curve.
COMON BILE DUCT EXPLORATION: A LOST ART

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Purpose: In 1970 common bile duct exploration (CBDE) was performed in 15% of patients undergoing cholecystectomy. With the introduction of endoscopic sphincterotomy and laparoscopic cholecystectomy, CBDE has become a rare operation. The aims of this analysis are to a) document the current utilization as well as the outcomes and b) compare laparoscopic to open bile duct exploration.

Methods: The ACS-NSQIP database from 2005 to 2009 was queried for cholecystectomy and CBDE. Patient demographics, mortality, serious morbidity and overall morbidity were compared for 649 (40%) laparoscopic and 953 (60%) open CBDE using standard statistical methods.

Results: Of 98,341 patients undergoing cholecystectomy, 1464 (1.5%) had a CBDE. An additional 158 patients undergoing CBDE had previously had their gallbladder removed. Patients undergoing open CBDE were more likely (p < 0.05) to be older, male, diabetic, and to have multiple comorbidities, jaundice and/or cholangitis. Outcomes are reported in the Table.

Conclusions: In the modern era, common bile duct exploration is an uncommon operation. Forty percent of the CBDEs are being performed laparoscopically in healthier patients with better outcomes. Efforts should be undertaken to train more surgeons to perform laparoscopic bile duct exploration.

<table>
<thead>
<tr>
<th>CBDE</th>
<th>30-Day Mortality</th>
<th>Serious Morbidity</th>
<th>Overall Morbidity</th>
<th>Length of Stay (d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Laparoscopic</td>
<td>0.5%</td>
<td>2.0%</td>
<td>4.2%</td>
<td>3.5</td>
</tr>
<tr>
<td>Open</td>
<td>4.4%*</td>
<td>15.7%*</td>
<td>20.5%*</td>
<td>10.5%*</td>
</tr>
<tr>
<td>Overall</td>
<td>2.9%</td>
<td>10.0%</td>
<td>14.8%</td>
<td>7.6</td>
</tr>
</tbody>
</table>

*p < 0.01 vs Laparoscopic
OUTCOME OF PANCREATIC REMNANT FOLLOWING SEGMENTAL PANCREATECTOMY FOR NON-INVASIVE INTRADUCTAL PAPILLARY MUCINOUS NEOPLASM (IPMN)

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Purpose: IPMN are often multifocal involving the entire pancreas. Due to morbidity of total pancreatectomy, surgeons will perform segmental pancreatectomy, resecting only the most “threatening” IPMN lesion(s). We sought to determine if the presence of residual IPMN following segmental pancreatectomy for non-invasive IPMN increases the risk for subsequent development of invasive cancer and decreases survival.

Methods: From 1991 to 2010, data on patients undergoing segmental resection of non-invasive IPMN were prospectively accrued at a high volume academic institution.

Results: Of 243 patients undergoing segmental resection for IPMN, 193 (79%) demonstrated non-invasive pathology. Of these, 152 (79%) had absence and 41 (21%) had presence of residual IPMN at initial operation. Of 41 with residual IPMN, 11 had positive IPMN margins, 23 had IPMN in remnant, and 7 both. During follow-up, 31 (20%) of 152 patients without residual IPMN developed a new radiographic lesion consistent with IPMN, and of these, 3 (10%) were invasive cancer. One (2%) of 41 patients with residual IPMN developed invasive cancer. In summary, of 193 initially non-invasive IPMN, 4 invasive cancers (2%) developed during follow-up. The mean progression free interval of these 4 patients was 54 (20–99) months.

Conclusions: Compared to patients undergoing complete operative IPMN clearance, patients with residual IPMN after segmental pancreatectomy do not demonstrate an increased risk of developing invasive disease or reduced survival. In patients without residual IPMN, who later develop new IPMN, the risk of invasive IPMN is increased, but survival is not reduced when compared to patients who do not develop new IPMN.

PERCUTANEOUS TRANSHEPATIC ISLET CELL AUTOTRANSPLANTATION AFTER PANCREATECTOMY FOR CHRONIC PANCREATITIS: A NOVEL APPROACH

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Background: In selected patients with chronic pancreatitis, extensive pancreatectomy can be effective for the treatment of intractable pain. The resultant morbid diabetes can be ameliorated with islet autotransplantation. Conventionally, islet infusion occurs intraoperatively after islet processing. A percutaneous transhepatic route in the immediate postoperative period is an alternate approach.

Methods: A prospectively collected database of patients undergoing pancreatectomy with percutaneous islet auto-transplantation (P-IAT) between March 2009 and May 2010 was reviewed. Hospital billing data were obtained with pertinent median charges determined and compared to estimated charges for an intraoperative infusion method (I-IAT).

Results: Thirty-six patients (28 women; median age 48) underwent pancreatectomy with P-IAT. Median operative time was 232 minutes, with median EBL 500 cc. Median time from pancreatic resection to islet transplantation was 269 minutes. A median of 208,248 IEq (2298 IEq/kg) were harvested. Peak portal venous pressure during islet infusion was a median 13 mmHg. Postoperative complications occurred in 17 patients (47%), including hepatic artery pseudoaneurysm and portal vein thrombosis (PVT). PVT occurred in 2 patients with portal pressures during infusion > 30 mmHg. With median follow-up of 8 months, 8 patients (23%) are insulin-free. Median pertinent charges for P-IAT were $36,318, while estimated median charges for I-IAT were $56,440. Surgeon opportunity cost allowed by

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P-IAT versus I-IAT was demonstrated by 66 additional procedures and $463,375 billed.

Conclusions: Percutaneous transhepatic islet cell autotransplantation is feasible and safe. Islet infusion in the immediate postoperative period is cost effective. Further follow-up is needed to assess long term results.

OUTCOMES OF ROBOTIC-ASSISTED PANCREATIC RESECTION FOR PANCREATIC ADENOCARCINOMA: A SINGLE-INSTITUTION REVIEW

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Introduction: Robotic surgery in advanced pancreatic resections is gaining momentum due to improved surgical dexterity and visualization. We analyzed oncologic outcomes for a consecutive series of robotic-assisted pancreatic resections (RAPR) for pancreatic adenocarcinoma (PAC).

Methods: Single-institution retrospective review of all patients (n = 21) undergoing RAPR for PAC between 2008 and 2010 in a tertiary referral center.

Results: We identified thirteen robotic-assisted pancreateco-duodenectomies and eight distal pancreatectomies. Average age was 70 years with equal gender distribution (48% women). Median blood loss was 300 cc (range 30–1000), while median OR time was 489 mins (range 174–686). The major complication rate (Clavien) was 19% (4/21) with a single delayed postoperative death at day 87 (1/21). A pancreatic leak occurred in 10% (2/21) of the patients. Median length of stay was 9 days (range 4–15 days). The conversion rate to open was 29% (6/21); 2 conversions were caused by failure to progress, whereas the other 4 were due to vascular abutment. Mean tumor size was 3 cm and the margin negative resection rate was 86% (18/21). Median lymph nodes (LN) harvested was 18 and the median LN positive was 1. Median time to receiving adjuvant chemotherapy was 69 days. Conversion to open correlated with a significantly higher risk of R1 status following traditional resection, signifying unexpected locally-advanced disease (p < 0.004).

Conclusions: Robotic-assisted pancreatic resection is a safe and feasible option for adenocarcinoma. Early experience suggests that oncologic endpoints are comparable to the open approach, with conversions to open resection reflecting tumor status rather than technical failure of the robotic approach.

A NEW TECHNIQUE FOR PANCREATICOJEJUNOSTOMY USING FULL THICKNESS PANCREATIC STAY SUTURES AND VIDEO MICROSCOPY

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Introduction: The leak rate after pancreaticojejunostomy continues to be significant, ranging 5–20% despite numerous modifications and techniques. Some leaks may occur because the bowel separates from the pancreas due to bowel edema or distension. A technique is presented that utilizes full thickness pancreatic stay sutures followed by duct-to-mucosa anastomosis performed with assistance of video microscopy.

Methods: Monofilament full thickness pancreatic stay sutures are placed on each side of the pancreatic duct, anchoring the posterior jejunum to the pancreatic face. Duct-to-mucosa anastomosis with internal stent is fashioned prior to tying the stay sutures. The anterior surface of the bowel is further anchored with two or three horizontal mattress sutures. This technique differs from most anastomotic techniques in that it is not a true two-layer technique, as the outer layer is not meant to be watertight. Rather, the stay sutures are meant to anchor the jejunum, but do so in a durable way not susceptible to disruption if the bowel becomes distended. The technique also uses video microscopy, which is a new method of magnification that replaces standard Loupe magnification. Video microscopy uses a high definition camera mounted on a mechanical arm that allows the surgeon to work off a video screen. This system provides variable magnification of 4X–12X and is simpler and more convenient than an operating microscope.

Results: This technique has been used in 8 consecutive high risk pancreatic anastomosis without evidence of pancreatic fistula. The anastomotic technique and the use of video microscopy are demonstrated.
RECURRENT HEPATOCELLULAR CANCER AFTER LIVER TRANSPLANT: IDENTIFYING THE HIGH-RISK PATIENT

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Introduction: Recurrence of hepatocellular cancer (HCC) after liver transplantation (LT) is rarely curable. However, with the advent of new therapies, identification of patients at high risk for recurrence at time of explant is critical.

Methods: We analyzed our database of 122 patients undergoing LT for HCC between 2002 and 2010. Pathologic features of the explant were used to predict risk of recurrent tumor. All necrotic and viable tumor nodules were included in explant staging. All patients met radiographic Milan criteria prior to transplant.

Results: Overall survival for the entire group at 1 and 3 years was 93% and 85% respectively. Thirteen patients developed HCC recurrence at a mean of 16 months post-transplant. By Kaplan-Meier analysis recurrence free survival at 1 and 3 years was 95% and 89% respectively. There were no recurrences in patients with explant pathology meeting Milan criteria (n = 68). Modeling of pathologic criteria determined that significant predictors of recurrence included: i) stage exceeding UCSF criteria (p < 0.001); ii) >3 tumors (p < 0.001); iii) presence of vascular invasion (p = 0.007); and iv) presence of bilobar lesions (p = 0.029). Step-wise modeling showed that the major risk factor for recurrence was pathology beyond UCSF criteria, and that when combined with vascular invasion the risk was particularly high (Table).

Conclusion: Explant pathology can be used to predict the risk of recurrent HCC after LT, which may allow for improved adjuvant strategies. In addition, our results provide additional support for continued acceptance of UCSF downstaging criteria for LT for HCC.

Table. Step-wise Modeling of Recurrence-Free Survival after LT using Explant Pathologic Staging

<table>
<thead>
<tr>
<th>Milan Stage</th>
<th>UCSF Stage</th>
<th>Vascular Invasion</th>
<th>1-Year Rate</th>
<th>3-Year Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within</td>
<td>n/a</td>
<td>n/a</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Exceeding</td>
<td>Within</td>
<td>Absent</td>
<td>97% (95%, 100%)</td>
<td>91% (82%, 100%)</td>
</tr>
<tr>
<td></td>
<td>Exceeding</td>
<td>Absent</td>
<td>90% (77%, 100%)</td>
<td>72% (48%, 100%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Present</td>
<td>86% (72%, 100%)</td>
<td>63% (40%, 98%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Present</td>
<td>57% (32%, 100%)</td>
<td>18% (4%, 97%)</td>
</tr>
</tbody>
</table>

GOOD OUTCOMES OF ORTHOTOPIC LIVER TRANSPLANTATION AT SMALL VOLUME CENTER

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Introduction: Liver transplantation (LT) has been accepted as the best treatment for patients with end-stage liver disease. There are some reports showed that liver transplant outcomes are better at high volume centers. However, in developing country, it is quite difficult to have LT more than 20 cases a year due to shortage of liver donor and financial problem. The first LT in Thailand was performed at our hospital in 1987. 132 cases of LT have been performed until December 2009. We reported herein the recent outcomes.

Material and methods: The medical records of LT patients between January 2003 and December 2009 were retrospectively reviewed. The operative outcomes and patient survival rate were analyzed.

Results: There were 69 patients and 70 LT procedures. 62 patients were adults and 7 patients were children. The mean age was 46.8 years (0.58–69). Most common indication was HBV cirrhosis (40%). The type of liver grafts were whole cadaveric graft 63 cases (90%), reduced size graft 4 cases (5.7%), and lateral segment graft from living donor 3 cases (4.3%). The mean MELD/PELD score was 20.6 (1–40). The major complications were acute renal failure (27.1%), acute cellular rejection (22.9%) and biliary complications (22.9%). The cumulative 1, 3 and 5 year patient survival rate were 86.6%, 80.3%, and 76.1% respectively which were comparable to UNOS data.

Conclusion: This study showed that LT can achieve a good outcome at small volume center in developing country. So the small volume center should not be discouraged and continues to improve outcome by teamwork approach.

CHOLEDOCHAL CYST DISEASE: LONG-TERM FOLLOW-UP AT A SINGLE HIGH-VOLUME INSTITUTION

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The natural history and long-term complications after surgical intervention for choledochal cyst disease in Western society is not well characterized. This study reports long-term follow-up of the largest Western series of patients with choledochal cyst disease.

Methods: 92 patients with choledochal cyst disease who underwent surgical management between 1976 and 2006 were identified. Data on long-term outcomes were obtained via chart review, office records, and telephone-based patient interviews.

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Conclusions: Patients with choledochal cysts are prone to long-term complications, particularly in the adult population. Choledochal cyst disease carries a risk of developing malignancy in addition to a risk of significant morbidity following surgical intervention. Therefore, life-long surveillance should be considered.

EFFECT OF DONOR RISK INDEX (DRI) AND CENTER VOLUME ON LIVER TRANSPLANTATION OUTCOMES

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Utilization of expanded criteria donors (ECD) organs across the United States has increased in recent years, reflecting the national organ shortage. Despite this, nearly 30% of marginal livers are discarded annually. Using a risk-adjusted model, we determined whether transplant center (TxC) procedure volume impacted marginal allograft utilization and survival, as well as recipient survival.

Methods: We queried the UNOS database for all deceased donor liver transplants (DDLT; n = 34,909) from 2002 to 2008, excluding split liver transplants. TxC (n = 141) were categorized by volume into tertiles: High (HV; 73.4 DDLT/TxC/Yr; 16.7% of TxC), Medium (MV; 47.8 DDLT/TxC/Yr; 22%) and Low (LV; 21.5 DDLT/TxC/Yr; 58.6% of TxC). Endpoints were allograft and recipient survival.

Results: Compared to their lower volume counterparts, HV centers more frequently utilized donors with higher DRI (HV:1.95, MV:1.84, LV:1.81; p < 0.001), met renal-ECD criteria, increased age (>40 years), death secondary to stroke and cardiac demise prior to donation (p < 0.001). Recipient characteristics (MELD, age), donor characteristics (DRI, race, age, cause of death) and region of donation were found to be independent factors for allograft and recipient survival. Risk adjusted models showed HV centers had better overall allograft (HV : OR 0.88, 95% CI 0.83–0.93) and recipient (HV : OR 0.86, 95% CI 0.80–0.91) survival when compared to LV centers (p < 0.0001). These trends persisted when observations with DRI below the median (1.9) were excluded (p < 0.0001).

Conclusion: HV centers utilized higher DRI livers more frequently and achieved improved risk-adjusted allograft and recipient survival. Further understanding of center specific results may improve allocation practices and future outcomes.

SPONTANEOUS RUPTURE OF HEPATIC HEMANGIOMAS

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1UNISA – Universidade Santo Amaro, Sao Paulo, SP; 2UNICID – Universidade Cidade de Sao Paulo, Sao Paulo, SP; 3HC-FMUSP, Sao Paulo, SP

Aim: To evaluate the incidence of spontaneous rupture of hepatic hemangiomas in the current literature considering the high incidence of this type of benign liver tumor in the population.

Material and methods: Medline and PubMed search from 1993 to 2010 about the spontaneous rupture of hepatic hemangiomas.

Results: Hepatic hemangiomas can be divided into two major groups: capillary hemangiomas and cavernous hemangiomas. These tumors more frequently affect females (80%) and adults in their fourth and fifth decades of life. The most cases are asymptomatic but a few patients may present a wide variety of clinical courses, where spontaneous or traumatic rupture is the worst severe complication. Imaging studies used in the diagnosis of hepatic hemangiomas in most cases include ultrasonography, dynamic contrast-enhanced computed tomography (CT) scanning, magnetic resonance imaging (MRI). In cases which the spontaneous rupture...
occurs, clinical manifestations consist of sudden abdominal pain, and anemia secondary to a haemoperitoneum. Disseminated intravascular coagulopathy can also occur. Haemodynamic instability and signs of hypovolemic shock appears in about one third of the cases. As the size of the hemangioma increase, the greater is the chance of rupture. The rate of spontaneous rupture ranges 1–4%.

**Conclusion:** Surgical treatment should be restricted to specific situations. Absolute surgical indications are spontaneous or traumatic rupture with hemoperitoneum, intratumoral bleeding and consumptive coagulopathy (Kassabach-Merrit syndrome). In a patient presenting acute abdominal pain, with unknown abdominal disease, spontaneous rupture of a hepatic tumor like hemangioma should be considered as a rare differential diagnose.

### THE ANATOMIC COURSE OF THE FIRST JEJUNAL BRANCH OF THE SUPERIOR MESENTERIC VEIN IN RELATION TO THE SUPERIOR MESENTERIC ARTERY


**Fox Chase Cancer Center, Philadelphia, PA**

**Introduction:** The purpose of this study is to determine the anatomic course of the first jejunal branch of the superior mesenteric vein (SMV) in relation to the superior mesenteric artery (SMA).

**Methods:** Three hundred consecutive contrast-enhanced computed tomography (CT) scans were reviewed by a surgical oncologist with confirmation of findings by an attending radiologist. Data recorded included the relationship of the first jejunal branch of the SMV to the SMA, branch diameter and inferior mesenteric vein (IMV) drainage.

**Results:** The overall incidence of a first jejunal branch coursing anterior to the SMA was 41%. There was no correlation between patient gender and position of the jejunal branch. In addition, there was no correlation between the size of the first jejunal branch and its location in relation to the SMA. The IMV drained into the SMV in 27% of the patients. The IMV drained into the SMV-portal vein confluence in 17% of patients and inserted into the splenic vein in 54%. An anterior coursing first jejunal branch statistically correlated with an IMV that drained into the SMV-portal vein confluence (p = 0.009).

**Conclusion:** The first jejunal branch of the SMV has a highly variable course in relation to the SMA and has a higher incidence of an anterior location in this population than previously reported. This knowledge is relevant to the abdominal surgeon.

### PANCREATODUODENECTOMY IN PATIENTS WITH HEPATIC CIRRHOSIS: IS IT WORTHWHILE?

J. B. Patel, A. Chauhan, T. J. Howard, J. R. Butler, A. Nakeeb, C. M. Schmidt, H. A. Pitt, M. G. House, K. D. Lillemoe and N. J. Zyromski

**Indiana University, Indianapolis, IN**

**Background:** Occasionally, unexpected hepatic cirrhosis is encountered during exploration for pancreatic resection. Surgical outcome data on pancreatocirrhosis in cirrhotic patients are scant. This study examined the short- and long-term outcomes of cirrhotic patients undergoing pancreatic head resection.

**Methods:** With IRB approval, records of 848 patients undergoing pancreatic head resection (1999–2009) were reviewed to identify concomitant liver disease. Demographics and outcomes were evaluated.

**Results:** Eleven patients with cirrhosis (4 female, median age 67.7 years) underwent pancreatic head resection (10 pancreatoduodenectomy, 1 total pancreatectomy). Median preoperative MELD score was 9 (range 7–18); no patient had ascites. Pathology showed: pancreatic adenocarcinoma (8), ampullary adenocarcinoma (2), distal cholangiocarcinoma (1). Two patients (18%) died in the perioperative period; one on POD 6 from hepatic insufficiency, and one on POD 35 related to myocardial infarction, gastrointestinal bleed, and delayed gastric emptying. Eight patients (73%) developed major perioperative complications: pulmonary (6), cardiac (3), gastrointestinal bleeding (2), and acute renal insufficiency (1). Five patients developed infections, 3 had delayed gastric emptying, 2 had pancreatic fistula, and 2 developed ascites. Median length of hospital stay was 12 days (range 7–51). Eight patients were discharged to home, and 2 to extended care facilities. Median survival was 32.5 months (range 12–60 months) with one patient alive at 5 years.

**Conclusion:** Patients with well-compensated liver disease tolerate pancreatic head resection, albeit with high perioperative morbidity and mortality. Long-term survival following cancer resections seemed surprisingly good. Pancreatoduodenectomy is acceptable for select patients with pancreatobiliary malignancy and concomitant liver disease.

---

**Table. Results of SMV/IMV Anatomy**

<table>
<thead>
<tr>
<th>IMV Drainage</th>
<th>Number (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Splenic Vein</td>
<td>163 (54%)</td>
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<td>SMV-Portal Vein Confluence</td>
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</tr>
<tr>
<td>SMV</td>
<td>82 (27%)</td>
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<tr>
<td>Ileal Branch</td>
<td>1 (0.3%)</td>
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<tr>
<td>Jejunal Branch</td>
<td>2 (0.67%)</td>
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</table>

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Journal Compilation © 2011 Americas Hepato-Pancreato-Biliary Association, HPB, 13 (Suppl. 1), 1–77
THE PROGNOSTIC IMPORTANCE OF LYPHOVASCULAR INVASION IN CHOLANGIOCARCINOMA ABOVE THE CYSTIC DUCT: A NEW SELECTION CRITERION FOR ADJUVANT THERAPY?

S. H. Patel1, D. A. Kooby1, J. Sarmiento2, C. Staley1 and S. K. Maithel1

1Emory University Department of Surgery, Division of Surgical Oncology, Winship Cancer Institute, Atlanta, GA; 2Department of Surgery, Division of General Surgery, Emory University, Atlanta, GA

Background: No standard criteria exist for the administration of adjuvant chemotherapy for completely resected cholangiocarcinoma (CC); however, lymph node (LN) metastases are an indicator of aggressive biology often used to select patients for chemotherapy. A limitation of this approach is that LN recovery after hilar and intrahepatic CC resection is typically minimal to none; therefore, a surrogate is needed.

Methods: All patients between 1/00 and 9/09 who underwent resection for hilar or intrahepatic CC at a single institution were identified from a prospectively maintained database. Pathologic factors were recorded and primary outcome was overall survival (OS).

Results: 69 patients underwent resection for hilar (n = 34) and intrahepatic (n = 35) CC. Median age was 66 years; 42 patients (39%) were male; median follow-up was 24.5 months, and median OS was 17 months. The median tumor size was 5 cm, 23% had a positive resection margin, 44% had perineural invasion (PNI), 32% had lymphovascular invasion (LVI), and 25% had positive LNs. The median number of LNs removed was 2, and the median number of positive LN was 0. Presence of LVI was associated with a reduced OS (11.9 vs 23.1 months, p = 0.023) (Figure). After accounting for all other adverse tumor factors, presence of LVI persisted as the only negative prognostic factor on multivariate Cox regression for OS (Table).

Conclusion: After complete resection of hilar and intrahepatic cholangiocarcinoma, the presence of lymphovascular invasion is the strongest pathologic factor for predicting reduced overall survival. This may potentially be used as a selection criterion for administering adjuvant chemotherapy.

Multivariate Cox Regression Analysis of Adverse Tumor Factors for Overall Survival (n = 69)

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<td>Pos LN</td>
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<td><strong>1.02–3.99</strong></td>
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SARCOPENIA NEGATIVELY IMPACTS SHORT-TERM OUTCOMES IN PATIENTS UNDERGOING HEPATIC RESECTION FOR COLORECTAL LIVER METASTASIS


Johns Hopkins Hospital, Baltimore, MD

Background: As indications for liver resection expand and more patients are offered surgery, objective measures to assess risk of peri-operative morbidity are needed. We sought to investigate the impact of sarcopenia (reduced muscle mass) on short- and long-term outcome of patients undergoing liver resection for colorectal liver metastasis (CRLM).

Methods: Sarcopenia was assessed in 259 patients undergoing liver resection for CRLM by measuring total psoas area (TPA) on CT-scans and normalizing for height. The impact of sarcopenia was assessed after controlling for background clinicopathological factors using multivariate modeling.

Results: Median patient age was 58 yrs and most patients (60%) were male. Forty-one (16%) patients had sarcopenia (TPA < 500 mm2/m2). There were no differences in baseline clinical, pathological, or operative characteristics between patients with or without sarcopenia (P > 0.05). Post-operatively 60 patients had a complication for an overall morbidity of 23.2%; 26 patients (10.0%) had a serious complication (Clavien grade 3–5). Presence of sarcopenia was strongly associated with increased risk of serious post-operative complication (OR 3.44; P = 0.007). Patients with sarcopenia had a longer hospital stay (6.7 vs 5.4 days; P = 0.03). On multivariate analysis, sarcopenia remained independently associated with increased risk of post-operative complications (OR 2.98; P = 0.03). However, sarcopenia was not significantly associated with long-term outcome as recurrence-free (HR = 1.07) and overall (HR = 1.05) survival were comparable in each group (both P > 0.05).

Conclusions: While patients with sarcopenia had increased risk of post-operative morbidity and longer hospital stay, long-term survival was not impacted by the presence of sarcopenia. Sarcopenia may be helpful in identifying patients at highest risk of peri-operative morbidity following resection of CRLM.
MRNA GENE EXPRESSION CORRELATES WITH HISTOLOGICAL INJURY ASSOCIATED WITH CHEMOTHERAPY


Introduction: It may be possible to predict patients at risk of developing chemotherapy induced hepatic injury by analysis of genes that have been established to be associated with development of other forms of toxicity and which are involved in the metabolism of the chemotherapeutic agents.

Methods: Two hundred twenty samples kept in tissue bank following hepatic resection had RNA extracted and reverse transcribed into cDNA. Real time quantitative PCR using these samples was then employed to quantitate mRNA expression of nucleotide excision repair genes ERCC1 and ERCC2, of relevance in the neutralisation of damage induced by oxaliplatin, as well as genes encoding enzymes of relevance to the metabolism of 5-fluorouracil, thymidylate synthase (TS), thymidine phosphorylase (TP) and dihydropyrimidine dehydrogenase (DPD). mRNA expression was correlated to histopathological injury patterns identified by two independent pathologists, scored via previously validated methods in relation to steatosis, steatohepatitis and sinusoidal obstruction syndrome.

Results: High levels of TS mRNA were statistically significantly associated with sinusoidal injury (p < 0.02). High levels of ERCC1 also displayed a trend towards this association. Low levels of DPD mRNA was associated with the development of steatosis. Levels of ERCC1 and ERCC2 did not have any further association with injury patterns, and TP also had no relation to injury pattern.

Conclusions: Predisposition to the development of chemotherapy induced hepatic injury may be potentially predictable based upon individual patient expression level of genes encoding enzymes related to the metabolism of chemotherapeutic agents.

RADIOLOGIC AND INTRAOPERATIVE DETECTION OF NEED FOR MESENTERIC VEIN RESECTION IN PATIENTS WITH ADENOCARCINOMA OF THE HEAD OF THE PANCREAS

Washington University In Saint Louis, Department of Surgery, Saint Louis, MO

Introduction: Effectiveness of radiologic/intraoperative prediction of need for SMV or portal vein resection during pancreatoduodenectomy for adenocarcinoma was evaluated.

Methods: 100/343 patients (29%) having pancreatoduodenectomy had vein resection based on radiologic and intraoperative assessments. Vein narrowing was the only preoperative radiologic sign considered to be absolute evidence of vascular involvement. Patients with abutment or loss of fat plane underwent trial dissection and had vein resection if the surgeon believed tumor adherence to vein was probable. Either actual invasion or microscopic tumor ≤1 mm from the resected vein (pathologic proximity) were criteria used to determine whether vein resection had actually been necessary.

Results: 77% of patients resected had one radiologic sign. 23% were resected on the basis of operative findings only. 79/100 patients had sufficiently detailed pathologic examination to assess tumor/vein relationship. In 41/79 patients there was microscopic invasion of the vein, while in 20/79 the tumor was ≤1 mm from the vein. In 18 patients (23%) the tumor was >1 mm from the vein. Consequently, in 61/79 patients (77% of assessable specimens) a positive margin (R1 resection), would have been obtained without vascular resection. The SMV/portal vein resection margin was microscopically negative (R0) in 98%, the same as the 243 patients without vein resection.

Conclusions: Combined radiologic/intraoperative assessment resulted in moderately high sensitivity of the actual need for vascular resection. The requirement for resection is not apparent preoperatively in about one-quarter of patients needing it. Readiness to perform vascular resection under these conditions leads to a very high local R0 rate.

PANCREATIC CANCER FOLLOWING A DIAGNOSIS OF NEW-ONSET DIABETES: A POPULATION-BASED STUDY

Surgical Analysis & Outcomes Research (SOAR), University of Massachusetts Medical School, Worcester, MA

Background: There is an association between pancreatic cancer (PC) and preceding new-onset diabetes. We hypothesized that patients with new-onset diabetes have important differences in tumor location, rate of resection, and survival.

Methods: SEER-Medicare 1991–2005 was used to identify diagnoses and dates for PC and diabetes. Kruskal-Wallis tests, stratified univariate analysis, Chi square tests, and Kaplan-Meier survival analysis were performed.
RESULTS: 22493 PC patients were identified, 44% with new onset diabetes preceding PC diagnosis. Females were less likely to present with diabetes (43.3% vs. 45.1% in males; p = 0.006). Overall tumor locations were: head 51.8%, body 9%, tail 10.3%, overlap/other 29%. Diabetic patients had fewer head tumors (50.9% vs. 52.4%) and more body tumors (10.1% vs. 8.3%). More diabetic patients were recommended for resection (33.9% vs. 32.7% p = 0.05), but with no significant difference in a proportion actually resected (12.6% vs. 13.2% p = 0.21). Median duration of diabetes prior to PC was 37.7 (range 12.7–69.9) months. There was significantly higher median survival in non-diabetics vs. diabetics for non-resected pancreatic head cancers (4.2 vs. 3.7 months p = 0.00008), and overall non-resected PC (3.4 vs. 3.1 months p = 0.0001).

CONCLUSIONS: There is a high proportion of new diabetics among PC patients, and diabetes may precede PC by a substantial period. While more patients with diabetes were recommended for resection, the proportion actually resected equaled non-diabetics. PC patients with diabetes without resection have diminished survival compared to their non-diabetic peers. The relationship between diabetes and PC as a symptom, predictor, and consequence is complex and warrants further study.

AMBIISPETIVE COMPARATIVE STUDY OF TWO SURGICAL STRATEGIES FOR HYDATID DISEASE OF THE LIVER

J. M. Ramia, F. Ruiz, R. De La Plaza, J. E. Quinones, P. Vuguillas and J. Garcia-Parreno
Hospital Universitario de Guadalajara, Guadalajara

Surgery is the preferred treatment for liver hidatidosis. Very few evidence clinical data exists about the technique of choice (radical vs conservative).

PURPOSE: To compare if results (feasibility, morbidity and mortality) of radical surgery are better than conservative techniques.

MATERIAL AND METHODS: A total of 88 patients with 105 cysts made were operated on. The study had two periods. Data from first period (January 2001–April 2007) (P1) were compiled retrospectively. The preferred surgical strategy was conservative surgery and T tube was placed. The second period May 2007–January 2010 (P2) was a prospective study conducted according to protocol guided by the criterion the RS should be performed whenever it was technically feasible.

RESULTS: The patients of the two periods showed no statistically significant differences in age, gender, primary symptom, cyst location, previous surgery, mortality, or recurrence. Among the P2 patients, patients had more preoperative jaundice, more preoperative ERCPs were performed, and cyst size was smaller (p < 0.05). In addition, the change in surgical strategy substantially increased the rate of radical surgery and diminished the number of T-tubes installed, morbidity, particularly biliary fistula, and the mean stay (p < 0.001). A negative finding in P2 was the death of two very older patients (5.5%) who had been treated by means of CS. The rate of radical surgery in P2 was near 75%.

CONCLUSIONS: In our opinion, radical surgery should be technique of choice when it was feasible because it diminishes morbidity, hospital stay and relapse. Conservative surgery must be employed only in selected cases.
MULTICENTRE STUDY OF LIVER METASTASIS FROM BREAST CANCER
J. M. Ramia1, R. Lopez-Andujar2, J. Torras1, L. Falgueras4, J. Gonzalez2, B. Sanchez6 and J. Figueras4
1Hospital Universitario de Guadalajara, Guadalajara; 2Hospital La Fe, Valencia; 3Clinica Universitaria de Navarra, Pamplona, Navarra; 4Department of Surgery. Hospital Santa Creu I Sant Pau, Barcelona; 5Hospital Santa Creu I Sant Pau, Barcelona; 6Hospital Vall D’Hebron, Barcelona; 7Department of Surgery. Hospital Clinico Universitario, Valencia; 8Department of Surgery. Hospital Josep Trueta, Girona

Surgical resection of liver metastasis from breast cancer (LMBC) is increasingly last years. We have done a Multicentre study to know the data of LMBC in Spain.

Material and methods: We have operated on 108 patients in 17 HPB Units. LMBC were 2.7% of total LM resection (108/3996). Mean age: 52 years (range: 30–79). Breast Cancer data: most frequent TNM was T2 (47%), N1 (51%) and M0 (84%). Most frequent stage was II (43%). Histology was ductal in 90%. Most frequent grade was G2 (65%). Estrogen receptors were positive in 72%. LMBC data: metachronic (84%), interval between BC-LMBC was 55 months (range: 0–211), interval between LMBC diagnosis and liver surgery was 9.5 months (range: 0–72). LMBC were unique in 52%. Mean size: 3 cm (range: 0.5–8).

Results: Liver procedures: minor hepatectomy (55%), major (29%) and exploratory laparotomy (16%). 9% done by laparoscopy. RF in 5 cases. No blood transfusion (89%). R0: 92%. Mortality: 0%. Morbidity: 14%. Relapse rate was 61%, 70% in the liver. Survival was 30 months but DFS 19 months, with 28 months follow-up. Survival 1, 3 y 5 years were: 87.7%, 66 y 33% and DFS: 57, 44 y 26.1%. Univariate analysis showed that synchronous LMBC, number >3 and R1 were negative prognostic factors, not confirmed in multivariate analysis.

Conclusions: Surgical results of LMBC are optimal. Interval between diagnosis and surgical resection is sometimes too long probably due to late referral to liver surgeons. A well defined guideline to treat LMBC will increase the patients resected that will imply a higher survival.

MULTICENTRE STUDY OF LIVER METASTASIS FROM COLORECTAL CANCER ON PATHOLOGIC LIVERS
J. M. Ramia1, R. Lopez-Andujar2, J. Torras1, L. Falgueras4, J. Gonzalez2, B. Sanchez6 and J. Figueras4
1Hospital Universitario de Guadalajara, Guadalajara; 2Hospital La Fe, Valencia; 3Hospital Universitario Bellvitge, Barcelona; 4Hospital Josep Trueta, Girona; 5Hospital Santa Creu I Sant Pau, Barcelona; 6Hospital Carlos Haya, Malaga

Resection of liver metastasis (LM) of colorectal cancer (CRC) in pathologic livers (cirrhosis or hepatopathy) is extremely rare. Several theories had been postulated for explaining this low rate but there is not a definitive explanation.

Material and methods: Retrospective multicentre study. 15 HPB Units were asked but only 6 had CRC-LM in PL. These Units had resected 2364 LM. Only 20 patients with 38 lesions were on PL (0.84%), 10 (cirrhosis) and 10 (chronic hepatopathy). Mean age was 65.4 years. 65% were male. Liver disfunction was known preoperatively in 18 cases (90%). Child status was always A. LM were synchronic in 6 patients (30%). Number of LM were 1.9 (range 1–4). Mean size was 3.4 cm (range 1.5–9). Preoperative CEA was: 32.3 (range: 1–184).

Results: We performed: 12 subsegmentectomies, 6 left lateral sectionectomy, 4 segmentectomies, 3 RF ablation and 4 exploratory laparotomy. Morbidity was 20% (Clavien I (1), II (2) y IVa (1)). Mortality: 0%. R0: 19 (95%). 12 patients (60%) did not receive postoperative chemotherapy. In the 16 resected cases, 10 presented relapse (62%). Six relapses were located in liver. Four patients died at the 4, 15, 22, and 37 months after surgery. Two of the deceased patients exhibited cirrhosis, another two chronic hepatopathy, while three of them had undergone resections. 5-year Actuarial survival is 39%. Disease free survival was 12.2 months and total survival 22.3 months.

Conclusions: Cirrhosis or cronic hepatopathy is not a contraindication for resection of CRC-LM and in selected cases liver resection is the best treatment.

A STANDARD DEFINITION OF MAJOR HEPATECTOMY: RESECTION OF FOUR OR MORE LIVER SEGMENTS
S. K. Reddy1, A. S. Barbas2, R. Turley2, J. L. Steel1, A. Tsung1, J. W. Marsh1, D. A. Geller1 and B. M. Clary2
1University of Pittsburgh Medical Center, Pittsburgh, PA; 2Duke University Medical Center, Durham, NC

Introduction: While commonly used to describe liver resections particularly at risk for post-operative complications, no uniform definition of “major” hepatectomy exists. The objective of this study is to specify the extent of hepatic resection that should describe a major hepatectomy.

Methods: Demographics, diagnoses, treatments, and outcomes of patients who underwent liver resection at two high-volume centers were reviewed.

Results: From 2002 to 2009, 1,670 patients underwent hepatic resection (Table). There were no differences in postoperative mortality (2.7% vs. 2.6%, p = 0.895), overall morbidity (40.6% vs. 35.9%, p = 0.194), or readmission after initial discharge (18.3% vs. 14.0%, p = 0.116) after resection of three compared to less than three liver segments. In contrast, post-operative mortality (7.4% vs. 2.6%, p < 0.0001), overall morbidity (49.3% vs. 36.9%, p = 0.0001), and readmission (20.7% vs. 14.9%, p = 0.002) were higher after resection of four or more segments compared to less than four segments. Hepatic, infectious, and septic complications were more common among patients who underwent resection of four or more segments compared to other patients (25.6% vs. 15.5%, p = 0.002) while there was no difference after resection of three and less than three segments (16.4% vs. 15.2%, p = 0.662). On multivariable analysis, resection of four or more segments was independently associated with increased post-operative mortality (p = 0.005), morbidity (p = 0.002), and hepatic, infectious, and septic complications (p = 0.0001).

Conclusions: Major hepatectomy should be defined as resection of four or more liver segments. This standard should be
considered when counseling patients about operative risks and evaluating studies that assess novel techniques and treatments to improve the safety profile of liver resection.

### DOES NEOADJUVANT CHEMOTHERAPY REVEAL DISEASE PRECLUDING SURGICAL TREATMENT OF INITIALLY RESECTABLE COLORECTAL LIVER METASTASES?

S. K. Reddy, A. Tsung, J. W. Marsh and D. A. Geller  
*University of Pittsburgh Medical Center, Pittsburgh, PA*

**Introduction:** One rationale supporting neoadjuvant chemotherapy for initially resectable colorectal cancer liver metastases (CRCLM) is to allow for growth of occult disease, thus preventing futile surgery. Yet evidence supporting this approach is lacking. This study aims to determine whether neoadjuvant chemotherapy reveals occult disease precluding surgical treatments of initially resectable CRCLM.

**Methods:** Demographics, radiologic imaging, treatments, and outcomes of patients aged 18–80 years, with one to four CRCLM were younger (median 58 vs. 65 years, *p* = 0.012), had more lesions (median 2 vs. 1, *p* = 0.017) compared to untreated patients (Table). There were no differences in frequency of hepatic resection and/or ablation between treated and untreated patients (Table). Only one patient underwent an R2 resection. No differences in margin positive liver resections (3.5% vs. 3.5%, *p* = 0.935) or disease recurrence six months after resection (21.3% vs. 15.3%, *p* = 0.082) between treated and untreated patients were observed.

**Conclusion:** Neoadjuvant chemotherapy for initially resectable CRCLM does not reveal occult disease precluding hepatic resection or affect early disease recurrence.

### NOVEL QUANTIFICATION OF THE DECAY OF TEMPORAL ACCURACY OF HIGH QUALITY AXIAL IMAGING FOR PANCREATIC CANCER

*The Johns Hopkins University, Baltimore, MD*

**Purpose:** Pancreatic adenocarcinoma is a dynamic disease that will progress through time in the majority of individuals. High quality pancreatic protocol CT (PPCT) scans are now considered the gold standard in evaluating pancreatic adenocarcinoma. To date, no study has quantified the temporal accuracy of PPCT scans in pancreatic adenocarcinoma.

**Methods:** We retrospectively reviewed the results of 2589 PPCT at a single institution over a 2-year time period and correlated radiographic to operative findings for patients who later underwent exploration for curative intent for pancreatic adenocarcinoma.

**Results:** 292 PPCT were performed in 256 patients who underwent exploration for pancreatic adenocarcinoma. 51.6% (132/256) were male, and the median age was 67 years (range 30–95 years). Median time between PPCT and surgical exploration was 17 days (range 1–395 days). 20 PPCT demonstrated metastatic disease. PPCT correctly predicted no evidence of metastatic disease in 226/272 (83.1%) scans. PPCT were more accurate at predicting the lack of metastatic disease if the study was performed within 28 days (88.1% vs. 68.1%, *P* = 0.003). The Figure depicts the depreciation of the negative predictive value of PPCT over time. The accuracy of PPCT in correctly predicting lack of vascular invasion was 82.9%, and this did not change over time (>28 days 80.4%, >28 days 97.2%, *P* = 0.71).

**Conclusions:** PPCT is accurate in the preoperative staging of pancreatic adenocarcinoma. However, the accuracy of PPCT significantly depreciates over time in regards to metastatic disease. Patients should undergo PPCT within 4 weeks of planned operative intervention for pancreatic adenocarcinoma.
CEACAM6 EXPRESSION IN GALLBLADDER CARCINOMA

Memorial Sloan-Kettering Cancer Center, New York, NY

Background: Gallbladder cancer is the most common biliary tract cancer with a dismal survival. CEACAM6 is a membrane protein involved in cell adhesion and signaling that is overexpressed in both pancreatic and biliary adenocarcinoma and associated with a poor prognosis. This study examines the significance of CEACAM6 expression in gallbladder cancer and its relationship to outcome.

Methods: Tissue microarrays containing triplicate cores of paraffin-embedded surgical specimens from patients with gallbladder cancer and control tissue were probed for CEACAM6 by immunohistochemistry. Clinical, pathologic and survival data were analyzed and correlated with CEACAM6 expression.

Results: 70 cases of gallbladder cancer from 1992 to 2007 were assembled in the tissue microarrays. They included 1 T1 (1%), 15 T2 (22%), 51 T3 (75%), 1 T4 (1%), tumors and 4 Stage 1 (6%), 44 Stage 2 (64%), 1 Stage 3 (1%), 20 Stage 4 (29%) patients. Positive CEACAM6 signal was present in 37/70 (53%) tumors and none of the control tissues. Overall median survival was 17 months. CEACAM6 staining did not correlate with age, sex, grade of differentiation, positive lymph nodes, vascular invasion or metastases but was associated with margin positive resection (p < 0.008) and higher AJCC stage (p < 0.02). Survival analysis of patients who had a curative or R0 resection demonstrated that CEACAM6 expression was not associated with disease-specific survival (19 months for positive vs 25 months for negative, p < 0.5).

Conclusions: CEACAM6 is a not prognostic factor in resected gallbladder carcinoma. However, it may serve as a marker of more aggressive disease.

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SURVIVAL IMPACT OF MALIGNANT PANCREATIC NEUROENDOCRINE AND ISLET CELL NEOPLASM PHENOTYPES

C. L. Roland, A. Bian, J. C. Mansour, A. C. Yopp, G. C. Balseh, R. Sharma, X. J. Xie and R. E. Schwarz
University of Texas Southwestern Medical Center, Dallas, TX

Introduction: Neoplasms of pancreatic neuroendocrine or islet cell origin encompass a wide variety of tumor types. The low incidence of malignant functional (F) or non-functional (NF) neuroendocrine islet cell tumors (ICTs) represents a challenge to precise post-therapeutic survival prediction.

Methods: A pancreatic ICT data set was created from a US-based multi-institutional database from 1980 to 2004. Prognostic factors with survival impact, and relationships between surgical therapy and overall survival (OS) were analyzed.

Results: 2,350 individuals were identified. Histologic designations included carcinoid tumors (n = 176), islet cell carcinomas (n = 959), neuroendocrine carcinomas (n = 1052), and malignant gastrinomas (n = 68), insulinomas (n = 47), glucagonomas (n = 30), or VIPomas (n = 18). Median tumor size was 4.8 cm. FICTs had a greater resection rate than NFICTs (43% vs. 30%, p = 0.003). Median OS was 30 months, with group differences ranging from NE carcinomas (21) to VIPomas (96; p < 0.0001). Diagnosis group and resection status had an obvious OS association: median OS of resected vs. unresected FICTs was 172 vs. 37 months, while that of NFICTs was 113 vs. 18 months (p < 0.0001, see Figure). Multivariate OS variables were: age, grade, surgical treatment (all at p < 0.0001), node involvement (p = 0.0002), histopathologic group (p = 0.004), and primary tumor site (p = 0.03). Compared to VIPomas, hazard ratios were: gastrinomas 1.4, insulinomas 1.8, glucagonomas 1.9, carcinoid tumors 1.6, islet cell carcinomas 2.1 and NE carcinomas (NOS) 2.1.

Conclusions: When controlled for other established prognostic parameters, histopathologic subtype assignment of pancreatic ICTs significantly affects survival prediction. Resective local treatment is associated with superior survival for all tumor types and remains the standard of care.

OUTCOMES OF PARTIAL LIVER TRANSPLANTATION: DECEASED DONOR SPLIT VS LIVE DONOR LIVER TRANSPLANTATION

R. F. Saidi, Y. Li, S. A. Shah and A. Bozordzadeh
University of Massachusetts Medical School, Worcester, MA

Organ shortage makes partial liver transplantation (PLT) an alternative option to whole organ transplantation. The aim of the study was to assess the outcome of PLT comparing deceased donor split (DD-SL) and live donor liver transplantation (LDLT) in adults as reported to the United Network for Organ Sharing (UNOS) in the MELD-era. Between 2002 and 2009, 2272 PLT were performed: DD-SL (n = 557, 24.5%) and LDLT (n = 1715, %75.5). DD-SL were performed with a right/extend right (82.1%), left lobe allograft
(17.9%), while LDLT used the right/extend right lobe (95.9%) and left lobe (4.1%). Demographic differences in the groups were most noticeable for lower MELD scores in LDLT (14.5 vs 20.9) recipients (P < 0.001), younger recipient age in LDLT (50.7 vs 52.8), and younger donor age in DD-SL (23 vs 37.3) (P < 0.001). Recipients status was coded as sick/very sick in 39.8% and 25% of DD-SL and LDLT, respectively (p < 0.001). Allograft survival was comparable between groups (p = 0.438), However, there was a trend for better patient survival after LDLT (p = 0.052). In Cox regression analysis, LDLT was associated with better allograft (HR = 0.7, 0.63–0.79, 95% CI, p < 0.0001) and patient survival (HR = 0.6, 0.55–0.64, 95% CI, p < 0.0001) compared to DD-SL. Despite different in donor and recipient characteristics, LDLT is associated with better allograft and patient survival compared to DD-SL. The benefit of LDLT over DD-SL suggests that the risk to the donor may justify the benefit when comparing it to the deceased donor alternative.

Table. Patients Characteristics

<table>
<thead>
<tr>
<th>Variables</th>
<th>DD-SL</th>
<th>LDLT</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>52.8 ± 10</td>
<td>50.7 ± 11</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Sex (male)</td>
<td>44.5%</td>
<td>44.5%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Donor age</td>
<td>23 ± 9.4</td>
<td>37.3 ± 10</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Donor sex (male)</td>
<td>69.2%</td>
<td>50.7%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>MELD</td>
<td>20.9 ± 9.2</td>
<td>14.5 ± 5.6</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>CIT (h)</td>
<td>8.2 ± 3.7</td>
<td>3.1 ± 5.9</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Recipient status (Sick/very sick)</td>
<td>39.8%</td>
<td>25%</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>5-year allograft survival</td>
<td>78.8%</td>
<td>79.8%</td>
<td>0.438</td>
</tr>
<tr>
<td>5-year patient survival</td>
<td>75.2%</td>
<td>78.2%</td>
<td>0.052</td>
</tr>
</tbody>
</table>

**MARKED VARIANCE BETWEEN ESTIMATED AND CALCULATED BLOOD LOSS FOR PANCREATIC RESECTION SURGERY**

N. J. Sanchez, S. Gondek, T. S. Kent, M. P. Callery and C. M. Vollmer  
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**Introduction:** Intraoperative blood loss estimated by surgeons/anesthesiologists (EBL) is a seminal outcome metric in high-acuity surgery, yet is notoriously inaccurate. However, more objective methods to gauge blood loss are available, but currently underemployed. We directly compared these approaches in order to promote calculated blood loss (CBL) as a standardized quality indicator following pancreatic resection.

**Methods:** Pancreatic resections over 8 years with complete annotation were analyzed. EBL was quantitatively compared to CBL based on available objective parameters (hematocrit, height, weight, transfusions) using a validated equation.

**Results:** 569 resections included 369 Proximal, 170 Distal, 6 Central, 9 Total, and 5 Other pancreatectomies. Generally, the median CBL is double the median EBL (Table). EBL underestimated CBL in 70% of the cases, while it overestimated only 30%. There were great discrepancies for the extreme ranges of blood loss: For cases < 100 ml EBL = 5.6% and CBL = 13.7%, while for cases > 1000 ml EBL = 5.6% but CBL = 22.6%. For patients transfused intraoperatively (12.3% overall), CBL correlated much closer to EBL (Median: 689 vs 600 ml), and CBL > EBL in 49% of the cases (vs 74% non-transfused), suggesting better clinical estimates in these difficult cases. Circulatory adjustments from blood loss temporally continue up to a day after the operation as median CBL (24 hr) > CBL (Operation) by another 200 ml.

**Conclusion:** There is marked variation between estimated and calculated blood loss which also fluctuates by the scope of operation. The effects of blood loss linger beyond the operation itself. These data argue for the more uniform adoption of CBL as a quality indicator for pancreatic resection surgery.
SAFETY OF HEPATIC RESECTIONS IN OBESE VETERANS
J. K. Saunders1,2, A. S. Rosman3, D. Neihaus2, T. H. Gouge1,2 and M. Melis 1,2
1New York University School of Medicine, New York, NY; 2NYHHS VAMC, New York, NY; 3Mount Sinai School of Medicine and Bronx VAMC, Bronx, NY

Introduction: We aimed to determine the effects of body mass index (BMI) on outcomes after liver resection performed at the Veteran Administration.

Methods: We queried the VASQIP database for liver resections (2005–2008), and grouped the patients into five categories: normal weight (NW, BMI 18.5–24.9), overweight (OW, BMI 25–29.9) Class 1 (OB1, BMI 30–34.9), Class 2 (OB2, BMI 35–39.9), and Class 3 obesity (OB3, BMI ≥ 40). Differences in risk factors and perioperative complications across groups were analyzed.

Results: Of 403 patients who underwent hepatectomy, 106 (26.3%) were NW, 161 (40.0%) OW, 94 (23.3%) OB1, 31 (7.7%) OB2, and 11 (2.7%) OB3. The BMI groups were similar in patient gender, age, diagnosis (90.3% malignancy), ASA class, rates of alcohol abuse, ascites, esophageal varices, and neoadjuvant treatment. Higher BMI was associated with increased rates of diabetes (18% vs. 27% vs. 36% vs. 39% vs. 45%, p 0.04) and lower incidence of smokers (53% vs. 35% vs. 30% vs. 16% vs. 9%, p 0.0001). There were no differences in type of resection performed, operative time, work RVU. OB3 received more blood transfusions (OB3 4.3 ± 2.7 vs. NW 1.1 ± 0.2, p 0.02). There were no differences across BMI groups in overall and specific morbidity, as well in length of stay. Nevertheless, compared to the other groups OB3 had a higher 30-day mortality (27% vs. 6%, 0.05). Multivariate analyses confirmed BMI > 40 as an independent predictor of post-operative mortality.

Conclusion: Obesity did not increase post-operative complications in veterans after liver resection. Mortality was higher in patients with BMI > 40.

COMPLETE RESOLUTION OF A MALIGNANT BILIARY STRICTURE USING COMBINED NEOADJUVANT CHEMORADIATION AND BRACHYTHERAPY BOOST PRIOR TO ORTHOTOPIC LIVER TRANSPLANTATION
J. Schwartz, L. J. Hazard, J. Carlisle, A. Burdette, K. Jones, H. Thiesset, W. Hutson and J. Sorensen University of Utah, Salt Lake City, Utah

This report demonstrates the complete resolution of a malignant biliary stricture using chemo-radiation (rx) followed by brachytherapy (BT) boost prior to orthotopic liver transplantation (OLT). The focus of this report is a 41 y.o. male with a 13 year history of primary sclerosing cholangitis. Cytological brushing of a known area of stricture (Figure 1) near the biliary confluence was consistent with adenocarci-
noma. Other clinical signs of primary liver disease were absent and he was selected to undergo percutaneous biliary access for intraluminal BT, external beam rx, neoadjuvant chemotherapy, staging laparotomy, and subsequent OLT. The patient was then transplanted using standard piggy back technique with Roux-en-Y biliary reconstruction at a calculated Model for End-Stage Liver Disease score of 17. Repeat cholangiography prior to OLT demonstrated complete resolution of the patient’s malignant stricture (Figure 1). An exhaustive search undertaken in the explanted liver demonstrated marked epithelial atypia, without definitive evidence of neoplasia. This report validates the use of chemorx and BT boost for early stage biliary neoplasia independent of, or as a component of, a well-defined neoadjuvant protocol culminating in OLT or standard surgical resection. While it would be speculative to suggest that such methods could potentially facilitate an R0 resection in a previously unresectable patient, further study is clearly indicated. New techniques may facilitate radiation dose escalation without adding significantly to normal tissue toxicity. Additional refinement may allow for more effective delivery of neoadjuvant therapy, stimulate the development of palliative treatments, and relegate therapeutic nihilism to obsolescence.

**Diagnostic Utility of the Modern Silverhawk Atherectomy Catheter: A Pilot Study**


*University of Utah, Salt Lake City, UT*

**Objectives:** As neoadjuvant protocols to facilitate orthotopic liver transplantation (OLT) in Stage I and II hilar cholangiocarcinoma (CCA) have resulted in significant gains in long-term survival, the purpose of this study was to determine the initial diagnostic utility of the modern Silverhawk atherectomy (SA) catheter in the evaluation of malignant-appearing biliary strictures (MABS).

**Methods:** A total of 40 patients with cholangiocarcinoma were identified during a retrospective review of medical records from 2006 to 2009. All were suspected of harboring MABS. The SA catheter was employed 9 times in 7 patients with MABS whose diagnoses were equivocal based on clinical parameters (Table 1).

**Results:** A definitive exclusion of neoplasia was made in 5 biopsy (bx) specimens. These three individuals were followed for 1–4 years to exclude the subsequent development of CCA. Four patients had samples positive for CCA; one of which became eligible for neoadjuvant therapy and OLT. All but one bx supplied sufficient tissue for reliable examination

**Conclusion:** Endoluminal bile duct bx by SA catheter appears to be effective in excluding or diagnosing CCA in patients with MABS. The existence of this technique to provide definitive diagnoses based on tissue architecture may impact therapy by allowing earlier diagnosis as well as the more efficient use of limited donor resources where protocols for OLT are available. Although initial results are promising, more experience with this approach is required to effectively determine clinical accuracy.
PULMONARY AND VENOUS THROMBOEMBOLISM RATES AMONGST LIVER RESECTION PATIENTS: AN EXAMINATION OF NSQUIP DATA

J. Schwartz, G. M. Vargas, H. Thiesset, G. Stoddard, L. Neumayer and J. Sorensen
University of Utah, Salt Lake City, Utah

Objective: The aim of this study was to examine the national rate of fatal and near-fatal thromboembolic events in patients undergoing major liver surgery.

Methods: The National Surgical Quality Improvement Program (NSQUIP) database was queried to collect data on the incidence of Pulmonary Embolism (PE) and Deep Vein Thrombosis (DVT) in the population subset of liver resection patients performed nationally during the years 2004–2009. A matched sample McNemar test was used to examine differences in annualized incidence rates.

Results: During the five year study period, 6,084 liver resections were performed amongst 268 NSQUIP institutions nationally. During this time, DVT and PE occurred at a rate of 1.97 and 1.36%, respectively, with DVT occurring 1.45 times more frequently than PE (RR = 1.45, 95% CI (1.09–1.91), p = 0.009). Incidence rates remained constant over the study period (Figure 1).

Conclusion: Recent data suggests that the rate of pulmonary (PE) and deep venous thrombosis (DVT) in patients with recently diagnosed neoplasms is 7 times higher than the general population. As primary and metastatic hepatic malignancies become increasingly more prevalent, surgical extirpation is being employed more frequently than in the past. However, thromboembolic prophylaxis (TEP) remains controversial in this population due to the perceived risk of coagulopathy in the setting of liver dysfunction. Examination of a national cohort indicates that the rate of VTE remains low after major liver resection. This finding may influence the decision to initiate TEP in a patient undergoing major liver surgery.

Table. Patient Disposition over time

<table>
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<th>Year</th>
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<th>Other Facility</th>
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</tr>
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<tr>
<td>1993</td>
<td>74.5%</td>
<td>5.5%</td>
<td>20.0%</td>
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<td>1994</td>
<td>69.8%</td>
<td>8.1%</td>
<td>22.0%</td>
</tr>
<tr>
<td>1995</td>
<td>63.6%</td>
<td>10.9%</td>
<td>25.5%</td>
</tr>
<tr>
<td>1996</td>
<td>61.7%</td>
<td>12.9%</td>
<td>25.5%</td>
</tr>
<tr>
<td>1997</td>
<td>63.9%</td>
<td>11.0%</td>
<td>25.1%</td>
</tr>
<tr>
<td>1998</td>
<td>61.3%</td>
<td>14.0%</td>
<td>24.7%</td>
</tr>
<tr>
<td>1999</td>
<td>63.1%</td>
<td>14.3%</td>
<td>22.6%</td>
</tr>
<tr>
<td>2000</td>
<td>58.5%</td>
<td>13.3%</td>
<td>28.2%</td>
</tr>
<tr>
<td>2001</td>
<td>57.6%</td>
<td>15.4%</td>
<td>27.0%</td>
</tr>
<tr>
<td>2002</td>
<td>62.1%</td>
<td>13.0%</td>
<td>24.0%</td>
</tr>
<tr>
<td>2003</td>
<td>58.0%</td>
<td>13.6%</td>
<td>28.4%</td>
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<tr>
<td>2004</td>
<td>54.4%</td>
<td>11.1%</td>
<td>34.5%</td>
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<tr>
<td>2005</td>
<td>53.7%</td>
<td>13.3%</td>
<td>33.0%</td>
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</table>
Conclusion: The results of our study demonstrate that following pancreatic resection, nearly half of the patients will need some assistance upon discharge. This information needs to be included in the patient counseling during pre-operative risk and benefit assessment.

REDUCTION IN TUMOR RECURRENCE FOLLOWING TREATMENT WITH AN NFKAPPA INHIBITOR IN A MOUSE RESECTION MODEL OF PANCREATIC DUCTAL ADENOCARCINOMA

J. E. Shea1, S. K. Kuwada2 and C. L. Scaife1
1Department of Surgery; University of Utah, Salt Lake City, UT; 2Department of Gastroenterology, University of Hawaii, Honolulu, HI

Background: Long-term survival after resection of pancreatic ductal adenocarcinoma (PDA) is less than 20%. Patients frequently succumb due to tumor recurrence. NFkappaB is not only expressed to a greater degree at the time of cancer cell adhesion, but inhibition of this pathway prevents cell adhesion. The present study was designed to determine if an NFkappaB inhibitor could prevent the development of local or distant recurrence following resection of a primary orthotopic pancreatic tumor in a mouse model.

Materials and methods: Twenty-five athymic mice were injected with MiaPaCa-2 cells into the tail of the pancreas. Four weeks after injection, mice with confirmed tumors (23/25) underwent resection of the primary tumor. Mice were treated with either an NFkappaB inhibitor (Bay 11-7085 (5 mg/kg)) or DMSO control 3 times a week. After 8 weeks, mice were assessed for tumor recurrence. Statistical differences were determined using chi-squared analysis.

Results: The recurrence rate in mice treated with the NFkappaB inhibitor was 23% (3/13) compared with 50% (5/10) in mice given carrier (p < 0.05). Two of the treated mice developed local recurrence while one developed distant. In control mice, two developed local recurrences, one developed a distant recurrence, while two developed both local and distant recurrence.

Discussion: The NFkappaB inhibitor Bay 11-7085 reduced the number of mice that developed recurrence following resection of the primary PDA tumor. Any treatment that can potentially inhibit tumor recurrence, both local and distant, would be beneficial for patient care.

BEVACIZUMAB DECREASES PORTAL VEIN EMBOLIZATION INDUCED TUMOUR GROWTH

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1McGill University Health Center, Department of Surgery, Section of Transplant and HPB Surgery, Montreal, Quebec; 2King Saud University, College of Medicine, Department of Surgery, Riyadh, Riyadh; 3McGill University Health Center, Department of Radiology, Montreal, Quebec

Introduction: Portal vein embolization (PVE) can convert selected patients with colorectal cancer liver metastases from an unresectable to a resectable state. We previously reported that PVE stimulates hypertrophy in the future liver remnant with or without the use of bevacizumab (BEV). The effect of PVE on tumour growth has been of concern. In murine models, PVE has increased total tumour volumes (TTV). The objective of this study is to assess the impact of preoperative PVE on tumour volumes with and without BEV.

Methodology: CT scans prior to and 4 weeks after PVE were evaluated in patients who undergoing neoadjuvant chemotherapy between 2002 and 2009. TTV was measured (cm³) using dedicated volume measurement software on a 3D work-station by two radiologists blinded to the type of chemotherapy. BEV was discontinued at least 4 weeks prior to PVE. The effect of PVE on tumour growth has been of concern. In murine models, PVE has increased total tumour volumes (TTV). The objective of this study is to assess the impact of preoperative PVE on tumour volumes with and without BEV.

Results: Although BEV decreased PVE TTV for the entire group were 58.5 cm³ and 81.0 cm³ respectively, p = 0.001. Tumor growth was higher in the BEV group (ΔTTV 38.7 cm³) vs. the non-BEV group (ΔTTV 14 cm³, p = 0.04).

GALLBLADDER PATCH REPAIR FOR LARGE-SIZED DUODENAL ULCER PERFORATIONS

A. Shimizu, H. Tanaka, T. Zuiki, Y. Sakuma, Y. Hosoya, N. Sata and Y. Yasuda
Department of Surgery, Jichi Medical University, Shimotsuke, Tochigi

Background: Omental patch is usually employed to repair a perforated duodenal ulcer. With a large defect of the duodenal wall, however, even if it is technically feasible, there remains a concern about postoperative stricture. Furthermore, the omentum is not readily available in some cases because of previous surgery or severe adhesions. Jejunal patch or Roux-en Y duodenojejunostomy is often used for those cases. Still such complicated procedures are not preferable because these patients are often elderly and seriously ill by the time of surgery. Gallbladder serosal patch has been applied for these cases with excellent outcome.

Method: The gallbladder was incised along the longitudinal axis up to the cystic duct, forming the pedicled serosal patch. The cystic artery was identified and secured maintaining the blood supply to the patch. The cystic duct was ligated. After trimming of the friable margins around the duodenal wall defect, the outer peritoneal layer of the gallbladder was applied over the duodenal defect and sutured circumferentially by using 4-0 PDS sutures. The macroscopic and microscopic healing features were examined.

Results: An 82- and a 53-year-old male with giant duodenal ulcer perforations were managed with this technique. The duodenal defects ranged from 3.5 to 5 cm in size. No post-operative perforation site leak, no significant narrowing of the lumen was noted. Endoscopy also confirmed that the patched duodenal defect was covered with neo-mucosa in weeks. Histological examination of the biopsy material revealed regenerated columnar epithelium.

Conclusion: Gallbladder patch repair is a safe and useful procedure for large-sized duodenal defects.
Conclusion: TTV increases after PVE. The increase in TTV appears to be less pronounced in patients receiving BEV as part of their chemotherapy regime.

THE AJCC STAGING SYSTEM FOR HEPATOCellular CARCINOMA PREDICTS SURVIVAL IN MEDICALLY TREATED WESTERN PATIENTS

V. Siripurapu, M. T. Nguyen, C. S. Denlinger, J. P. Hoffman and Y. S. Chun
Fox Chase Cancer Center, Philadelphia, PA

Introduction: The American Joint Committee on Cancer (AJCC) staging system for hepatocellular carcinoma is based on pathologic features of surgically resected specimens. The aim of this study was to evaluate the prognostic significance of the AJCC staging system in a medically treated Western patient population.

Methods: Medical records of 299 consecutive patients evaluated at a single institution for hepatocellular carcinoma between 1994 and 2009 were reviewed. Log-rank and Cox analysis of overall survival versus clinicopathologic factors was performed; P < 0.05 was considered statistically significant.

Results: Surgical resection or orthotopic liver transplantation was performed in 44 of the 299 patients (15%), while 255 patients (85%) received medical treatment, including ablation, chemoembolization, and/or sorafenib. Median overall survival of the cohort was 13.5 months, with 5-year survival rates of 25% and 14%, respectively. Univariate analysis, the following factors were significantly associated with overall survival: race, gender, Child-Pugh class, multiple tumors, major vascular invasion, tumor grade, serum alpha-fetoprotein, Model for End-Stage Liver Disease (MELD) score, and AJCC stage (Figure). On multivariate analysis, AJCC stage was an independent predictor of overall survival (P = 0.002). Among the 255 medically treated patients, AJCC stage remained an independent predictor of survival (P = 0.006).

Conclusion: The AJCC staging system for hepatocellular carcinoma accurately stratifies prognosis in a medically treated Western patient population.

MINIMALLY INVASIVE RETROPERITONEAL NECROSECTOMY IN SEVERE ACUTE PANCREATITIS: SINGLE CENTER EXPERIENCE

V. Sitaram1, P. Joseph1, F. L. Vyas1, R. S. Raju1, J. C. Singh2 and K. N. Chacko2
1Christian Medical College, Vellore, Tamilnadu; 2Christian Medical College, Vellore, Tamilnadu

Introduction: Severe acute pancreatitis (SAP) can be lethal. We reviewed our experience to see influence of minimally invasive techniques.

Methods: Data from hospital records of patients with SAP during the period March 2007 to May 2010 was entered into a standard proforma and analyzed.

Results: Nineteen patients had infected pancreatic and/or peripancreatic necrosis (IPPN). Four patients underwent open necrosectomy (2 died). One patient underwent sinus tract necrosectomy through postoperative wound drain track. Fourteen patients were treated by ‘step-up’ approach (anatomy of necrosis permitted placement of radiologically guided drain). Of these, 1 patient improved with only radiologically guided pigtail catheter drainage; remaining 13 required minimally invasive retroperitoneal necrosectomy (MRPN). Mean age: 38.6 years; 86.6% males. Etiology: alcohol abuse (56%), biliary (25%). Forty-four percent had undergone abdominal procedures earlier. Eleven/15 patients had necrosis involving >50% of pancreas on CT. All had trial with antibiotics following drain insertion. All had culture positive necrosis at first procedure (fungal elements 3, polymicrobial 9). E. coli was the commonest organism. Post procedure ICU stay range: 0–26 days (median 3). Complications included bile leak (1), bleeding (1). Both resolved without intervention. Median (range) hospital stay was 44 days (25–101). Two patients in MRPN group died. Late complications included incisional hernia (1) and groin abscess (1).

Conclusions: MRPN is safe and effective in treating IPPN. Previous operation is not a contraindication. Anatomy of necrosis should provide access for placement of radiologically guided drain. Drain tract is used as approach for MRPN.

THERAPY OF LIVER METASTASES OF CARCINOID – OUR EXPERIENCES

T. Skalicky
Charles University Prague, University Hospital Pilsen, Department of Surgery, Pilsen, West Bohemia

Introduction: Authors are presenting group of 15 patients with liver metastases of the carcinoid. Patients were cured between 2000 and 2009 in Dpt. of Surgery, University Hospital in Pilsen.

Methods: Diagnosis of liver metastases was in our group of patients made by liver ultrasound, dynamic computer tomography and in some cases by magnetic resonance. In case of unknown primary tumor localization or absence of liver...
metastases we have used Octreoscan. Therapy was radical resection or palliative surgery in non-resectable tumors with carcinoid syndrome to perform cytoreduction. Also open, laparoscopic or transcutaneous radiofrequency ablation (RFA) was performed as well as chemoembolisation.

**Results:** Our group contained 15 patients, we have performed 25 radical and palliative operations, radical liver resection was made in 7 cases, the rest of interventions were repeated surgery in 8 patients (16 × RFA, 1 × chemoembolisation of large secondary tumor with severe carcinoid syndrom. The primary tumors were in pancreas (3×), bile duct (1×) and in ileocecal region (11×). We did not find extra abdominal localization of tumor. From our group 1 patient died 2 years after RFA due to generalization, 14 patients are alive. Mean time of follow-up is 8 years. All patients after radical resection are without recurrence of disease, the others are without presence of carcinoid syndrom. Palliative surgery was made after consultation with oncologist in cases of conservative treatment failure. Complications were in 33%, right side fluidothorax after radical resection, severe postembolisation syndrom after chemoembolisation. There was no death in postoperative period.

**RECOMMENDATIONS AND PERFORMANCE OF RESECTION FOR LOCALIZED HEPATOCELLULAR CARCINOMA IN THE MEDICARE POPULATION**

J. K. Smith, Y. Li, S. Ng, E. R. Witkowski, J. F. Tseng and S. A. Shah

*Surgical Outcomes Analysis & Research, University of Massachusetts Medical School, Worcester, MA*

**Background:** Along with liver transplantation, surgical resection remains an effective treatment strategy for early stage hepatocellular carcinoma (HCC) in the US. We sought to examine the factors associated with recommendation and receipt of resection among patients with resectable HCC.

**Methods:** Medicare-eligible patients ≥65 years of age at time of diagnosis of HCC who had localized, presumably resectable, disease were identified from the Surveillance, Epidemiology, and End Results (SEER)-Medicare linked database, 1991–2005. Univariate, multivariate, and survival analyses were performed to examine the outcomes of recommendation for resection, receipt of resection, and median survival.

**Results:** Among 2445 patients with localized HCC, 698 (34.1%) were recommended for surgery, and 90.8% of those recommended underwent resection. Resection primarily took place at urban teaching hospitals. After adjusting for patient and hospital characteristics, factors significantly associated with being recommended for surgery included: younger age, higher socioeconomic status (defined by US Census 2000 data on income, poverty level, and education), and lower comorbidity index (Figure). Patients with resectable HCC who underwent surgical resection had a higher median survival compared to those who did not undergo any therapy (36.9 vs. 3.6 months; p < 0.0001).

**Conclusions:** Patients with localized HCC undergoing resection exhibit a survival advantage over their nonresected peers. Despite this, only 34.1% of these patients with localized HCC are being recommended for surgery, with demonstrated socioeconomic and racial disparities. Further studies regarding the barriers to access and referral for surgery in this increasingly common malignancy are warranted.

**Figure.** Odds ratio estimates for probability of recommendation for surgical resection among all patients with resectable HCC
HEPATIC ADENOMATOSIS: OUTCOMES AND HISTOLOGIC HETEROGENEITY

R. L. Smoot\textsuperscript{1}, M. J. Truty\textsuperscript{1}, T. Schnelldorfer\textsuperscript{1}, T. C. Smyrk\textsuperscript{2}, G. J. Gores\textsuperscript{3} and D. M. Nagorney\textsuperscript{1}

\textsuperscript{1}Mayo Clinic Division of GI and General Surgery, Rochester, MN; \textsuperscript{2}Mayo Clinic Department of Pathology and Laboratory Medicine, Rochester, MN; \textsuperscript{3}Mayo Clinic Division of Gastroenterology and Hepatology, Rochester, MN

Hepatic adenomatosis, defined as 4 or more adenomas, is a rare condition. The optimal management of these patients has yet to be defined. Previous work in single adenomas has demonstrated distinct molecular subtypes with adenomas demonstrating constitutively active $\beta$-catenin having a higher risk of malignant progression. Patients were retrospectively identified from surgical and medical indexes for the years 1990–2008. Charts were reviewed for demographic, clinical, and procedural data. Available tissue blocks were examined for histologic classification and stained for $\beta$-catenin localization. Adenomas were classified histologically as steatotic, inflammatory (telangiectatic), or unclassified. Forty-six patients (87% female, median age 37 years), were identified. Presenting symptoms were abdominal pain (24 patients, 52%), bleeding (13 patients, 28%), abdominal fullness (4 patients, 9%), and early satiety (1 patient, 2%). Thirty-three patients (72%) underwent operative treatment. One patient (2%) had hepatocellular carcinoma (HCC). A total of 92 adenomas from 30 patients (median 3 per patient) were available for pathologic review. All adenomas demonstrated normal cytoplasmic staining for $\beta$-catenin. Nineteen patients (63%) had a single histologic subtype, while 11 patients (37%) had two subtypes. Twenty-six patients (87%) had an unclassified adenoma, 8 (27%) had an inflammatory adenoma, and 6 patients (20%) had a steatotic adenoma. Median follow-up was 25.9 months with no progression to carcinoma noted and no recurrence in the patient with HCC. In patients with hepatic adenomatosis there is heterogeneity in histologic subtype from adenoma to adenoma within an individual patient. This heterogeneity hinders classification of patients with multiple adenomas.

LAPAROSCOPIC PANCREAS SPARING PARTIAL DUODENAL RESECTION

Mayo Clinic, Florida, Jacksonville, FL

Introduction: Partial excision of the duodenum to treat a variety of duodenal pathology have been described in literature. These partial duodenal resections often spare patients the morbidity of a whipple operation when performed for appropriate indications. Advantages of an organ sparing operation include restoration of a near normal gastrointestinal tract with improved absorptive capacity, weight gain, and quality of life. More recently, a minimal access approach has been applied to this operation, sparing the patient the morbidity of an open operation. Although technically challenging, this procedure has been successfully performed and

<table>
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<tr>
<th>Pt</th>
<th>Age</th>
<th>Sex</th>
<th>Preoperative</th>
<th>Pancreas-preserving Duodenal resection</th>
<th>Reconstruction</th>
<th>Pathology</th>
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<td>70</td>
<td>F</td>
<td>Duodenal adenoma</td>
<td>Proximal duodenal resection/distal gastrectomy</td>
<td>Stapled loop Billroth II gastrojejunostomy</td>
<td>5 cm tubular adenoma</td>
</tr>
<tr>
<td>2</td>
<td>56</td>
<td>M</td>
<td>FAP with duodenal adenomas</td>
<td>Total duodenectomy and distal gastrectomy</td>
<td>Pancraticojejunostomy; choledochojejunostomy; stapled loop Billroth II gastrojejunostomy</td>
<td>Multiple tubular adenomas; no dysplasia</td>
</tr>
<tr>
<td>3</td>
<td>77</td>
<td>F</td>
<td>Duodenal adenoma with high grade dysplasia</td>
<td>Pylorus preserving resection of the 1\textsuperscript{st} and 2\textsuperscript{nd} portion of the duodenum</td>
<td>Handsewn loop duodenojejunostomy</td>
<td>3.5 cm tubulovillous adenoma with non-invasive intra-mucosal carcinoma</td>
</tr>
<tr>
<td>4</td>
<td>19</td>
<td>F</td>
<td>Large retroperitoneal mass behind pancreas and duodenum</td>
<td>Hand assisted resection of the 3\textsuperscript{rd} and 4\textsuperscript{th} portion of the duodenum and uncinate process</td>
<td>Stapled side to side duodenojejunostomy</td>
<td>8.5 cm non-invasive lymphangiolipoma</td>
</tr>
<tr>
<td>5</td>
<td>78</td>
<td>M</td>
<td>Duodenal carcinoid</td>
<td>Pylorus preserving resection of the 1\textsuperscript{st} and 2\textsuperscript{nd} portion of the duodenum</td>
<td>Handsewn loop duodenojejunostomy</td>
<td>2 cm carcinoid tumor</td>
</tr>
</tbody>
</table>
we aim to describe our experience over the past 18 months with this procedure.

**Methods and procedures:** This is an IRB-approved retrospective cohort study from a single tertiary-care referral center. Between May 2009 and September 2010, five patients underwent laparoscopic pancreas sparing partial duodenal resection. All 5 patients underwent an entirely laparoscopic procedure.

**Results:** Patient age, sex, preoperative diagnosis, portion of duodenum resected, reconstruction method, and final pathology is given in the Table below. The illustration below depicts the separation of the duodenum from the pancreas for patient 2. The only remaining attachment is the duct.

**Conclusions:** Laparoscopic separation of the duodenum from the pancreas appears to be feasible and may spare patients from undergoing a pancreaticoduodenectomy. The magnified view afforded by laparoscopy may offer a technical advantage in this step of the procedure. Partial duodenal resection is an option in selected patients with duodenal pathology and significant comorbidities who would not otherwise be a candidate for major pancreaticoduodenal resection.

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**OUTCOMES AFTER TIPS: A BRIDGE TO NOWHERE**


University of South Florida and Tampa General Hospital Digestive Disorders Center, Tampa, FL

**Background:** While first being promoted as a “bridge to transplantation”, TIPS has become the modality of choice for portal decompression for patients with refractory variceal bleeding or ascites due to cirrhosis and portal hypertension. This study was undertaken to determine outcomes after TIPS and the utility of TIPS as an effective “bridge” to transplantation.

**Methods:** All patients who underwent TIPS from 2001 to 2010 at a university affiliated hospital were studied. Median data are presented.

**Results:** TIPS was undertaken in 256 patients with a median MELD score of 12; 91% of patients had cirrhosis due to alcohol and/or hepatitis. TIPS decreased portal vein – IVC gradients from 17 mmHg to 5 mmHg, p < 0.001. 62 (24%) patients underwent reinterventions for stenosis/occlusion. 153 (60%) patients have died; survival after TIPS was 7.5 months (Figure). MELD score, Child-Pugh Score, Child Class, etiology of cirrhosis, and urgency for TIPS did not predict subsequent transplantation after TIPS. 35 (14%) patients underwent liver transplantation; 10 (27%) have died. Calculated survival after transplantation was 28 months (Figure).

**Conclusion:** TIPS effectively decompresses portal hypertension. As a definitive therapy for complicated portal hypertension, TIPS leads to frequent reinterventions and short survival. After TIPS, subsequent transplantation cannot be predicted and is uncommonly undertaken. TIPS is a “bridge” to transplantation that is seldom “crossed” and transplantation after TIPS is plagued by relatively poor survival when undertaken. Outcomes after TIPS and the infrequency of transplantation following TIPS make TIPS very difficult to recommend on merit.

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**PANCREATICODUODENECTOMY IN THE ELDERLY PATIENTS: AN EVALUATION OF THE MODIFIED POSSUM SCORING SYSTEM**

T. Tanaka

Shimane University, Izumo City, Shimane

**Objective:** In recent years, pancreatic resection has come to be indicated mainly in the elderly. The safety of pancreaticoduodenectomy (PD) was investigated retrospectively in elderly patients.

**Methods:** From 1996 to 2007, 316 patients underwent PD. The subjects were divided into two groups by the aged 75 and above (aged group, n = 62) and the aged 74 and below (control, n = 254). For risk assessment using the POSSUM system, data on 12 parameters related to physiological score (PS) and 6 parameters related to operative severity score were derived from the database. Two modified versions of POSSUM, such as elderly POSSUM (E-POSSUM) and at Hiroshima (H-POSSUM), were estimated. The frequency of observed and expected complications (O/E ratio) was compared in both groups.

**Results:** Postoperative complications were seen 33/62 (53.2%) in the aged group, 94/254 (37.0%) in the control. The rate of hospital death occurred 10/62 (4.8%) in the aged, 7/254 (2.8%) in the control. The PS of the aged group (18.9 + 3.4) was significantly higher than the control (16.0 + 3.2). The morbidity and mortality rate among patients with PS scores of 21 were significantly higher as compared with those with PS scores of 720. The O/E ratio of postoperative complication was 0.87 in the aged group, and 0.72 in the control by original POSSUM, 1.14 and 0.94 by E-POSSUM, 1.14 and 0.95 by H-POSSUM.

**Conclusion:** The modified POSSUM scoring systems are useful as a means of risk assessment in elderly patients undergoing PD.
PREOPERATIVE TUMOUR MARKERS AS PROGNOSTIC FACTORS OF COLORECTAL LIVER METASTASES

V. Treska¹, J. Vrazilova², I. Treska³ and O. Topolcan²
¹University Hospital, Pilsen; ²University Hospital, Pilsen

Background: Tumour recurrence develops in 45–80% of patients at various time intervals after liver resection or radiofrequency ablation (RFA) for colorectal liver metastases. The aim of study was to assess the prognostic significance of preoperative tumour marker serum levels for disease free interval (DFI) and overall patient survival (OS) after liver surgery.

Methodology: In prospective non-randomized study preoperative serum levels of carcinoembryonic antigen -CEA, CA 19-9, CA 72-4, thymidine kinase (TK), tissue polypeptide antigen (TPA) and tissue polypeptide specific antigen (TPS) were evaluated by multiplex analysis in 235 patients operated on for colorectal liver metastases (CLM). Liver resection was performed on 164 patients and radiofrequency ablation on 71 patients.

Results: Preoperative serum levels of TPA (cut off level = 53 IU/L, HR = 4.5, p < 0.01) and TPS (cut off level = 81 IU/L, HR = 5.1, p < 0.007) were important for OS and DFI after liver resection. Preoperative serum levels of TPA were also important for OS (p < 0.003) and DFI (p < 0.001) after RFA. Preoperative serum levels of TPS correlated with OS (p < 0.005) and DFI (p < 0.0001) after RFA.

Conclusions: TPA and TPS are important predictive markers for OS and DFI after liver resections and radiofrequency ablations for colorectal liver metastases. The study was supported by grant IGA MZ NS 9727-4 and NS 19240-3/09.

SURGICAL TREATMENT OF NON-COLORECTAL LIVER METASTASES

V. Treska, T. Skalicky and A. Sutnar
University Hospital, Department of Surgery, Pilsen, NO

Background/aim: Non-colorectal liver metastases (NCLM) represent small group of liver metastases with different biological behavior. That is why the surgical treatment of NCLM is still matter of discussion. The aim of the study was to evaluate the university center experience with surgical treatment of NCLM.

Methods: Seventy nine patients were evaluated in the prospective study (2000–9/2010). The average length of time after the primary surgery was 3.8 years (0–8.5 years). Radiofrequency ablation (RFA) was performed in 53 patients (67.1%), liver resection in 26 (32.9%). Preoperative chemotherapeutical downstaging or portal vein embolization was performed in 12 patients (15.2%).

Results: One, three and five years patient’s survival after the liver resection or RFA was 88.6, 72.5 and 36.9%. The best survival rate was in patients with radically treated carcinoid (5 years – 100%), breast cancer (5 years – 33.8%), renal carcinoma (3 years – 44.4%) and gynecological tumors metastases (2 years – 72.9%). There was no difference between liver surgery and RFA in the long-term results. Patients with extrahepatic metastases (most often nodules of hepatoduodenal ligament, lung metastases) had worse prognosis (p < 0.01) in spite of their surgical or RFA removal. Non ablation was borderly statistically significant (p < 0.08) from the point of long term patient’s survival.

Conclusions: The long-term results of patients after liver resection or RFA of NCLM are promising. Liver resection or RFA have a comparable results and takes the firm place in multi-modal treatment strategy. This work was supported by the grants NS 9727-4/2008, NS 10240-3/2009 and NS 9723-4.

HEPATIC RESECTION FOR METASTATIC GASTROINTESTINAL STROMAL TUMORS IN THE TYROSINE KINASE INHIBITOR ERA

R. S. Turley¹, A. S. Barbas¹, S. K. Reddy² and B. M. Clary¹
¹Duke University Department of Surgery, Durham, NC; ²University of Pittsburgh Department of Surgery, Pittsburgh, PA

Up to 40% of patients who undergo primary resection of their gastrointestinal stromal tumors (GISTs) will recur within 18–24 months. Before the advent of tyrosine kinase inhibitors (TKIs), surgical resection was the primary treatment for hepatic GIST metastases with 5-year survival rates reported as 27–34%. Whether the availability of tyrosine kinase inhibitors has prolonged survival after extirpation of hepatic GIST metastases remains unclear. Here, we assess long-term survival and outcomes for patients undergoing hepatic resection for metastatic GIST tumors in the era of TKIs.

Methods: Demographics, treatments, and outcomes of patients who underwent hepatic resection at a high-volume center were reviewed from 1998 to 2010. Recurrence and survival were measured from the date of metastectomy. Actuarial survival curves were generated using the Kaplan-Meier method.

Results: Twenty-two patients underwent hepatic resection for metastatic GISTs, with 12 patients receiving adjuvant therapy with TKIs. With a mean follow-up of 38 months, 13 (59%) of patients suffered recurrence (intrahepatic only, n = 6; extrahepatic only, n = 4; both = 3) with a median time of 8.6 months. The 1-, 3-, and 5-year overall survival rates were 95.0, 62.7, and 54.9% respectively. Four patients (18.1%) suffered complications classified as 3 or greater on the Clavien scale. There was one operative mortality (4.95%).

Table:

| Age (Med, IQR) | 62.5 (54.6–67.8) |
| Primary Size (cm) (Med, IQR) | 9 (5.5–18) |
| Primary GIST Site, n(%) | | |
| Stomach | 11 (50) |
| Small Intestine | 9 (41) |
| Rectum | 1 (5) |
| Unknown | 1 (5) |
| Neoadjuvant TKI, n(%) | 8 (38) |
| Adjuvant TKI, n(%) | 12 (55) |
| Major Hepatectomy, n(%) | 9 (41) |
| Other Major Procedure, n(%) | 6 (27) |
| Hepatic Lesion Size (cm) (Med, IQR) | 4.5 (2.2–9.7) |
| Number of Hepatic Lesions, (Med, IQR) | 1 (1–2) |
| Clavien Class III or greater complication, n(%) | 4 (18) |
| Death, n(%) | 1 (5) |
| Readmission, n(%) | 4 (18) |
| Reoperation, n(%) | 1 (5) |
Conclusions: In the era of TKIs, patients undergoing hepatic resection for metastatic GIST exhibit survival rates exceeding historical reports. This study supports a multidisciplinary approach for treating metastatic GISTs and provides rationale for a prospective clinical trial examining the optimal timing of liver resection and systemic therapy.

VASCULAR SURGERY COLLABORATION DURING PANCREATICODUODENECTOMY WITH VASCULAR RECONSTRUCTION

R. S. Turley1, A. S. Barbas1, E. P. Ceppa1, K. Peterson2, E. K. Paulson2, D. G. Blazer1, B. M. Clary1, T. N. Pappas1, D. S. Tyler4, R. L. McCann1 and R. R. White1
1Department of Surgery, Durham, NC; 2Department of Radiology, Durham, NC

Once considered unresectable, pancreatic cancer patients with venous involvement now have survival after pancreaticoduodenectomy (PD) with en-bloc vascular resection (VR) comparable to patients without vascular involvement. We hypothesize that a multidisciplinary approach involving a dedicated vascular surgeon will minimize morbidity and improve patency of vascular reconstructions.

Methods: We identified 204 patients who underwent PD for pancreatic adenocarcinoma from 1997 to 2008. Patients who underwent PD with VR (N = 42) were compared to patients who underwent standard PD (N = 162). Vascular reconstructions were performed by a vascular surgeon and utilized primary repair (N = 8), vein patch (N = 25), or interposition grafting (N = 9) with femoral or other venous conduit.

Results: Patients undergoing PD with VR had larger tumors (3.0 vs 2.5 cm, p < 0.01) but did not have different rates of positive margins (26% vs. 28%, p = 0.84) or lymph nodes (50% vs 38%, p = 0.14). The VR group had higher mean blood loss (875 mL vs 550 mL, p = 0 < 0.01), but no differences in mortality, complication rates, length of stay, or readmission rates. After a median follow-up of 29 months, overall survival rates were similar (Figure). Predictors of death on multivariate analysis included histological grade, number of positive lymph nodes, and tumor size, but not VR (Table). When evaluated by CT scans within 6 months, 97% of reconstructions remained patent.

Conclusions: The need for VR is not a contraindication to potentially curative resection in patients with pancreatic adenocarcinoma. High patency rates and lack of increased perioperative morbidity may have been attributable to the routine collaboration of an interested vascular surgeon.

COMPLICATIONS OF ROBOT-ASSISTED LAPAROSCOPIC PANCREATICODUODENECTOMY: AN EARLY EXPERIENCE

R. Uppal, P. Newell, C. Hammill, M. A. Cassera and P. D. Hansen
Providence Portland Medical Center, Portland, OR

Introduction: Robot-assisted laparoscopic pancreaticoduodenectomy (RALPD) is a technically complex procedure which is being tested in certain specialty centers.

Methods: Data was collected retrospectively on all patients who underwent elective RALPD between 4/2009 and 9/2010. An attempt was made to determine whether the initial complication was attributable to the robotic approach.

Results: Twenty-three patients were scheduled for RALPD, of which twenty were completed laparoscopically and three converted open due to bleeding (1), portal vein invasion (1), and adhesions (1). Mean operative time was 606 minutes (range 455–935) and estimated blood loss was 300 mL. Mean length of stay for all patients was 18 days (6.4 days in uncomplicated cases). Complications were reported in 14 patients, including 6 patients with major complications (Clavien Dindo >3b), who had a mean length of stay of 42 days. There were no perioperative deaths. Three patients

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leaked at the duodenoejunostomy, compared to zero duode-
nojejunal leaks in the 34 patients who underwent open pan-
creatocoduodenectomy in the same time period. 5 patients had
intra-abdominal abscesses as their initial complication, of
whom 2 had no prior ERCP. One patient had a pulmonary
embolism post operative day 2. Other complications occurred
with roughly the same frequency as in open cases.

**Conclusion:** Extended operative time and duodenoeju-
nosomy anastomotic technique are unique to the laparoscopic
approach and may have contributed to several of the major
complications described. The overall complication rate is
similar to open pancreatocoduodenectomy. With critical revi-
sion of operative technique, we believe we can reduce the
complication rate for LARPD.

### DISTAL PANCREATECTOMY FOR
### PANCREATIC ADENOCARCINOMA:
### CLINICOPATHOLOGIC
### CHARACTERISTICS AND LONG
### TERM SURVIVAL

R. Venkat, K. Olinio, S. Reddy, J. L. Cameron, M. Choti,
H. Nathan, N. Ahuja, T. M. Pawlik, B. H. Edil,
R. D. Schulick and C. L. Wolfgang

*The Johns Hopkins Medical Institutions Department of
Surgery, Baltimore, MD*

**Objective:** The outcome of resected pancreatic adenocarci-
noma of the body/tail of the pancreas requiring distal pan-
createctomy (DP) is less well studied than head/uncinate
tumors resected by pancreaticoduodenectomy (PD).

**Methods:** Between 1990 and 2010, patients who underwent
DP (n = 215) or PD (n = 1703) for adenocarcinoma were
identified. Information on demographics, operative charac-
teristics, pathology and survival were compared between DP
and PD.

**Results:** The DP and PD patients were comparable in age,
sex and Charlson score at presentation (Table). PD patients
had a longer hospital length of stay than DP patients (10 vs.
7 days, p = 0.04. When comparing DP to PD, there was a
higher proportion of T1 (p = 0.009), T2 (p < 0.0001) and T4
lesions (p < 0.0003) with less T3 lesions (p < 0.0001). The
median total lymph nodes harvested were comparable across
the groups; however, DP was associated with a lower rate of
lymph node positivity (p < 0.0001). DP also had a lower risk
of vascular invasion (p = 0.04) and margin positivity (p <
0.0001). DP was associated with a significantly better unad-
justed overall long-term survival than PD (P = 0.03, Figure).
However, there were no significant differences in the periop-
erative mortality and long-term survival between PD and DP
after adjusting for multiple clinico-pathological factors.

**Conclusion:** Patients who are found to be resectable at the
time of presentation and undergo DP have better pathological
tumor characteristics in contrast to PD. Despite differences
at the time of initial presentation, DP for adenocarcinoma has
similar perioperative outcomes with no significant differ-
es in adjusted long-term survival compared to PD.

<table>
<thead>
<tr>
<th>Number (Percent)</th>
<th>DP</th>
<th>PD</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (median, yrs)</strong></td>
<td>67</td>
<td>68</td>
<td>0.97</td>
</tr>
<tr>
<td>Female</td>
<td>109 (50.7)</td>
<td>790 (46.4)</td>
<td>0.23</td>
</tr>
<tr>
<td>Caucasian</td>
<td>180 (83.7)</td>
<td>1502 (88.2)</td>
<td>0.06</td>
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<tr>
<td><strong>Charlson Comorbidity score</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>0–2</td>
<td>22 (10.9)</td>
<td>166 (10.3)</td>
<td>0.75</td>
</tr>
<tr>
<td>3–6</td>
<td>117 (58.3)</td>
<td>907 (56.2)</td>
<td>0.04</td>
</tr>
<tr>
<td>&gt;7</td>
<td>62 (30.8)</td>
<td>540 (33.5)</td>
<td>0.04</td>
</tr>
<tr>
<td><strong>Length of stay</strong></td>
<td>&lt;0.0001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(median, days)</td>
<td>7</td>
<td>10</td>
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</tr>
<tr>
<td><strong>Tumor size</strong></td>
<td>3.5</td>
<td>3.0</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>(median, cm)</td>
<td></td>
<td></td>
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<tr>
<td><strong>T Stage</strong></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>T1</td>
<td>17 (7.9)</td>
<td>68 (4.0)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>T2</td>
<td>72 (33.5)</td>
<td>157 (9.2)</td>
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<td>T3</td>
<td>87 (40.5)</td>
<td>1065 (62.5)</td>
<td>&lt;0.0001</td>
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<tr>
<td>T4</td>
<td>13 (6.0)</td>
<td>42 (2.5)</td>
<td>&lt;0.0001</td>
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<tr>
<td><strong>Total lymph nodes</strong></td>
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<td>17</td>
<td>0.38</td>
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<td>harvested (median)</td>
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<td></td>
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<tr>
<td><strong>Lymph node</strong></td>
<td>128 (59.5)</td>
<td>1336 (78.4)</td>
<td>&lt;0.0001</td>
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<tr>
<td>metastases</td>
<td></td>
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<tr>
<td><strong>Vascular invasion</strong></td>
<td>73 (48.3)</td>
<td>726 (56.9)</td>
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<td>Perineural invasion</td>
<td>155 (89.1)</td>
<td>1273 (90.9)</td>
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<td>31 (15.0)</td>
<td>477 (28.1)</td>
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<td>30-day mortality</td>
<td>3 (1.4)</td>
<td>20 (1.2)</td>
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<td><strong>90-day mortality</strong></td>
<td>10 (4.6)</td>
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<td></td>
</tr>
</tbody>
</table>

*Charlson score was unavailable in patients operated before 1993.
†Vascular invasion status not known: DP (n = 64), PD (n = 428)
‡Perineural invasion status not known: DP (n = 41), PD (n = 302)
**Margin status not known DP (n = 8), PD (n = 6)
INTRADUCTAL PAPILLARY MUCINOUS NEOPLASMS (IPMN) < 3 CM ON IMAGING: CLINICOPATHOLOGICAL CHARACTERISTICS AND THE IMPORTANCE OF SOLID COMPONENTS

R. Venkat1, S. Reddy1, K. Olino1, M. Weiss2, J. L. Cameron1, M. A. Choti1, R. H. Hruban1, T. M. Pawlik3, N. Ahuja1, B. H. Edil1, R. D. Schulick1 and C. L. Wolfgang1
1Johns Hopkins Medical Institutions Department of Surgery, Baltimore, MD; 2Memorial Sloan-Kettering Cancer Center, New York, NY; 3Johns Hopkins Medical Institutions Department of Pathology, Baltimore, MD

Objective: To evaluate the validity of the Tanaka criterion and assess characteristics at presentation and long term survival of resected side-branch or mixed-type IPMN < 3 cm with or without a solid component.

Methods: A retrospective review of clinico-pathological data in patients who underwent a pancreatectomy for side-branch or mixed-type (MT) IPMN < 3 cm (N = 98) from a single institution’s prospectively maintained database.

Results: The average age at presentation was 66.7 years and 60.2% were females. Thirty-eight (38.8%) were mixed type and 60 (61.2%) were side-branch. Twenty-six (26.5%) were located in the body/tail and 72 (73.5%) in the head/uncinate. Thirty-four (34.7%) IPMNs had solid components on radiology. Pathology revealed the following: 26.5% (n = 26) low-grade dysplasia, 29.6% (n = 29) moderate-grade dysplasia and 22.4% (n = 22) high-grade dysplasia (carcinoma in situ; CIS), 3.1% (n = 3) IPMN (NOS) and 18.4% (n = 18) with associated invasive cancer. IPMN with solid components were significantly associated with a higher proportion of invasive cancer (p < 0.0001) and with a poorer long term survival (p = 0.004, Figure).

Conclusion: Our findings suggest that small BD or MT IPMN with radiological evidence of a solid component is strongly associated with invasive cancer. In the absence of a solid component, a large proportion harbor CIS but not invasive cancer. These findings support the international consensus guidelines. However, given the high proportion of CIS in small lesions without a solid component, prospective clinical trials are needed to determine whether smaller lesions should be resected before they progress to invasive carcinoma or if other characteristics can be identified to stratify this group further.

<table>
<thead>
<tr>
<th>Number(Percent)</th>
<th>No solid component</th>
<th>Solid component</th>
<th>p-value</th>
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<tr>
<td>Age (mean, yr)</td>
<td>68.1</td>
<td>64.1</td>
<td>0.12</td>
</tr>
<tr>
<td>Type of tumor</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Side-branch</td>
<td>43 (67.2)</td>
<td>17 (50)</td>
<td>0.10</td>
</tr>
<tr>
<td>Mixed type</td>
<td>21 (32.8)</td>
<td>17 (50)</td>
<td></td>
</tr>
<tr>
<td>Tumor size</td>
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<td></td>
<td></td>
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<tr>
<td>(mean, cm)</td>
<td>1.8</td>
<td>2.0</td>
<td>0.07</td>
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<tr>
<td>Age (mean, yr)</td>
<td>68.1</td>
<td>64.1</td>
<td>0.12</td>
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<tr>
<td>Type of tumor</td>
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</tr>
<tr>
<td>Mixed type</td>
<td>21 (32.8)</td>
<td>17 (50)</td>
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</tr>
<tr>
<td>Histology</td>
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<td>Low grade dysplasia</td>
<td>19 (29.7)</td>
<td>7 (20.6)</td>
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<tr>
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<td>24 (37.5)</td>
<td>5 (14.7)</td>
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<tr>
<td>High grade Dysplasia (CIN)</td>
<td>16 (25.0)</td>
<td>6 (17.6)</td>
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<td>IPMN (NOS)</td>
<td>3 (4.7)</td>
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<td>0.2</td>
</tr>
<tr>
<td>IPMN with CIS</td>
<td>2 (3.1)</td>
<td>16 (47.1)</td>
<td><strong>&lt;0.0001</strong></td>
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<tr>
<td>Recurrence</td>
<td>5 (7.8)</td>
<td>6 (17.6)</td>
<td>0.14</td>
</tr>
</tbody>
</table>

CIN: Carcinoma in situ; NOS: Non-specific.

FIRST DISSECTION OF THE SUPERIOR MESENTERIC ARTERY IN PANCREATICODUODENECTOMY FOR CANCERS OF THE PERIAMPUTLLARY REGION

E. Vicente, Y. Quijano, H. J. Duran, M. Marcello, P. Galindo, E. Diaz-Reqes, A. Lopez, L. Cordoba, A. Muro, E. Garcia and E. Vicente

Madrid Norte Sanchinarro Hospital, Madrid

Pancreaticoduodenectomy (PD) is the only effective treatment for cancers of the periampullary region. Many technical modifications of reconstruction after PD have been described.
One of the important predictive factors of prognosis is the presence of retroperitoneal lymph node metastases, which are present in 20–77% of resected specimens of patients with carcinoma of the head of the pancreas. Hence, lymph node dissection to the right of the superior mesenteric vessels is a minimum requirement. In order to achieve an oncologically acceptable lymph node clearance, we describe the technique of PD in which the SMA is dissected first and the posterior pancreatic capsule is dissected early during the operation. The posterior part of the pancreatic head is dissected off the vessels first without dividing the pancreatic neck. This method allowing early detection of inoperability accomplishes adequate lymphadenectomy and easier identification and safeguarding of a replaced right hepatic artery, if one is present. The video illustrate the different surgical steps.

SURGICAL TECHNIQUE OF ARTERIAL RESECTION IN RADICAL PANCREATIC SURGERY


Madrid Norte Sanchinarro Hospital, Madrid

Arterial resection performed at the time of oncological pancreaticoduodenectomy for adenocarcinoma remains controversial. Neoplasms in the pancreatic head and/or body may be deemed locally unresectable at laparotomy because they appear to encase the celiac axis, common hepatic artery, right hepatic artery or superior mesenteric artery. We present patients who underwent arterial resection with and without reconstruction at the time of pancreaticoduodenectomy. The video illustrate the different surgical steps.

VASCULAR GRAFTS OF CADAVERIC DONOR. AN EXCELLENT ALTERNATIVE FOR HEPATIC VENOUS OUTFLOW RECONSTRUCTION IN PATIENTS WITH RECURRENT LIVER METASTASES INVOLVING HEPATIC VENOUS OUTFLOW

E. Vicente, Y. Quijano, P. Galindo, M. E. Marcello, H. J. Duran, E. Diaz-Reques, C. Corbacho, B. Morato, P. Hidalgo, E. Garcia and E. Vicente

Madrid Norte Sanchinarro Hospital, Madrid

Introduction: Resection of recurrent liver tumors involving the hepatic venous outflow remains controversial. Resection provides the best chance of cure. Adequate surgical clearance can require resection and reconstruction of the hepatic veins.

Methods: A 32-year-old man was referred to our hospital with a history of an elective low anterior resection because of distal rectal cancer, right hepatic trisectionectomy and nonanatomic metastasectomy from the central part of segments 2 and 3 because liver metastases. Fourteen months postoperatively a recurrence developed within the liver remnant. A CT scan and venography reveals a 4 cm liver mass in the left liver remnant, which appeared to be closely apposed to the left hepatic vein. A positron emission tomography with 18 FDG show the evidence of solitary liver metastatic disease.

Results: The preoperative diagnosis was recurrence of colorectal liver metastases involving the hepatic venous outflow and surgical treatment was indicated; Nonanatomic metastasectomy with resection and reconstruction of the intrahepatic venous outflow with vascular graft of cadaveric donor.

Conclusion(s): Hepatic vein involvement by hepatic malignancies does not necessarily preclude resection. Liver resection with reconstruction of the hepatic veins can be performed in selected cases. The vascular grafts of cadaveric donor offer an excellent alternative for hepatic venous outflow reconstruction.

CHOLANGIOCARCINOMA IN SITU WITH EXTENSIVE INTRAEPITHELIAL SPREAD IN A NON-CIRRHOTIC PATIENT PRESENTING WITH BILIARY OBSTRUCTION

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D. Sindram, J. B. Martinie and D. A. Iannitti

1Division of HPB Surgery, Department of Surgery, Carolinas Medical Center, Charlotte, NC; 2Department of Pathology, Carolinas Medical Center, Charlotte, NC

Purpose: Biliary intraepithelial neoplasia (BilIN) is a spectrum of cellular atypia and a precursor to cholangiocarcinoma. BilIN-3 is equivalent to cholangiocarcinoma in situ (CIS). BilIN-3 is described in the setting of viral and alcoholic cirrhosis, but not in non-cirrhotic patients. A characteristic of cholangiocarcinoma is diffuse intraepithelial spread, the pathogenesis of which remains unclear. Dysplastic cells may spread extensively before invasion; conversely, invasive carcinoma may spread laterally during invasion. We describe a case of CIS with extensive intraepithelial spread presenting with biliary obstruction in a non-cirrhotic patient.

Methods: Review of patient charts, radiologic imaging, and pathologic specimens.

Results: A 59-year-old female with a history of colon cancer treated by colectomy without adjuvant therapy in 2005 is found on follow-up to have an elevated alkaline phosphatase (817 IU/L). She has no history of cirrhosis, hepatitis, autoimmune disease, or alcohol abuse. CEA level was normal and CA19.9 was elevated (65 U/mL). CT scan and MRI showed mildly dilated right intrahepatic bile ducts with mild central right ductal thickening. ERCP showed a 2 cm stenosis at the confluence of the right anterior and posterior sectoral ducts. Brushing cytology was negative. The patient underwent a laparoscopic right hepatectomy. Pathologic analysis showed CIS with extensive spread of atypical cells to sectoral bile ducts in the setting of mild peri-portal inflammation, fibrosis, and macrosteatosis.

Conclusion: We report a rare case of extensive CIS presenting with biliary obstruction in a non-cirrhotic patient. Pathologic analysis suggests that extensive intraepithelial spread of CIS may occur prior invasion.
THE ROLE OF THE RENIN-ANGIOTENSIN SYSTEM ON MACROPHAGE PLASTICITY IN COLORECTAL LIVER METASTASES

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This study aimed to determine if the renin-angiotensin system (RAS), which has immunomodulatory effects and can be targeted to inhibit tumour growth, could affect macrophage activation status and if liver macrophages are altered during growth of colorectal liver metastases. In vitro, mouse macrophage cells (P388D1) expressed key RAS receptors; angiotensin (ANG) II type 1 receptor (AT1R) and AT2R. The expression of CD14 (a marker of classical activation) by P388D1s increased when treated with the classical RAS peptide ANG II compared to the alternative RAS peptide ANG-(1-7). This effect was mitigated by AT1R blockade. In contrast, no change in the alternative activation marker CD206 was observed. The counter-regulatory effects of the classical and alternative RAS peptides were confirmed by their divergent effect on iNOS expression by P388D1s. Using a murine model of colorectal liver metastases, macrophage depletion by gadolinium chloride (20 mg/kg) during the late stages of tumour growth decreased tumour load compared to controls, an effect not observed when macrophages were depleted during the early stages of metastatic growth. Protein levels of key growth factors, VEGF and TNF-α also differed according to tumour growth stage. These results suggest that macrophages have divergent effects on tumour growth depending on the stage of tumour progression and that changes in macrophage function might be, at least in part, regulated by the RAS.

DENVER PERITONEOVENOUS SHUNTS: A SURGICAL OPTION FOR REFRACTORY ASCITES DUE TO MALIGNANCY OR CIRRHOSIS

M. A. White, W. J. Pories and E. E. Zervos
East Carolina University, Pitt County Memorial Hospital, Greenville, NC

Patients with chronic ascites due to either malignancy or cirrhosis may require frequent large volume paracentesis and/or high dose diuretics to control their ascites. Peritoneovenous shunting is another option to control medically refractory ascites but is perceived by many to carry unacceptable complication and device failure rates. However, these can be minimized with meticulous technique and careful patient selection. This video presentation is designed to review the indications for shunt placement and proper surgical placement technique to maximize a favorable result. Our patient, a 50-year-old female with end stage liver disease secondary to alcoholism and Hepatitis C, has a MELD score of 21 and is a Child’s class C cirrhotic. She presented with refractory ascites for a 2 month period that was unmanageable with high dose medical therapy, requiring biweekly large volume paracentesis. Percutaneous shunt placement technique is shown emphasizing: establishment of sterile ascites, percutaneous central venous access, large volume paracentesis, proper positioning of the venous catheter to reduce the incidence of thrombosis, secure placement of the pump chamber in a subcutaneous pocket, percutaneous access of the peritoneal cavity avoiding pneumothorax and liver laceration, and pursestring closure of the peritoneal entry site to prevent reflux of ascites. The patient did well postoperatively and subsequently had complete resolution of her ascites without diuretics as verified by CT scan. Peritoneovenous shunts can successfully provide palliation for patients with end stage liver disease. The procedure, while having well described complications, can be done safely with minimal morbidity in appropriately selected patients.

THE IMPACT OF SPINAL ANALGESIA ON PANCREATIC SURGERY OUTCOMES

M. D. Winner, J. DiNorcia, M. K. Lee, J. A. Lee, B. A. Schrope, J. A. Chabot and J. D. Allendorf
Columbia University Medical Center, Department of Surgery, New York, NY

Purpose: To evaluate outcomes after spinal and epidural analgesia in elective, open pancreatic surgery.

Methods: We reviewed the records of patients who had elective, open pancreatic surgery. We categorized patients as receiving epidural analgesia, spinal analgesia, or no spinal/epidural (“PCA-only”), and compared fluid intakes, pain scores, opiate use, operating room times, and complications between the three groups.

Results: Of the 129 patients who had elective, open pancreatic surgery in the last nine months of 2009, 107 had available data on epidural and spinal use. Post-operative pain scores were available for 79. Thirteen patients received epidural catheters and 51 received intrathecal morphine injections (spinal). All 107 received a PCA. Patients receiving spinal analgesia had lower average post-operative pain scores (1.9 on a visual analog scale) when compared to the epidural and PCA-only groups (3.6 and 3.3 respectively, p < 0.05), as well as lower consumption of additional intravenous opiates in the first 24 post-operative hours compared to PCA-only (5.2 mg vs. 10.1 mg dilaudid-equivalents, p < 0.05.) Non-operative minutes in the operating room were significantly higher in the Spinal (38 min) and in the Epidural and PCA-only groups (3.6 and 3.3 respectively, p < 0.05). EBL, intra- and post-operative fluid balances, morbidity, mortality, and length of stay were equivalent between the three groups.

Conclusion: In patients who had elective, open pancreatic surgery, spinal analgesia offered excellent post-operative pain control, though resulted in more non-operative minutes in the operating room. Spinal analgesia did not affect length of stay or post-operative morbidity or mortality.
METHOD OF SPLENIC PRESERVATION DURING DISTAL PANCREATECTOMY IMPACTS FISTULA RATES


¹University of Wisconsin, Madison, WI; ²Emory University, Atlanta, GA; ³Indiana University, Bloomington, IN; ⁴Northwestern University, Chicago, IL; ⁵Vanderbilt University, Nashville, TN; ⁶University of Louisville, Louisville, KY; ⁷University of Cincinnati, Cincinnati, OH; ⁸Washington University, St. Louis, MO

Introduction: Distal pancreatectomy with splenectomy (DPS) has been the standard treatment for pancreatic body/tail tumors, but spleen-preserving distal pancreatectomy (SPDP) is increasingly used. Two methods exist – splenic vessel preservation (SPDP-VP) and excision (SPDP-VE). It is unknown how the method of SPDP impacts postoperative pancreatic fistula (POPF) rates.

Methods: Records from patients undergoing distal pancreatectomy at 9 academic medical centers were analyzed. Chi-square tests and a multivariate model were used to assess the impact of surgical technique on POPF, accounting for center, operative approach, diagnosis, BMI, length of specimen, and blood loss.

Results: 675 patients were included. Pancreatic pathology included: cysts (34%), adenocarcinoma (19%), neuroendocrine tumors (16%), pancreatitis (15%), metastases (5%), and other (11%). When POPF rates between DPS and SPDP were compared, there was no significant difference. When POPF rates were examined by method of splenic preservation, those undergoing SPDP-VP had significantly higher POPF rates than those with SPDP-VE for both total (36% vs 15%, p = 0.02) and clinically significant (grade B/C) POPF (23% vs 7%, p = 0.02). When multivariate analysis was performed to control for other contributing factors, SPDP-VP remained an important risk factor for POPF (p = 0.006).

Discussion: In our multicenter data set, the approach to splenic vessels during SPDP had a significant independent impact on POPF rates. These results suggest that preservation of the splenic vessels during SPDP may be associated with higher rates of POPF when compared to vessel excision. This observation should be confirmed by prospective analyses because it has the potential to alter the risk/benefit ratio for splenic preservation.

<table>
<thead>
<tr>
<th>Variable</th>
<th>DPS (%)</th>
<th>SPDP-VP (%)</th>
<th>SPDP-VE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients (%)</td>
<td>563 (82%)</td>
<td>71 (10%)</td>
<td>41 (6%)</td>
</tr>
<tr>
<td>Laparoscopic (%)</td>
<td>168 (30%)</td>
<td>49 (69%)</td>
<td>34 (83%)</td>
</tr>
<tr>
<td>BMI (±SD)</td>
<td>27 ± 6.4</td>
<td>26.6 ± 6.4</td>
<td>28.8 ± 7.1</td>
</tr>
<tr>
<td>Pancreatic length (cm ± SD)</td>
<td>9.4 ± 3.8</td>
<td>7.4 ± 3.7</td>
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<td>EBL (mL ± SD)</td>
<td>561 ± 755</td>
<td>254 ± 354</td>
<td>537 ± 866</td>
</tr>
<tr>
<td>Cystic diagnosis</td>
<td>35%</td>
<td>56%</td>
<td>44%</td>
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<tr>
<td>Stapled technique</td>
<td>73%</td>
<td>53%</td>
<td>45%</td>
</tr>
<tr>
<td>Total leak rate</td>
<td>24%</td>
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<tr>
<td>Significant leak rate</td>
<td>12%</td>
<td>23%</td>
<td>7%</td>
</tr>
</tbody>
</table>

NATIONWIDE PATTERNS IN RESECTION FOR METASTATIC Pancreatic CANCER


Surgical Outcomes Analysis & Research, University of Massachusetts Medical School, Worcester, MA

Background: The role of resection in patients with metastatic pancreatic cancer remains controversial. Limited data exists regarding operative management for metastases. We sought to determine whether patients are receiving resection for metastatic disease nationwide, and whether resected patients received any benefit from surgery.

Methods: Patients ≥18 years with pancreatic adenocarcinoma and distant disease were identified in SEER 1998–2007. Univariate and multivariate analyses were performed. Survival was analyzed by Kaplan-Meier methods and Cox proportional-hazard ratios.

Results: Among 22597 patients with metastatic disease, pancreatic resection was recommended to 3647 (16.1%), and performed on 753 (3.3%). 1901 (8.4%) received radiation, 19895 (88.0%) received no radiation or surgery. There was a substantial decrease in patients recommended for surgery 1998–2007 (33.94% to 8.19%, p < 0.0001), but no change in pancreatic resections performed (3.3% to 3.1%, p = 0.7834). Female sex, younger age, and marital status were predictive of undergoing pancreatic resection (p < 0.05). Unadjusted median survival was higher in patients who received pancreatic resection (8 vs. 3 months, p < 0.0001). 9.3% of resected patients also underwent resection of metastatic site(s). In patients who received pancreatic resection, Cox modeling revealed that resection of metastatic site(s) was not associated with any additional benefit.

Conclusions: For patients with metastatic pancreatic cancer, rates of pancreatic resection remain stable near 3%. Patients who underwent pancreatectomy had improved survival compared to unresected peers, but additional resection of metastatic site(s) did not improve survival. Given the highly-selected nature of the resected cohort, resection of primary disease should be approached with caution. Our analysis suggests that resection of metastatic site(s) is not indicated.
PILOT STUDY OF 18F-FLUOROCHOLINE PET/CT OF THE LIVER IN PATIENTS WITH HEPATOCELLULAR CANCER

L. L. Wong1,2, G. Okimoto1 and S. Kwee1,3
1Cancer Research Center of Hawaii, Honolulu, Hawaii; 2Hawaii Medical Center-East, Honolulu, Hawaii; 3Queens Medical Center, Honolulu, Hawaii

Background: Positron emission tomography (PET) with [18F]-fluorodeoxyglucose is valuable for cancer diagnosis/staging, but hepatocellular carcinoma (HCC) has metabolic characteristics that limit its usefulness. Upregulated phosphocholine synthesis is a hallmark of cancer and promising target for diagnosis/therapy. The investigational tracer [18F]-fluoromethylcholine (FCH) is a synthetic substrate for choline kinase and marker of phosphocholine synthesis. This pilot study addresses feasibility of detecting HCC using FCH PET/CT.

Methods: Fourteen patients with known HCC underwent FCH-PET/CT performed under IND. Data collected included patient characteristics, laboratory studies, MELD score. Maximum standardized uptake value (SUVmax) from tumor and adjacent liver were measured on PET.

Results: Mean Tumor SUVmax was significantly increased compared to background (10.8 vs. 7.1, p < 0.01), supporting potential discrimination of HCC by FCH. The smallest tumor detected was 7 mm, indicating feasibility for classifying lesions <2 cm. Variations in global liver FCH uptake were observed in cirrhotic patients, with liver SUVmax significantly inversely correlated with MELD score (r = −0.71, p < 0.01). To further investigate FCH metabolism and liver function, normal liver FCH uptake in 20 healthy volunteers (from a previous IND biodistribution study) were compared to HCC patients, revealing significant differences in FCH uptake between healthy livers and tumor-affected and unaffected areas of HCC patients (SUVmax 11.7 vs. 7.1, p < 0.01, and 11.7 vs. 7.5, p < 0.01 respectively).

Conclusions: FCH is a novel molecular imaging agent that shows significant promise in liver disease/cancer. Unlike other diagnostic imaging, FCH-PET/CT may have the ability to determine underlying liver function and therefore potentially optimize selection of therapy.

ADOPTIVE T-CELL TRANSFER TARGETING PANCREATIC CANCER

Baylor College of Medicine, Houston, TX

Background: Conventional chemotherapy and radiotherapy produce a marginal survival benefit in pancreatic cancer, underscoring the need for novel therapies. The aim of this study was to develop an adoptive T-cell transfer approach to target tumors expressing PSCA, a tumor-associated antigen which is frequently expressed by pancreatic cancer cells.

Methods: PSCA expression on primary tumor samples was confirmed by immunohistochemistry. Patient-derived T cells were then activated in vitro using CD3/CD28 and transduced with a retroviral vector encoding a chimeric antigen receptor (CAR) targeting PSCA. The ability of these cells to kill tumor cells was analyzed in a chromium release assay.

Results: PSCA was expressed on 70% of primary tumor samples screened. Patient-derived activated T cells could be readily generated in clinically relevant numbers and transduced with CAR/PSCA, with transduction efficiencies >50%. These tumor-targeted T cells were able to specifically kill PSCA-expressing pancreatic cancer cell lines CAPAN1, and PL45 (60%, 99% and 71% killing at an effector:target (E:T) ratio of 20:1, respectively) in a 4-hour chromium release assay, with no non-specific killing of PSCA negative target cells (293T – 25% at 20:1 E:T), thus indicating the potential efficacy and safety of this approach.

Conclusion: PSCA is frequently expressed on pancreatic cancer cells and can be targeted for immune mediated destruction using CAR-modified adoptively transferred T cells. The safety and efficacy of this approach deserves further study and may represent a promising novel treatment for patients with pancreatic cancer.

LAPAROSCOPIC LIVER RESECTION FOR HEPATOCELLULAR CARCINOMA; A SINGLE CENTER EXPERIENCE

S. Yoon and K. Kim
Asan Medical Center, Ulsan University, Seoul

Background: There are a few reports of the advantages of laparoscopic liver resection of hepatocellular carcinoma (HCC). The purpose of this study was to evaluate the short-term result of laparoscopic liver resection.

Methods: From July 2007 to February 2010, there were 56 patients with HCC who underwent laparoscopic liver resection in our hospital.

Results: The mean age was 55.3 ± 9.72 (range 35–70) years and mean tumor size was 2.82 ± 1.19 (range 1.0–5.5) cm. The median operative time was 212.93 ± 96.48 min (range: 95–720 min), and median blood loss was 722.14 ± 120.88 ml (range: 150–800 ml) and two patients required intra-operative blood transfusion, but significantly blood loss was none. The mean resection margin was 2.03 ± 1.68 cm (0.1–9.0 cm). There is no in hospital mortality, and two patients have post-operative complication as wound seroma and ascites. Return to normal diet was achieved on average at 1.87 ± 0.8 days (range: 1–4 days). The mean hospital stay was 8.88 ± 2.34 days (range: 6–17 days). The 34 months overall and disease-free survival rates were 83.5% and 70.5%, respectively.

Conclusion: This procedure is developing and safe technique in a select group of patients including those with malignancies, resulting in short hospital stays, rapid return to normal diet, full mobility and minimal morbidity with acceptable oncological parameter.

EVOlUTION OF THE SURGICAL MANAGEMENT OF PERIHILAR CHOLANGIOCARCINOMA IN A WESTERN CENTER DEMONSTRATES IMPROVED SURVIVAL WITH ENDOSCOPIC BILIARY DRAINAGE AND REDUCED USE OF BLOOD TRANSFUSION

A. L. Young, T. Igami, Y. Senda, R. Adair, S. Farid, G. J. Tooood, K. R. Prasad and P. Lodge
St James’s University Hospital, Leeds, West Yorkshire

Introduction: Perihilar cholangiocarcinoma (PHCCA) remains a surgical challenge with few large reported series,
particular in Western centers. We investigated which factors affected survival in our unit.

**Methods:** A prospectively maintained database was interrogated to identify all resections. Clinico-pathological data was analyzed and assessed for impact on survival. Subsequently data for resections during the periods 1994–1998, 1999–2003 and 2004–2008 were compared.

**Results:** 83 patients underwent resection. Almost 3/4 required hepatic trisectionectomy. Overall survival was 70% at 1 year, 36% at 3 years and 20% at 5 years. Size of tumour, R0 status, distant metastasis, tumour grade, portal vein resection, microscopic direct vascular invasion, T-stage, and blood transfusion requirement significantly affected outcome on univariate analysis. Distant metastases (p = 0.040), percutaneous biliary drainage (p = 0.015) and blood transfusion requirement (p = 0.026) were significant on multivariate analysis. Survival outcomes improved significantly in the most recent period and in addition blood transfusion requirement was significantly reduced in the most recent time period.

**Conclusion:** This is the first series to report blood transfusion requirement and pre-operative percutaneous biliary drainage as independent poor prognostic indicators following resection of PHCCA. Long term survival can be achieved following aggressive surgical resection of this tumour but a learning curve is apparent which supports the management of these patients in high volume centers to achieve improved outcomes.

**REGIONAL TUMOUR DIFFERENCES IN PROSTAGLANDIN E2 LEVELS MAY PROMOTE DEVELOPMENT OF COLORECTAL LIVER METASTASES BY PROMOTING EPITHELIAL-MESENCHYMAL TRANSITION**

A. L. Young¹, M. A. Hull² and G. J. Toogood¹

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Blocking Prostaglandin(PGE2) production using COX inhibitors has proven benefit in cancer therapy. NAD+-dependent 15-PGDH Dehydrogenase (15-PGDH) represents another level of control over tissue PGE2 levels (controls rate-limiting step in PGE2 breakdown). The hypoxic tumor microenvironment may affect PGE2 levels, promoting cancer cell invasion/metastasis (epithelial-mesenchymal transition (EMT)). We investigated control of PGE2 levels in colorectal cancer liver metastases (CRCLM) relative to hypoxia and EMT. Paired central and peripheral tissue from 20 CRCLM were obtained to measure tissue PGE2, NAD+ levels, 15-PGDH enzyme activity and immunoreactive 15-PGDH and COX-2 protein levels. Parallel in-vitro studies used a LIM1863 CRC cell model of EMT. PGE2 levels were increased in the centre of CRCLM relative to peripheral tissue by a mean of 26% (95% CI: 1–52%; p = 0.045). Counter-intuitively, 15-PGDH protein levels were increased in the centre of tumors (immunoreactivity p = 0.036; [3H]PGE2 catabolism: p = 0.016). However, NAD+ levels were 59% (25–72%; p = 0.015) lower in the centre of CRCLM than the periphery suggesting inefficient 15-PGDH-dependent catabolism may explain raised PGE2 levels. In central areas of CRCLM, cancer cells exhibiting low E-cadherin expression (EMT marker) had higher expression of 15-PGDH than neighbouring E-cadherin-positive cells. Our tissue observations were mirrored by in-vitro experiments. 15-PGDH activity was significantly decreased when NAD+ was present at a limiting concentration. Furthermore, PGE2 promoted EMT in LIM 1863 cells in a concentration-dependent manner. Regional differences in PGE2 levels and 15-PGDH expression/function are apparent in CRCLM (possibly linked to hypoxia). PGE2 promotes EMT in human CRC cells. We present a new mechanism for how hypoxia promotes EMT through NAD+ depletion leading to decreased 15-PGDH function and increased PGE2 levels.

**CIRCULATING TUMOR CELLS IN PATIENTS UNDERGOING LIVER RESECTION FOR COLORECTAL CANCER LIVER METASTASES**

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Hepatic resection improves the prognosis of patients with colorectal cancer (CRC) liver metastases, but recurrent disease occurs in >50% of patients. Dissemination of circulating tumor cells (CTCs) likely occurs early in metastatic progression. The prognostic or predictive role of CTCs in CRC remains uncertain. However, some have suggested that patients can be stratified into unfavorable and favorable prognostic groups based on CTC levels of ≥3 or <3 CTCs/7.5 mls of blood. To understand the clinical relevance of CTCs in patients undergoing liver resection for CRC metastases, 7.5 mls of hepatic (HV) and peripheral (PV) vein blood were drawn intraoperatively from patients (n = 33, Male = 17, Female = 16, range 40–73 yr) prior to liver transection. CTCs were enumerated using CellSearch® technology, which distinguishes epithelial cells from leukocytes using specific antibodies. These early data reveal no difference in the number of CTCs in HV vs. PV samples (mean ± s.d = 8 ± 11 vs. 5 ± 6, p = 0.4). Univariate analyses did not show an association between unfavorable and favorable HV or PV CTC counts with age, sex, chemotherapy prior to liver resection (5-FU or FOLFOX or FOLFIRI, Bevacizumab), number of liver metastases, or tumor volume. We have shown that there are detectable levels of circulating epithelial cells, likely representing CTCs, in patients with CRC liver metastases. These early data also suggest that there are no significant differences in the number of CTCs in HV vs. PV circulations. Patients are being followed prospectively to determine if CTC counts will be predictive of recurrence.
PLATINUM-BASED CHEMOTHERAPY IN PATIENTS WITH PANCREATIC CANCER AND GERMLINE BRCA2 MUTATIONS

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Patients with germline BRCA2 mutations have an increased risk of developing breast, ovarian and pancreatic cancer. BRCA-deficient malignant cells are particularly sensitive to cross-linking agents, providing a rationale for tailored chemotherapy using platinum agents in germline BRCA2 mutation carriers with pancreatic cancer. Therefore, we used platinum-based chemotherapy in two recent cases of pancreatic cancer with germline BRCA2 mutations. A 53-year-old woman with a history of previously treated breast cancer presented with locally advanced pancreatic cancer, abutting the portal vein and superior mesenteric artery. Tumor regression was observed with 2 cycles of cisplatinum/gemcitabine followed by external beam radiation with 5-FU. A standard pancreaticoduodenectomy was performed and pathology revealed a well-differentiated adenocarcinoma (T3) with negative resection margins and 26 negative lymph nodes. The patient received 4 adjuvant cycles of cisplatinum/gemcitabine and remains disease-free at 30 months post-resection. A 63-year-old woman presented with a resectable pancreatic cancer in the setting of recurrent ovarian cancer. She was previously treated with hysterectomy, bilateral salpingo-oophorectomy, omentectomy and intra-peritoneal carboplatin/paclitaxel. Following 6 cycles of systemic carboplatin/paclitaxel, there was complete regression of the ovarian cancer recurrence with stability in the pancreatic mass. At laparotomy, there was no evidence of carcinomatosis and a standard pancreaticoduodenectomy was performed. The pathology showed a well-differentiated adenocarcinoma (T3) with negative resection margins and 13 negative lymph nodes. She received 3 adjuvant cycles of carboplatin/paclitaxel and is disease-free at 15 months post-resection. These results support the use of platinum agents in germline BRCA mutation carriers with pancreatic cancer.