Resident Research Day

June 20, 2024
7:00 - 8:30 am

Location: Foerderer Auditorium College Building 2nd Floor

Moderator: Hien Dang, PhD

Jefferson
HOME OF SIDNEY KIMMEL MEDICAL COLLEGE

Presented by the
Department of Surgery
Division of Surgical Research

Itinerary

7:00 – 7:03	Opening Remarks, **Charles J. Yeo, MD** Samuel D. Gross Professor and Chair of Surgery Senior Vice President and Chair, Enterprise Surgery
7:03 – 7:10	Contrast-Enhanced Ultrasound Guided High Intensity Focused Ultrasound Treatment of Liver Laceration in a Swine Survival Model by **Fari Fall, MD**
7:10 – 7:12	Discussion
7:12 – 7:19	Evaluating the Efficacy of Large Language Models in CPT Coding for Craniofacial Surgery: A Comparative Analysis by **Emily Isch, MD**
7:19 – 7:21	Discussion
7:21 – 7:28	Disparities and Survival in Contralateral Prophylactic Mastectomy: A Review of the National Cancer Database by **Kathleen Jarrell, MD**
7:28 – 7:30	Discussion
7:30 – 7:37	Do Female Patients Suffer Worse Outcomes than Male Patients after Inguinal Hernia Repair? An ACHQC Study by **Sunjay Kumar, MD**
7:37 – 7:39	Discussion
7:39 – 7:46	Identifying Reliable Metrics across Episodes of Suspected Early-Stage Lung Cancer by **Luke Meredith, MD**
7:46 – 7:48	Discussion
7:48 – 7:55	Resident Driven Guideline to Reduce Iatrogenic Pneumothoraxes from Small Bore Feeding Tubes: A Quality and Safety Improvement Project by **Sourav Podder, MD**
7:55 – 7:57	Discussion
7:57 – 8:04	Extrahepatic Cholangiocarcinoma: Genomic Variables Associated with Anatomical Location and Outcome by **William Preston, MD**
8:04 – 8:06	Discussion
8:06 – 8:13	Incidence and Management of Cardiothoracic Relevant Extrapulmonary Findings found on Low Dose CTs by **Hamza Rshaidat, MD**
8:13 – 8:15	Discussion
8:16 – 8:30	Closing Remarks

Research Abstracts

Fari Fall, MD
Mentor:
Loren Berman, MD (Primary);
George Koenig, DO
Department of Surgery,
Nemours Children's Health, Wilmington, DE
Thomas Jefferson University, Philadelphia, PA

Awards:
Pediatric Surgery Research Fellowship, Nemours Children's Health

Contrast-Enhanced Ultrasound Guided High Intensity Focused Ultrasound Treatment of Liver Laceration in a Swine Survival Model

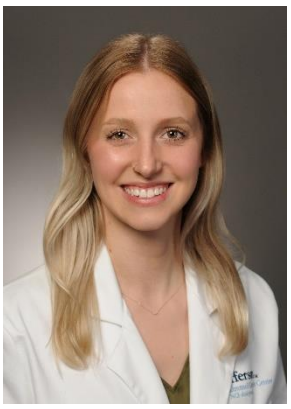
Background: We aimed to demonstrate the feasibility of using contrast-enhanced ultrasound (CEUS)-guided high intensity focused ultrasound (HIFU) for the rapid identification and treatment of active bleeding from liver lacerations in a 24-hour swine survival model.

Methods: A two-element ultrasound transducer was coupled to a scanner for co-registered diagnostic imaging and ablation. Contrast imaging was performed for identification of bleeding and for vessel targeting. Initial in vivo work in four swine evaluated the size and location of the liver ablation area as a function of treatment parameters with and without the presence of an ultrasound contrast agent infusion. The ability of the system to detect active bleeding and achieve hemostasis was then evaluated in an open abdomen swine model. Eight pigs received a 2x2 cm laceration across a superficial hepatic vein to induce active hemorrhage. Animals were then randomized to receive either CEUS imaging alone or CEUS combined with HIFU treatment. Finally, lacerations were created in an additional 8 swine, treated with CEUS-guided HIFU, and animals recovered for 24-hour survival. Vital signs, time to hemostasis, total blood loss, platelet counts, survival, and pathology were obtained and compared across groups.

Results: Control animals treated with CEUS alone did not achieve hemostasis and were euthanized within 30 minutes. In contrast, all swine treated with CEUS-guided HIFU achieved hemostasis within 60 seconds of treatment and had less blood loss than the controls (80±46 ml vs 687±271 ml; $p=0.002$).

For the survival studies, hemostasis was achieved in all animals after 2-6 45-second treatment cycles (median=2.5 treatments). Total blood loss was 173±159 ml. There were no changes in systolic or diastolic pressure, heart rate, or oxygen saturation between the pre- and post- laceration control ($p>0.10$). No changes were observed in hemoglobin, white blood cell count, or platelets pre-laceration and 24 hours post hemostasis ($p>0.25$). Importantly, all animals survived for the full 24-hour monitoring period before being euthanized. On gross pathologic examination, no apparent damage was detected in the adjacent organs or liver ducts, although some animals did show signs of full thickness burns through the back of the treated liver lobe. Overlap between the lacerated vessel and ablation area were noted on pathology, reinforcing the belief that HIFU directly leads to hemostasis following laceration.

Conclusion: This preclinical study suggests that CEUS-guided HIFU is a promising tool for the noninvasive rapid identification and subsequent treatment of active bleeding from liver lacerations.



Emily Isch, MD
Mentors:
EJ Caterson MD, PhD
Division of Plastic Surgery,
Department of Surgery Nemours Children's Hospital

Awards:
Saligman PGY2-3 year

Evaluating the Efficacy of Large Language Models in CPT Coding for Craniofacial Surgery: A Comparative Analysis

Background: The advent of Large Language Models (LLMs) like ChatGPT has introduced significant advancements in various surgical disciplines. These developments have led to an increased interest in the utilization of LLMs for Current Procedural Terminology (CPT) coding in surgery. With CPT coding being a complex and time-consuming process, often exacerbated by the scarcity of professional coders, there is a pressing need for innovative solutions to enhance coding efficiency and accuracy.

Methods: This observational study evaluated the effectiveness of five publicly available large language models—Perplexity.AI, Bard, BingAI, ChatGPT 3.5, and ChatGPT 4.0—in accurately identifying CPT codes for craniofacial procedures. A consistent query format was employed to test each model, ensuring the inclusion of detailed procedure components where necessary. The responses were classified as correct, partially correct, or incorrect based on their alignment with established CPT coding for the specified procedures.

Results: The results indicate that while there is no overall significant association between the type of AI model and the correctness of CPT code identification, there are notable differences in performance for simple and complex CPT codes among the models. Specifically, ChatGPT 4.0 showed higher accuracy for complex codes, whereas Perplexity.AI and Bard were more consistent with simple codes.

Conclusions: This study highlights the feasibility and potential benefits of integrating LLMs into the CPT coding process for craniofacial surgery. The findings advocate for further refinement and training of AI models to improve their accuracy and practicality, suggesting a future where AI-assisted coding could become a standard component of surgical workflows, aligning with the ongoing digital transformation in healthcare.

Kathleen Jarrell, MD
Mentor:
Oluwadamilola "Lola" Fayanju, MD
Division of Breast Surgery, Penn Medicine

Disparities and Survival in Contralateral Prophylactic Mastectomy: A Review of the National Cancer Database

Background: Contralateral prophylactic mastectomy (CPM) rates continue to grow, despite an unclear survival benefit and controversy surrounding potential for overtreatment and racial disparities in patients who receive CPM. This study aimed to determine differences in sociodemographic factors between patients who did and did not undergo CPM and to evaluate differences in overall survival and time to surgery between these two groups.

Methods: We conducted a retrospective review of the National Cancer Database of women > 18 years old diagnosed with Stage 0-III breast cancer in 2010-2019 who underwent mastectomy with or without CPM. Patients with inflammatory breast cancer were excluded. Age, race/ethnicity, insurance status, geographic region, ZIP-level median household income (HHI), Charlson-Deyo Comorbidity Score, stage, facility location, receipt of reconstruction, and time to surgery (TTS) were collected for each patient. A multivariate logistic regression was utilized to estimate the association between patient demographics and receiving CPM, after adjustment for known covariates. Cox Proportional Hazard Regression analyses were utilized to assess the association between overall survival (OS) and time to treatment.

Results: This cohort included 1,282,151 patients, of whom 21,741 (9.5%) underwent CPM. Of CPM patients, 43% were cT2-3 and 4.1% cN2-3, vs 29% and 2.1% for mastectomy alone ($p = <0.001$). Non-Hispanic Black (OR 0.79, CI 0.77 - 0.80, $p <0.05$) and Asian patients (OR 0.77, CI 0.74 - 0.79, $p < 0.05$) had reduced odds of receiving CPM compared to white patients. Patients whose ZIP-level median HHI was <$40,227 (OR 0.88, CI 0.86 - 0.91, $p < 0.05$), who were uninsured (OR 0.67, CI 0.63 - 0.71, $p < 0.05$), or who had a higher Charlson-Deyo Index Score (OR 0.79, CI 0.71 - 0.87, $p < 0.05$) had reduced odds of receiving CPM. Patients who did not receive CPM or reconstruction had a mean TTS of 58 days (SD = 63.6 days) compared to those who had CPM and reconstruction with 87 days (SD = 74.0 days) TTS ($p < 0.05$). Among CPM patients, those whose TTS was within 31-60 days had a HR of 0.75 (CI 0.71-0.79, $p < 0.001$) and those within 61-90 days had a HR of 0.80 (CI 0.74-0.86, $p <0.001$) compared to those who underwent surgery within 30 days (Table).

Conclusions: This study supports existing literature that Non-Hispanic Black, Asian, low-income, and uninsured patients, as well as patients with more comorbidities, are less likely to undergo CPM. These results are reassuring that waiting over 90 days to undergo CPM had no significant impact on survival despite these patients having more advanced disease.

Sunjay Kumar, MD

Mentor:
Francesco Palazzo, MD
General Surgery, Thomas Jefferson University Hospital

Awards:
Partial salary support from SAGES, Saligman Awardee

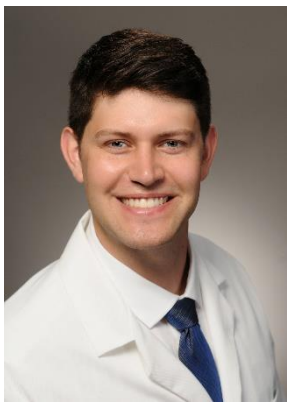
Do Female Patients Suffer Worse Outcomes than Male Patients after Inguinal Hernia Repair? An ACHQC Study

Background: Inguinal hernia repair (IHR) is one of the most common general surgical operations. Some evidence suggests that female patients are at higher risk of chronic postoperative pain and hernia recurrence. We investigated rates of chronic inguinal pain and recurrence after IHR in both male and female patients utilizing the Abdominal Core Health Quality Collaborative (ACHQC) database.

Methods: METHODS: The ACHQC database was queried for patients undergoing elective, unilateral inguinal hernia repair with permanent synthetic mesh who completed 30-day clinical follow-up and baseline and 1-year European Registry for Abdominal Wall Hernias (EuraHS) surveys. Both open and minimally invasive (MIS) cases, including laparoscopic transabdominal preperitoneal (L-TAPP), laparoscopic totally extraperitoneal (TEP), and robotic transabdominal preperitoneal (R-TAPP) were included. Outcomes were compared via univariate analysis using Pearson and Wilcoxon tests for categorical and continuous variables, respectively. Multivariable linear regression models were then used to examine the outcomes of 1-year EuraHS pain, restrictions, and cosmesis scores while a logistic regression was used for recurrence.

Results: The search identified a total of 1,582 subjects, 1,448 male and 134 female. Baseline characteristics of both groups were similar regarding age, medical comorbidities, operative approach, and operative time. In male patients, the approach was open in 41% and MIS in 59% (12% L-TAPP, 23% TEP, and 23% R-TAPP). In female patients, the approach was open in 35% and MIS in 65% (16% L-TAPP, 22% TEP, and 27% R-TAPP). Female patients more often had femoral hernias and the use of self-fixating mesh. Male patients more often had indirect hernias and underwent suture fixation. The ilioinguinal nerve was fully excised in 58% of female patients compared to 29% of male patients. Hernia recurrence rates were higher in female patients at both 1- and 2-year follow up (8% vs 4% p=0.03 and 8% vs 5% p=0.25). 1-year EuraHS overall and EuraHS pain scores were worse in female patients than male patients (p=0.004 and p=0.024, Figure 1). On multivariable regression analysis, female sex was associated with worse pain (adjusted effect size 0.76, 95% CI 0.16-1.36), restriction of activities (adjusted effect size 1.64, 95% CI 0.74-2.54), and cosmesis scores (adjusted effect size 0.77, 95% CI 0.21-1.32) compared to male sex. The odds of hernia recurrence in female patients undergoing their first IHR were similar to those of all patients undergoing repeat IHR (Figure 2). Furthermore, female sex may be a more important risk factor for recurrence than BMI or active smoking.

Conclusions: This study demonstrates that despite analyzing data from highly-trained hernia surgeons, who performed a greater proportion of minimally invasive IHR than is typically reported, recurrence and quality of life after IHR are strikingly worse in female patients. Identification of these disparities in outcomes is the first step towards achieving health equity in IHR.



Luke Meredith, MD
Mentor:
Tyler Grenda, MD, MS
Division of Thoracic Surgery, Thomas Jefferson University Hospital

Identifying Reliable Metrics across Episodes of Suspected Early-Stage Lung Cancer

Background: Defining episodes of care and identifying reliable metrics in the management of suspected early-stage lung cancer will be imperative to profiling hospital performance. We sought to measure the reliability of utilization metrics surrounding episodes of suspected early-stage lung cancer management.

Methods: A retrospective cohort study was completed to identify patients with a lung nodule in 2018 who underwent an intervention by the end of 2019. This study included hospitals in Florida, Maryland, and Pennsylvania. Ambulatory interventions included bronchoscopic intervention, image-guided biopsy, stereotactic body radiation therapy, chemotherapy, and multiple biopsy interventions. Inpatient interventions included lung resection, for which the rate of nonmalignant resection and morbidity were analyzed. The reliability of each risk-adjusted utilization and inpatient metric was calculated using mixed effects logistic regression.

Results: A total of 7,446 patients were identified across 368 hospitals. The median reliability for the risk-adjusted utilization at the hospital level for bronchoscopic intervention was 0.67 (Interquartile Range (IQR) 0-0.9), and for image-guided biopsy was 0.68 (IQR 0-0.91). The proportion of hospitals reaching the established reliability benchmark of 0.7 for utilization of a bronchoscopic intervention and image-guided biopsy was 45.6% and 49.2%, respectively. Median reliability was found to be zero for chemotherapy, stereotactic body radiation therapy, and multiple biopsy procedures. For lung resection outcomes, the median reliability of nonmalignant resection was 0.21(IQR 0-0.42) and the median reliability of morbidity was 0.18 (IQR 0-0.38).

Conclusions: Utilization of bronchoscopic interventions and image-guided biopsy in the management of suspected early-stage lung cancer met common reliability benchmarks for some hospitals. Understanding which metrics are reliable may influence inclusion in designing episodes of care to comprehensively compare hospital performance.

Sourav Podder, MD
Mentor:
Scott Cowan, MD
Division of General Surgery, Thomas Jefferson University Hospital

Resident Driven Guideline to Reduce Iatrogenic Pneumothoraxes from Small Bore Feeding Tubes: A Quality and Safety Improvement Project

Background: In 2015, at a 3-hospital academic medical system, there was a series of iatrogenic pneumothoraxes caused by small bore feeding tubes (SBFT). At the time, there were no hospital guidelines in place for the safe passage of SBFTs. Thus, in 2016 the Department of Surgery developed and implemented a formal guideline to reduce complications associated with SBFT insertions.

Methods: A hospital guideline was formulated by a resident-led, multidisciplinary team through a consensus-driven process. It was determined that SBFTs would be placed either with the Cortrak Enteral Access System (EAS) or via Non-Cortrak Methods which included the 2 Step X-ray Method or with the assistance of a scope or imaging. A 'Super User' Competency Process for the Cortrak EAS was included in the hospital guideline. The number of iatrogenic pneumothoraxes from SBFT placements were monitored and the cases were reviewed via root cause analyses.

Results: With the development of the formal clinical guideline in 2016, there was a decrease in the number of iatrogenic pneumothoraxes caused by SBFT insertions. In 2015, there were 3 SBFT-related iatrogenic pneumothoraxes, which initiated the development of the hospital guideline. In 2016 and 2017, there was 1 iatrogenic pneumothorax per year. In 2018, there were 2 cases of iatrogenic pneumothoraxes. Since 2018, there have been no SBFT related iatrogenic pneumothoraxes across our 3-hospital system. The median days between each iatrogenic pneumothorax was 195 days.

Conclusion: This project demonstrates the effectiveness of developing a formal hospital guideline for the safe passage of small bore feeding tubes.

William Preston, MD
Mentor:
William Jarnagin, MD
Division of HPB Surgery, Memorial Sloan Kettering Cancer Center

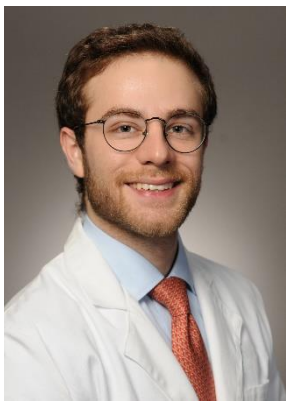
Extrahepatic Cholangiocarcinoma: Genomic Variables Associated with Anatomical Location and Outcome

Background: This study aimed to define genomic differences between perihilar (PCA) and distal (DCA) extrahepatic cholangiocarcinoma (ECA) and identify genomic determinants of survival.

Methods: Consecutive ECA patients with tissue for targeted next-generation sequencing were analyzed, stratified by anatomic site (PCA/DCA), disease extent, and treatment. Associations between genomic alterations, clinicopathologic features, and outcomes were analyzed using Cox proportional hazards regression to compare survival.

Results: Two-hundred-twenty-four patients diagnosed between 2004 and 2022 (n=127 PCA, n=97 DCA) met inclusion criteria. Median survival was 29 months (43 after resection and 17 from diagnosis for unresectable disease). Compared to PCA, DCA was enriched in TP53alt (alterations; 69% vs. 33%, Q<0.01), epigenetic pathway alterations (45% vs. 29%, Q=0.041), and had more total altered pathways (median 3 vs. 2, Q<0.01). KRASalt frequency was similar between PCA (36%) and DCA (37%); however, DCA was enriched in KRAS G12D (19% vs. 9%, P=0.002). No other clinicopathologic or genomic variables distinguished subtypes. In resected patients, no genomic alterations were associated with outcome. However, in unresectable patients, CDKN2Aalt (HR 2.59 [1.48, 4.52]) and APCalt (HR 5.11 [1.96, 13.3]) were associated with reduced survival. For the entire cohort, irresectability (HR 3.13 [2.25, 4.36]), CDKN2Aalt (HR 1.80 [1.80, 2.68]), and APCalt (HR 2.00 [1.04, 3.87]) were associated with poor survival.

Conclusions: CDKN2Aalt and APCalt were associated with poor survival in ECA, primarily in advanced disease. As PCA and DCA were genetically similar, co-analysis of PCA and DCA in future genomic studies is reasonable.



Hamza Rshaidat, MD
Mentor:
Olugbenga Okusanya, MD
Thoracic Surgery, Thomas Jefferson University Hospital

Incidence and Management of Cardiothoracic Relevant Extrapulmonary Findings found on Low Dose CTs

Background: We aim to investigate the incidence of extrapulmonary findings found on low-dose CT that may warrant evaluation by cardiothoracic surgeons and describe their management and referral patterns at our institution.

Methods: We conducted a retrospective cohort study of patients who underwent low-dose CT through a centralized Lung Cancer Screening Program at Thomas Jefferson University Hospital between January 2018 and December 2022. Chart review using the electronic medical record was performed for patients with incidental findings. Demographic, workup, referral, and management data was collected.

Results: 2,285 patients underwent low-dose CT, of which 16% (368/2,285) had an extrapulmonary finding that may have an indication for clinical evaluation by a cardiothoracic surgeon. The most common incidental finding was a hiatal hernia with a prevalence of 6.3% (144/2,285), followed by ascending thoracic aneurysms with a prevalence of 3.6% (82/2,285), and small pericardial effusions with a prevalence of 1.2% (28/2,285). Of the patients with symptomatic hiatal hernias, 29% (14/48) were referred to a cardiothoracic surgeon compared to only 6.25% (6/96) in the asymptomatic group. Of the patients with thoracic aneurysms, 48% (39/82) had aneurysms □4.2 cm. Of the □4.2 cm group, 18% (7/39) were followed by a cardiothoracic surgeon compared to 11.6% (5/43) in patients with aneurysms < 4.2 cm.

Conclusion: Hiatal hernias and ascending thoracic aneurysms were the two most prevalent incidental findings identified on low-dose CT during lung cancer screening. We demonstrated potential gaps in hiatal hernia referral patterns. Referring patients with thoracic aneurysms to cardiothoracic surgeons may not be initially warranted.