**Introduction:** As flexible endoscopy becomes an increasingly valuable minimally invasive approach to surgical challenges, an efficient and comprehensive training curriculum is needed to train surgeons competent in therapeutic endoscopy. We developed a modular curriculum utilizing a simulation-based, “into the fire” approach to endoscopic foreign body removal for practicing physicians with task performance pre- and post-testing.

**Methods:** From 2020 to 2021, two sessions of our advanced flexible endoscopy course were taught by two expert endoscopists specialized in gastrointestinal surgery. Our course uses ex-vivo porcine models and focuses on safe manipulation and foreign body removal utilizing our simulation module. The module is further composed of didactics and mentored practice simulations, followed by post-course examinations. Pre- and post-course assessments and surveys were used to evaluate knowledge, performance, and confidence of participants, and subsequently analyzed using the paired t-test.

**Results:** Of the 16 practicing physicians who participated in the course, 43.8% of whom were certified in Fundamentals of Endoscopic Surgery, and 62.5% had completed over 200 upper endoscopies. Upon course completion, scoring on knowledge-based written examinations improved from 3.4 ± 1.9 to 5.8 ± 2.0 (p < 0.001). Technical facility of each participant demonstrated significant overall improvement with post-course score increases from 15.8 ± 2.5 to 23.6 ± 1.6 (p < 0.001), with skill refinement specifically observed in technical subcategories of appropriate instrument use (p < 0.001), foreign body manipulation (p < 0.001), and successful foreign body removal (p < 0.001). Confidence surveys likewise demonstrated significant increase in confidence of skill competency after completion of the curriculum 11.6 ± 3.4 to 23.0 ± 5.5 (p < 0.001).

**Conclusion:** The “into the fire” approach to teaching endoscopic foreign body removal utilizing our simulation module provides an effective curriculum to improve knowledge, confidence, and overall technical performance. Our methodology utilizes hands-on, simulation-based pre-testing prior to instruction to introduce clinical scenarios and technical challenges, while accounting for and tailoring to provider-specific variation in knowledge and experience to facilitate training efficiency.
Use of Virtual Platform for Delivery of Simulation-Based Laparoscopic Training Curriculum in LMICs

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INTRODUCTION: Laparoscopic surgery is rapidly expanding in low and middle-income countries (LMICs), yet many surgeons in LMICs have limited formal training in laparoscopy. In 2017, Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) implemented Global Laparoscopic Advancement Program (GLAP), an in-person simulation-based laparoscopic training curriculum for surgeons in LMICs. Over a 1-weekend course, this program taught surgical residents laparoscopic skills and equipped attending surgeons with effective teaching strategies. In light of COVID-19, SAGES adapted GLAP to a virtual format, delivering this curriculum virtually over 6 months. This study explores the feasibility and efficacy of virtual laparoscopic simulation training in resource-restricted settings.

METHODS AND PROCEDURES: Participants from San Jose, Costa Rica, and Leon, Mexico, enrolled in the virtual GLAP curriculum, meeting biweekly for 2-h didactic classes and 2-h hands-on live simulation practice. Participants completed pre- and post-program surveys assessing their perception of simulation-based training. Surgical residents’ laparoscopic skills were evaluated using the Fundamental of Laparoscopic Surgery (FLS) exam during the initial and final weeks of the program.

RESULTS: Of the 23 total participants (11 attendings, 12 residents), 20 completed the pre-program survey, and 19 completed the post-program survey, while 10 residents completed both pre- and post- evaluation of FLS skills. Respondents (100%) reported the program was good use of their time and that education by telecommunication was easily reproduced. At completion of the program, residents were 38.2% faster in completing the bimanual transfer (2:15 vs 4:07, p < 0.05), 39% faster on the precision cutting (2:38 vs 4:14, p < 0.05), and 171% faster on the endoloop task (1:16 vs 2:48, p < 0.05). There was no significant difference in completing intracorporeal (4:33 vs. 6:51, p = 0.067) and extracorporeal knot tie (4:17 vs. 3:16, p = 0.205). On a Likert scale (1 = worst, 5 = best), participants appreciated the program’s quality (mean 4.68), effectiveness of teaching (mean 4.57, depth of content (mean 4.31), and quality of faculty (mean 4.74). Participants considered the practice sessions (47%) and access to mentors (32%) as their favorite aspects, while technical issues (32%) and class content (21%) were the least favorite aspects of the program.

CONCLUSION: A virtual simulation-based curriculum can be an effective training strategy for teaching laparoscopic skills to surgeons in LMICs. Participants demonstrated an improvement in laparoscopic skills, and they appreciated the mentorship and opportunity to practice laparoscopic skills. Future programs can expand on the use of a virtual platform as a low-cost, effective strategy for training laparoscopic skills in LMICs.

An Analysis of Publications Originating from Abstracts Presented at the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) Meeting

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Purpose/Background: Abstracts submitted to medical meetings undergo limited review prior to presentation but may significantly influence clinical practice before the peer review process required for manuscript publication. This study evaluates the rate of manuscript publication arising from abstracts presented at the SAGES Annual Scientific Meeting in 2019 and determine factors associated with publication. We hypothesize that successful publication is associated with podium presentation and higher H-index of authors.

Methods: Abstracts presented at the 2019 SAGES Annual Meeting were reviewed. Identification of published manuscripts by the same authors using the same data was completed using MedLine, Embase, Google Scholar, and verified via Scopus. Factors evaluated for association with publication were author and abstract measures including the number of prior publications and H-indices, mode and category of the presentation, country or state of origin, journal, and impact factor. Descriptive and bivariate statistics were described.

Results: A total of 726 abstracts (160 podiums, 566 posters) were included. The overall manuscript publication rate was 38.8%: 80% for podiums and 37.7% for posters (p < 0.001). The publication rate in Surgical Endoscopy was 93.7% for podiums compared to 24.7% for posters (p < 0.001). Median time to publication for podiums was 4 months [IQR 3–6] and 13 months [IQR 8–20] for posters (p < 0.001) (Fig. 1). The median journal impact factor was 4.6 [IQR 4.6–4.6] for podiums and 4.1 [IQR 1.9–4.6] for posters (p = 0.074). The median number of previously published manuscripts for first authors and senior authors were 4 [IQR 1–8] and 28 [IQR 7–76]; median H-indices were 3 [IQR 1–8] and 15 [IQR 5–30]. Successful publication was not associated with the number of previous publications (p = 0.47; p = 0.371) or H-indices (p = 0.23; p = 0.917) of first or senior authors on logistic regression.

Conclusion: A significant proportion of abstract presentations at the SAGES Annual Meeting are not published as peer-reviewed manuscripts. The conversion rate was significantly higher in podium presentations, likely due to manuscript submission requirements for podiums and higher quality projects being selected for podiums. Meeting attendees should be cognizant of incorporating the findings of presented research into clinical practice prior to peer review.
A Systematic Review of Robotic Surgery Curricula Using a Contemporary Educational Framework

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INTRODUCTION: There has been a rising trend in robotic surgery. Thus, there is a demand for a robotic surgery curriculum (RSC) amongst stakeholders. Despite several RSC, there are limited data available with respect to their curricular designs and the use of evidence based educational frameworks. Our aim was to study the existing RSC using Kern’s 6-step approach in curricular design and investigate implementation, settings, and types of assessments.

METHODS: A systematic review was conducted using PubMed, PubMed Central, Cochrane, Embase, and Scopus (search from 2001–2021). PRISMA Guidelines was used to guide the search. The curricula designed for general and upper GI surgery were included. Urology and gynecology were excluded. The articles were reviewed by 5 reviewers.

RESULTS: Our review yielded 66 articles. The majority of RSC used all elements of Kern’s curricular design. All RSC used commercial virtual reality simulators (VRS) and 36.4% only used VRS. A small percentage of curricula implemented dry or wet lab, cadaver, animal lab, and/or operating room (Table.1). Majority (63.2%) were designed to teach the use of robotic console and only 37% provided training on specific tasks and procedures. The main assessment modality were VRS performance metrics or global rating assessments (36% each). The self-reported survey and video review by experts were other assessment modalities, 10.6% and 8.5%, respectively.

CONCLUSION: Most institutions used commercial VRS as the main component of their RSC. Although the majority of the study incorporated all elements of Kern’s framework, there are critical deficiencies in teaching of the tasks and procedures, the quality of assessments tools in measuring operative performance, and measuring the educational value of these interventions. The next step is to study validity evidence for assessment tools and the educational effectiveness of these curricula.

Table 1. Categories of Robotic Surgery Curricula

| Curriculum          | Frequency (%) |
|---------------------|---------------|
| VR                  | 24 (36.4%)    |
| VR + dry lab        | 8 (12.1%)     |
| Dry lab             | 7 (10.6%)     |
| VR + OR             | 6 (9.1%)      |
| VR + wet lab        | 5 (7.6%)      |
| VR + Animal lab     | 3 (4.5%)      |
| VR + wet lab + OR   | 3 (4.5%)      |
| VR + dry lab + OR   | 2 (3%)        |
| VR + cadaver        | 1 (1.5%)      |
| VR: Virtual reality, OR: operative room |

Video Based Coaching for Surgical Residents: A Systematic Review and Meta-Analysis

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Background: Video-based coaching (VBC) is a relatively novel surgical education technique that can be used as a supplement to current teaching methods in surgery and may be useful in competency-based frameworks. Restrictions in resident work hours and recent operating room resource cut-backs because of the COVID-19 pandemic have rendered VBC even more applicable. The objective of this systematic review and meta-analysis was to pool previously published data and provide an update on the evidence for preoperative and postoperative VBC in post-graduate surgical education.

Methods: Medline, Embase, and CENTRAL were systematically searched. Articles were included if they were randomized controlled trials (RCTs) comparing surgical residents receiving and not receiving VBC. A pairwise meta-analyses using inverse variance random effects was performed. Standardized mean differences (SMD) were used as the primary outcome measure to account for differences in objective surgical skill evaluation tools. Risk of bias assessment was performed using the Cochrane Risk-of-Bias Tool for RCTs 2.0.

Results: From 2,727 citations, 12 studies with 179 residents receiving VBC and 159 residents receiving standard surgical teaching without VBC were included. There was no significant difference in post-coaching scores on objective surgical skill evaluation tools between groups (SMD 0.53, 95%CI -0.05 to 1.11, p = 0.07, I2 = 77%). However, residents receiving VBC were significantly more likely to improve upon their pre-coaching scores (SMD 1.96, 95%CI 0.74 to 3.19, p = 0.002, I2 = 85%). Results were unchanged with leave-one-out sensitivity analysis and subgroup analysis according to operative setting (i.e., simulation, operating room). Risk of bias was low for five studies, unclear for four studies, and high for three studies.

Conclusion: VBC is effective at improving objective surgical skills in post-graduate surgical trainees of various levels across both simulation and live-operative settings. The benefit may be most substantial for trainees with lower baseline levels of objective skill. Further study is required to determine the long-term benefits of this intervention as well as its impact on patient outcomes.
S012

Changes in Functional Neuroimaging Measures as Novices Gain Proficiency on the FLS Sutting Task

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INTRODUCTION: As trainees practice fundamental surgical skills, they typically rely on performance measures such as time and errors to determine improvement. However, these measures may be limited in their sensitivity. Thus, the goal of this study was to evaluate the use of portable neuroimaging measures to map the neural processes associated with learning basic surgical skills, towards the goal of developing further objective measures of skill development.

METHODS AND PROCEDURES: Seven subjects participated in this learning curve study. Each subject completed 15 sessions of training on the FLS suture with intracorporeal knot tying task in a standard FLS box trainer, finishing 75 repetitions of the task. Functional near infrared spectroscopy (fNIRS) data was recorded using an optode montage that covered the prefrontal and sensorimotor brain areas throughout the task. The HOMER3 and AtlasViewer toolboxes were used to calculate oxy-hemoglobin (HbO) and deoxyhemoglobin (HbR) concentrations. Average HbO changes were determined for repetitions performed during the first week of training compared to the third week of training. Statistical differences between the time periods were evaluated using a general linear model comparison, setting significance at p < 0.05.

RESULTS: Average performance scores across task repetitions increased significantly from the first week to the last week of training (250.7 (standard deviation = 86.6) to 447.3 (48.3), max = 600, p < 0.01). During the first week of training, there was significant lateral prefrontal cortex (PFC) activation (leftmost figure). Over the third week, significant activation was observed in the PFC as well as the sensorimotor areas (middle figure). When comparing the two periods, significant differences in activation (p < 0.05) were found for the 1) right medial PFC, 2) left lateral PFC, 3) left parietal cortex, and 4) left supramarginal gyrus (circled in yellow in rightmost figure). With increased proficiency, trainees had increased activation in regions associated with visuomotor performance.

CONCLUSIONS: As shown by the portable neuroimaging measures, learners engaged the sensorimotor areas more substantially as they developed skill on the FLS sutting task and contribute to the body of knowledge on objective metrics for skill evaluation.

S014

Minimally Invasive Surgery Fellowship Website Content: Are Applicants Receiving Enough Information?

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Objective: Advanced GI/Minimally Invasive Surgery (MIS) fellowships are one of the largest non-ACGME post-residency training pathways. MIS programs are highly competitive, with only 68% of applicants in the 2021 cycle matching into fellowship positions. An evaluation of MIS fellowship program websites is warranted to determine if general surgery applicants are receiving adequate information to meet their needs.

Methods: Using the Fellowship Council website, the authors identified 92 MIS fellowship programs that advertised open fellowship positions for general surgery residency graduates. These 92 fellowship websites were evaluated for 12 pre-identified variables based on published literature.

Results: 90% of websites included access to contact information and 72% of websites displayed selection criteria; however, other recruitment information offered to applicants was limited. Only 25% of websites mentioned interview details, 34% of websites showcased fellows, and 51% included a faculty directory. Regarding operative information, only 46% of MIS fellowship websites mentioned case volume, 23% mentioned hospital locations, and 55% mentioned rotation schedules. Didactic information focused on research productivity; academic conferences were only mentioned in 40% of websites. Fellow wellness and career information was skipped on many websites, with 30% describing resident benefits and 16% dedicating a section to career development. Overall, the mean number of pre-identified variables present on a fellowship website was 6.57 ± 2.39 (54.75% ± 19.17%).

| Website Information | Number of Programs | % Total |
|----------------------|--------------------|--------|
| Career Development   | 15                 | 16%    |
| Affiliated Hospitals | 21                 | 23%    |
| Interview Details    | 23                 | 25%    |
| Benefits             | 28                 | 30%    |
| Fellows              | 31                 | 34%    |
| Conferences          | 37                 | 40%    |
| Case Volume          | 42                 | 46%    |
| Faculty              | 47                 | 51%    |
| Rotations            | 51                 | 55%    |
| Selection Criteria   | 66                 | 72%    |
| Research             | 74                 | 80%    |
| Contact Information  | 83                 | 90%    |

Conclusions: General surgery residents turn to program websites when evaluating MIS fellowships. Although websites contain adequate information on several variables evaluated in the study, information on benefits and career development, fellow and faculty support, and case volume were limited. By including more information that is important to applicants on websites, MIS fellowship programs may attract applicants who are a stronger “match” for their program and lead to an overall better-informed applicant pool.
The Use of Advanced Robotic Simulation Labs to Advance and Assess Senior Resident Robotic Skills and OR Leadership Competency

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Introduction: Currently, robotic curriculum for surgical trainees mainly focuses on basic robotic skills. As robotic operations become more pervasive, residents are completing more complex cases in the live operative setting. However, there remains a lack of formal curricula focused on higher-ordered robotic technical and non-technical skills including obtaining optimal exposure, use of bedside assistant, and team leadership skills as the primary surgeon.

Here, we describe a novel curriculum for robotic hiatal hernia repair developed for senior surgical residents to be utilized as both practice of higher leveled robotic technical and leadership skills and as a standardized assessment of these skills.

Methods: Twelve senior residents (PGY4 and 5) participated in a robotic hiatal hernia repair skills curriculum at our surgical simulation center. Before and after the curriculum, residents completed a survey on demographics, robotic case numbers, confidence ratings, and a knowledge assessment. The curriculum began with a brief faculty-led robotic hiatal hernia repair didactic. Residents then independently completed a robotic hiatal hernia repair on an animate model in pairs. Two proctors provided minimal guidance throughout the simulation and scored residents using two validated assessment tools: Ottawa Surgical Competency Operating Room Evaluation (O-SCORE) and Global Ratings Scale of Operative Performance. Scores were analyzed using paired t-test and Pearson’s correlation coefficient.

Results: Prior to the curriculum, senior residents had low confidence (mean score: 2.6 on Likert scale from 1 to 5) on ability to independently complete a robotic hiatal hernia case. Confidence significantly increased post-simulation (mean score: 3.3, p = 0.0009). Mean O-SCORE was 3.6 out of 5 (range 2 – 4) and mean Global Rating Scale score was 25.4 out of 30 (range 12 – 31). O-SCORE and Global Rating scores were strongly positively correlated (R = 0.94, p < 0.00001). Number of robotic cases completed prior to the lab and O-SCORE had a strong positive correlation (R = 0.84, p = 0.0006). This was also true for the Global Rating Scale of Operative Performance (R = 0.88, p = 0.0002). “Use of bedside assistant” component on O-SCORE had the lowest mean score for residents.

Conclusions: Simulations such as this can be used (1) to practice higher ordered robotic technical and non-technical leadership skills in a low-stakes setting, and (2) to assess residents in a standardized method to evaluate competency, a crucial component as surgical education moves towards competency-based training.

Figure 1. Resident confidence ratings and knowledge scores pre- and post-simulation lab.

Figure 2. Number of robotic cases completed prior to simulation lab is strongly positively correlated with O-SCORE (Fig 2a) and Global Ratings Scale of Operative performance scores (Fig 2b).

S016

TRENDS IN RESIDENT SUPERVISION AND PATIENT OUTCOMES OF LAPAROSCOPIC CHOLECYSTECTOMIES AFTER ENFORCEMENT OF THE ACGME DUTY HOUR STANDARDS IN 2003.

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Introduction: Laparoscopic cholecystectomy is a common general surgery operation in which trainees are expected to become proficient. Recent changes in resident work hours and increased emphasis on patient safety have impacted resident supervision in unclear ways. The Veterans Affairs Surgical Quality Improvement Program (VASQIP) database tracks outcomes of surgical procedures within the VA. We sought to use this database to study laparoscopic cholecystectomy outcomes stratified on trainee supervision.

Methods: After IRB approval, records for 82,239 laparoscopic cholecystectomies from fiscal year 2000–2020 were obtained from the VAQIP database. Of these, 25,640 records did not define the level of resident supervision or were coded as staff only and were excluded. Frequency of resident operating without the attending scrubbed was trended over time. The remaining 54,144 cases were case matched based on sex, race, ASA score, diabetes, smoking, renal failure, COPD, CHF, steroid usage, wound classification, and emergency designation. Comorbidities and outcomes were examined. All data was examined using χ², Student t-test and Fisher’s Exact Test within SPSS version 26.

Results: Significantly more cases were performed without the attending scrubbed before 2003 than after (14.6% vs 1.60%, p < 0.001) After case matching, in 1464 cases the attending physician was scrubbed, and in 1549 the attending physician was not scrubbed. Patients were statistically similar in all measured comorbidities between the groups. Operative time was noted to be slightly longer when the attending was scrubbed (1.86 h ± 0.79 vs 1.72 ± 0.67, p < 0.001) as well as increased complication rates (9.0% vs 6.1%, p = 0.002) and need to return to the OR (4.0% vs 2.0%, p = 0.001). No differences existed for 30-day mortality (0.8% vs 0.5%, p = 0.416), post-operative length of stay (2.7 days vs 2.96 days, p = 0.453), or superficial infection (1.9% vs 1.7%, p = 0.728).

Conclusion: Our analysis of the VASQIP database indicates that rates of resident independent operating have minimal impact on patient outcomes. Longer operative time and complication rates with attendings scrubbed may reflect increased case complexity. Further research is required to better define the changes in resident surgical education and their impact on patient outcomes.
Development of a machine learning model for anatomical landmark detection based on the Rouvière’s sulcus and liver base of segment IV images for guiding bile duct dissection location

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OBJECTIVE: To develop the machine learning model for anatomical landmark detection system based on the Rouvière’s sulcus and liver base of segment IV images for guiding bile duct dissection location.

BACKGROUND: Common bile duct injury is a devastating complication of Laparoscopic cholecystectomy. Surgeons dissect in a potentially dangerous location due to misinterpretation and identification of the erroneous structure. Using a deep learning system coupled with a laparoscopic suite, surgeons can recognize the safety landmark in real time and maintain the dissection on course.

METHOD: The anatomical landmark detection model was developed with a deep learning algorithm to classify and locate Rouvière’s sulcus (RS) and liver base of segment IV with an experience laparoscopic surgeon’s supervision. The computer generates a line between RS and liver base of segment IV as a safety landmark for guide dissection. The model accuracy was evaluated with mean average precision. The prototype integrated with laparoscopic suite for investigated real-time clinical application.

RESULT: The fast deep learning algorithm YOLOv4 was used for supervised model training. The dataset of 6,400 images from 40 Laparoscopic cholecystectomy videos was arranged for developing the model and validating with two experienced laparoscopic surgeons. The average precision of each landmark computed at 1000th iteration is 54.91% for the liver base of segment IV; 9.42% for RS slit type; 46.10% for RS open type; 16.75% for RS scar type. Mean average precision of the model is 31.79%. The surgeons acceptance of the guide dissection line is 83.33%

CONCLUSION: The AI landmark detection system draws a guide dissection line between Rouvière’s sulcus and segment IV’s liver base. During laparoscopic cholecystectomy, this prototype model guides the surgeon to dissect in the right place with potential reduced risk of the common bile duct injury.

S018

IMPACT OF PREOPERATIVE ESOPHAGOGASTRODUODENOSCOPY IN PATIENTS UNDERGOING BARIATRIC SURGERY AND DEVELOPMENT OF A MODEL TO PREDICT ABNORMAL FINDINGS

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INTRODUCTION: Preoperative esophagogastroduodenoscopy (EGD) in patients undergoing bariatric surgery can help surgeons detect abnormalities in the upper gastrointestinal (UGI) tract that may require a change in surgical plan. However, the need for EGD before bariatric surgery is controversial. We aimed to determine the prevalence of UGI abnormalities and evaluate the predictive factors of abnormal findings that require a change in surgical plan or cause a delay in surgical treatment in patients who underwent bariatric surgery and develop a prediction model.

METHODS AND PROCEDURES: The medical records from January 2012 to July 2020 were retrospectively reviewed in patients who underwent EGD before bariatric surgery. The EGD findings were classified into four groups based on their effects on management. Group 1 had normal findings. Group 2 had abnormal findings that did not require a change in surgical management. Group 3 had abnormal findings that required a change in the surgical plan or caused a delay in surgical treatment. Group 4 had contraindications to surgery. Predictive factors for Groups 2 and 3 were analysed using univariate and multivariate analyses. A model visualized as a nomogram was developed based on significant factors. Discrimination and calibration were evaluated.

RESULTS: A total of 461 patient records (63.8% females) were reviewed. The mean age was 35.1 ± 11.2 years and the mean BMI was 47.7 ± 8.7 kg/m2. The prevalences of endoscopic findings in Groups 1, 2, 3, and 4 were 42.5%, 35.6%, 21.9%, and 0%, respectively. The most common abnormal findings in Groups 2 and 3 were non-erosive gastritis (31.2%) followed by Helicobacter pylori infection (18.7%) and hiatal hernia (10.2%). Male sex and NSAID use were significantly associated with detection of lesions in Groups 2 and 3 and either on univariate or multivariate analysis, while type 2 diabetes mellitus (T2DM) was a significant protective factor on multivariate analysis. On subgroup analysis in patients ≥ 40 years old, multivariate analysis revealed age, BMI, and NSAID use were significantly associated with detection of lesions in Groups 2 and 3, while T2DM was still a significant protective factor. A nomogram to predict lesions in Groups 2 and 3 for this subgroup was developed and showed good discrimination (C-statistics 0.737 [95% CI, 0.721–0.752]).

CONCLUSIONS: A high prevalence of abnormal endoscopic findings was observed in Thai patients who underwent bariatric surgery. Preoperative EGD screening is helpful in detecting UGI abnormalities. The new nomogram may help rational utilization of EGD prior to bariatric surgery.
Incidence and Short-Term Outcomes of General Surgeons Performing Elective Minimally Invasive Bariatric Surgery: A 5-year Review of MBSAQIP

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Introduction: Surgical weight loss procedures have become pivotal in the management of major comorbidities in patients with obesity. The number of such cases performed across the entire United States is on the rise. These surgeries are mostly being performed by Metabolic and Bariatric Specialty trained surgeons (MBS) however few are still being done by General Surgeons (GS) and thus we would like to study their incidence and the 30-day postoperative outcomes.

Methods: Patients undergoing elective minimally invasive sleeve gastrectomy and gastric bypass from the years 2015 to 2019 were identified using the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) database. Patients were classified based on the specialty of the physician performing the operative procedure and their outcomes analyzed (MBS vs GS).

Results: Of the 632,890 cases identified over the 5 years from the database, 2.5% were performed by GS. Patients in the GS group were white, higher ASA 4 category, lower incidence of preoperative factors such as smoking, hypertension, on dialysis, limited ambulation, cardiac and respiratory comorbidities, and being on therapeutic anticoagulation. Multivariate analysis of post-operative outcomes controlling for significant preoperative factors revealed a 15% increased risk of readmission (95% CI 1.05–1.27) with no significant difference in overall mortality or morbidity.

Conclusion: Approximately 2.5% of all minimally invasive elective bariatric procedures performed across the United States are by general surgeons. In the select patient population being operated by them, their overall outcomes are similar to those of specialty trained Metabolic and Bariatric surgeons.

FIGHTING THE OBESITY PANDEMIC DURING THE COVID PANDEMIC

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INTRODUCTION: The widespread effect of the COVID19 pandemic impacted the delay of surgical care. Specific patient populations have been identified as high risk of significant morbidity and mortality if they contract COVID19. One of these at-risk populations is the obese population. Prior literature shows the most effective way to combat obesity is by weight loss surgery. However, at different times throughout the COVID19 pandemic elective inpatient surgeries have been halted due to bed availability. Recognizing that major complications following bariatric surgery are extremely low (bleeding 0–4%, anastomotic leaks 0.8%), we felt outpatient bariatric surgery would be safe for low-risk patients. Complications such as DVT, PE, infection, and anastomotic leaks typically present over 7 days post-operatively, well outside the usual length-of-stay. Bleeding events, severe post-operative nausea, and dehydration typically occur in the first few days post-operatively. Our bariatric surgery group designed a pathway focused on detecting and treating these early post-op complications. Thus, allowing bariatric patients to undergo weight loss surgery as outpatients, going home on POD 0.

METHODS: We previously designed a preoperative evaluation tool that identified bariatric patients as low risk, moderate risk, and high risk. Low risk patients included patients with BMI < 50 and high functional capacity. During a 9-month period, 50 patients were identified as being low risk and an acceptable risk for outpatient surgery. We designed a postoperative protocol that included IV hydration and PO intake goals to meet a safe discharge. We sent patients home with a pulse oximeter and had them self-monitor their pulse and oxygen saturation. We called all patients at 10 pm to assess how they were doing and their vitals. Patients returned to clinic the following day and were seen by a provider, received IV hydration, and labs were drawn.

RESULTS: 50 of 55 patients (90.9%) were successfully discharged on POD 0. Zero of the 50 patients discharged were readmitted in the early post-operative period. Zero patients required a reoperation. We had zero deaths in the patient group discharged on POD 0.

CONCLUSION: We demonstrate that by identifying low risk patients for outpatient bariatric surgery and by implementing remote monitoring of vitals and outpatient hydration, we were able to safely perform outpatient bariatric surgery.
Post Sleeve Reflux: Indicators and Impact on Outcomes
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Introduction: Sleeve gastrectomy (SG) represents the majority of primary bariatric operations. However, post-operative gastroesophageal reflux disease (GERD) remains a significant morbidity, placing patients at risk of long-term proton pump inhibitor usage, esophageal malignancy, and operative re-intervention. We aim to evaluate the incidence and impact of within a single center experience.

Materials/Methods: A retrospective review of a prospectively maintained database was performed identifying patients undergoing laparoscopic or robotic SG. Primary outcomes included weight loss, rates of de-novo or aggravated post-operative GERD, and surgical or endoscopic re-intervention. Subgroup analysis was performed between Group 1 (post operative de-novo/aggravated GERD) and Group 2 (absence of post-operative or aggravated GERD) for differences between primary outcomes, preoperative endoscopy, manometry, and pH studies. De-Novo GERD and aggravated was defined as persistent GERD complaints or new/increased PPI usage in GERD naive or prior GERD patients, respectively.

Results: 392 patients were identified between 2014 – 2019. Average demographics were: age 42.3 (18 – 84) years, Charlson Comorbidity Index (CCI) 1.12 (0 -10), and body mass index (BMI) 43.5 (26 – 74). 98% of cases were performed laparoscopically. The average excess weight loss (EWL) was 51.0% and 46.4% at 1 and 2 years post-operatively. Average follow up was 516 (6 – 2694) days. 69 (17%) patients in total developed post operative de-novo or aggravated GERD. Group 1 had significantly higher EWL at 9 months (57% vs 47%, p 0.003). EWL at 1 year trended towards higher losses with Group 1 (56% vs 49%, p 0.051).

13 (3%) patients required operative re-intervention for both GERD and other morbidities: 4 RYGB conversions, 4 diagnostic laparoscopies, 3 HHR, 1 MSA placement. Group 1 (De-novo/aggravated GERD) had a higher rate of post-operative intervention at 14% compared to Group 2 (No De-novo/aggravated GERD) at 1% (p 0.0001).

Subanalysis demonstrated that Group 1 had elevated preoperative DeMeester scores on pH testing (34.8 vs 18.9, p 0.03). De-novo GERD had an elevated post-operative total acid exposure when compared to aggravated GERD (12.7% vs 7.0% p 0.03).

No significant differences were found between preoperative endoscopy findings (gastritis, esophagitis, hiatal hernia), pre and postoperative total acid exposure, post-operative DeMeester scores, and high resolution manometry values (distal contractile integral, integrated relaxation pressure, and percent peristalsis) regarding de-novo/aggravated GERD development.

Conclusion: Preoperative Bravo identifies patients at higher risk of GERD following sleeve, potentially prompting more aggressive HHR and patient education for risks of surgery.

Aspirin Use as a Risk Factor for Marginal Ulceration in Roux-en-Y Gastric Bypass Patients: A Meta-analysis of 22,205 Patients
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Background: Roux-en-Y gastric bypass (RYGB) is a recognized, safe bariatric procedure with minimal complications. Marginal ulceration, however, remains a challenging problem with an incidence of 8–12%. While chronic NSAID use is an established risk factor of ulcer formation, aspirin use itself as a cause for marginal ulceration is still unclear. We aim to compare the rates of marginal ulceration in RYGB patients with and without aspirin use.

Methods: PubMed, Science Direct, Cochrane, Web of Science, and Google Scholar were searched from articles between 2008 and 2021 by two independent reviewers using the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) system (Fig. 1). The risk of bias was assessed using Newcastle–Ottawa Scale. Metanalysis was conducted using a random-effect model.

Results: From 17,543 studies screened, we included 3 studies. One study had a low risk of bias, and the other 2 presented a high risk of bias in the Newcastle–Ottawa Scale. We included 22,205 patients, 1784 with aspirin use and 20,421 without aspirin use. After the meta-analysis, patients who used aspirin had a significantly higher marginal ulceration rate than those who did not (RR = 1.025 [95% CI 1.16 to 1.81], p < 0.002, I² = 56%), as shown in the Fig. 2. However, the study with a lower risk of bias did not correlate aspirin use with marginal ulceration.

Conclusions: Aspirin use is associated with increased rates of marginal ulceration after RYGB.

Supplemental Material:

Figure 1

Identification of studies via databases and registers
- Records identified from databases (n = 17,343)
- Records remaining after screening (n = 57,170)
- Reports excluded (n = 17,768)
- Records screened (n = 17,768)
- Reports not retrieved (n = 12)
- Reports assessed for eligibility (n = 8)
- Studies included in review (n = 3)

Figure 2

Identification of studies via databases and registers
- Records identified from databases (n = 17,343)
- Records removed before screening (n = 173)
- Records screened (n = 57,170)
- Reports sought for retrieval (n = 12)
- Reports assessed for eligibility (n = 8)
- Studies included in review (n = 3)
Introduction: Recent data describing gastrointestinal (GI) symptoms experienced by patients after bariatric surgery is lacking, and previous studies in sleeve gastrectomy patients have been limited in scope of follow-up time or extent of GI symptoms examined. We sought to characterize the frequency and duration of self-reported GI symptoms in patients who had undergone sleeve gastrectomy.

Methods and Procedures: Sleeve gastrectomy patients seen at three Boston area hospitals received electronic surveys prior to each appointment from 7/2020–7/2021. Prospectively collected surveys included questions regarding the following postoperative GI symptoms: abdominal pain, bloating, reflux when standing, reflux when lying down, dysgeusia, dysphagia, regurgitation, nausea, emesis, diarrhea, constipation, low blood sugar, palpitations, dizziness, and perspiration. Descriptive analyses were performed for patient demographics. Chi-square tests were used to compare frequency of GI symptoms between different follow-up timepoints.

Results: Four hundred ninety-one sleeve gastrectomy patients completed postoperative surveys with mean follow-up time of 1.9 years. Mean age was 46.6 years, and 81.3% were female. The most reported GI symptoms across the entire cohort included constipation (56.6%), bloating (54.0%), reflux when standing (41.5%), and reflux when lying down (39.9%) while the least commonly reported symptoms were palpitations (16.3%), low blood sugar (15.7%), and emesis (15.1%). Compared to the first follow-up visit, less than one month postoperatively, sleeve gastrectomy patients reported significantly less bloating and abdominal pain at three to six months postoperatively (p = 0.02, p = 0.003, respectively) and at six to twelve months postoperatively (p = 0.03, p < .0001, respectively); however, no significant differences were reported in diarrhea, constipation, or reflux across these timepoints. At follow-up timepoints greater than one year, patients reported significantly less bloating, abdominal pain (p = 0.21), diarrhea (p = 0.55), or constipation (p = 0.06) compared to first follow-up visit.

Conclusions: Patients experience both upper and lower GI symptoms following sleeve gastrectomy, and symptoms, including bloating, diarrhea, constipation, and reflux may persist through long-term follow-up. These self-reported symptoms guide preoperative counseling with patients considering bariatric surgery and inform postoperative expectations for both patients and surgeons.

Patient-Reported Gastrointestinal Symptoms following Sleeve Gastrectomy
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Introduction: The outcomes of endoscopic stenting used for treatment of marginal ulcer and associated complications following laparoscopic Roux-en-Y gastric bypass
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Introduction: Metabolic bariatric surgery (MBS) for morbid obesity has revolutionized the treatment of this disease process. These operations, however, have been associated with numerous potential post-operative complications. Marginal ulcers resulting after Roux-en-Y gastric bypass are well documented in the literature, with rates of 0.5–16%. Historically, the treatment of marginal ulcers has largely been based on the surgical platform. Emerging evidence suggests that endoscopic therapy with stenting is an acceptable, minimally invasive strategy to treat various bariatric surgical complications.

Objective: To determine if endoscopic stenting for marginal ulcer and its associated complications improves outcomes in patients who have undergone laparoscopic Roux-en-Y gastric bypass.

Methods: A retrospective review was performed on all patients who underwent laparoscopic Roux-en-Y gastric bypass with subsequent diagnosis of either a marginal ulcer or complication from marginal ulcer, at a single tertiary-care hospital, from April 2015-April 2019 with follow-up through November 2020. The control group consisted of patients treated by methods other than endoscopic stenting. The treatment group consisted of all patients treated with endoscopic stenting. Patient’s data included: demographics, medical history, presenting symptom, pertinent procedure data, treatment data, and outcome data.

Results: A total of 75 patients were included in the study. Of these, 58 (77.3%) were treated for their marginal ulcer without a stent, and 17 (22.7%) were treated with stent. Demographics and medical comorbidities were similar between study groups. Patient presentation leading to marginal ulcer diagnosis were similar between study groups with the exception of perforation. One patient treated without stent (1.7%) presented with perforation, compared to 8 patients in the stent group (44.4%; p < 0.001). Endoscopic evidence of treatment success was improved in the stent group (100% vs. 50%, P < 0.001). Median time to resolution of marginal ulcer was shorter in the stent group at 1.4 months (1.4 - 3.8), versus patients treated without stent at 4.5 months (2.3 - 8.7) p = 0.0007. Of those patients treated with covered stent, stent migration was noted in 50% of Wallflex stents and 14.3% of Axios stents. While not statistically significant, there exists a trend toward reduced migration rate in patients treated with Axios stent as compared to Wallflex stent, P = 0.129.

Conclusion: Based upon our findings of a shorter interval to treatment success, the use of covered stents for the treatment of marginal ulcer following bariatric surgery is a safe and effective approach. Stenting also appears to be a safe and effective treatment option for perforation resulting from marginal ulcer.
Effectiveness of Bariatric Surgery Targeting Opioid Prescriptions (BSTOP) Protocol on Postoperative Pain Control

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Background: There has been a recent increase in the application of various enhanced recovery after surgery (ERAS) protocols for bariatric surgeries. Studies thus far have shown a decrease in hospital stays without significant differences in readmission rates and complications. In 2019, the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) developed its own ERAS protocol, called Bariatric Surgery Targeting Opioid Prescriptions (BSTOP). It aims to decrease opioid prescriptions while improving postoperative pain management, by including multimodal methods of perioperative pain management, with minimization of opioid use, and regional anesthesia. The objective of this study is to evaluate the effectiveness of the BSTOP protocol on patients' needs for opioids postoperatively and upon discharge.

Methods: A single-institution prospective cohort study for patients who underwent bariatric surgeries from October 2019 to May 2021 was conducted. Data was collected on morphine equivalent dose (MED) of opioids during different stages of inpatient and outpatient care. Baseline data was collected from October 2019 to March 2020. BSTOP was implemented in July 2020 and data was collected until May 2021. The protocol called for a non-opioid medication regimen pre-, intra- and postoperatively and post-discharge with opioid use only upon patient demand postoperatively for severe breakthrough pain. There were no other changes in patient care, such as patient education and expectations. Primary outcomes were total opioid use post-operatively and upon discharge and length of hospital stay. Secondary outcomes were total opioid use post-operatively and upon discharge and length of hospital stay.

Results: A total of 1348 patients had bariatric surgery between October 2019 and May 2021 and were included in the study, with the baseline cohort consisting of 486 patients and BSTOP cohort consisting of 862 patients. On average, there was a 36% reduction in total inpatient opiate use (p < 0.001), 79% reduction in outpatient total opiate use (p < 0.001) and 92% reduction in patient-controlled anesthesia (PCA) fentanyl use (p = 0) after implementation of the BSTOP protocol in July 2020. The length of hospital stay also significantly decreased, with an absolute reduction of 0.31 days (p < 0.001).

Conclusion: The BSTOP protocol significantly reduced opioid use for both inpatient and outpatient care, near complete avoidance of PCAs and decrease in overall hospital stay.

Keywords: enhanced recovery after surgery; ERAS; BSTOP; bariatric surgery; sleeve gastrectomy; gastric bypass

Impact of the COVID-19 Pandemic on Utilization of Inpatient and Outpatient Bariatric Surgery

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Importance: During the COVID-19 pandemic, deferral of elective surgical procedures served as a primary mechanism to increase surge inpatient capacity. The extent to which the COVID-19 pandemic reduced access to bariatric surgery and whether health systems responded by shifting towards outpatient procedures remains unknown.

Objective: We assessed the extent to which the volume of bariatric surgery decreased during the COVID-19 pandemic, if there was a shift towards outpatient procedures, and whether the change in utilization varied by race and ethnicity.

Design, setting and participants: This is a retrospective observational study using the Premier Healthcare Database from 2019–2020. Data was extracted for hospitals performing laparoscopic sleeve gastrectomy and laparoscopic gastric bypass. A Poisson regression model with hospital fixed effects was used to assess the relative monthly within-hospital reduction in surgical encounters in 2020 compared to 2019.

Main outcomes and measures: The main outcome was the within-hospital monthly relative change in bariatric surgical volume. Secondary outcomes included the relative change in within-hospital inpatient and outpatient bariatric surgical volume and whether the proportion of inpatient and outpatient procedures varied by race and ethnicity.

Results: The volume of bariatric encounters decreased by 21.4% from 48,363 procedures among 235 hospitals in 2019 to 38,535 procedures among 231 hospitals in 2020. This decrease in volume was most pronounced for inpatient bariatric procedures in April and May with a 97.6% decrease (95% CI 98.3% – 96.7% decrease, p < 0.001) and 64.3% (95% CI 69.9%-57.7% decrease, p < 0.001), respectively. Outpatient bariatric surgery saw a 100% decrease in April (95% CI 100%-100% decrease, p < 0.001) and stable or increased volume compared to 2019 in all subsequent months. While the total volume of both procedures decreased, gastric bypasses made up a higher proportion in 2020 compared to 2019 (32.6% vs 30.7%, p < 0.005), a reversal of recent trends in the declining proportion of gastric bypasses performed relative to sleeve gastrectomy. The months of August and December saw the greatest proportion of gastric bypasses performed as outpatient (August: 275.0%, CI 79.8%-682.2%; December: 134.8%, CI 25.0%-340.8%). Variation in outpatient surgical utilization did not vary significantly by race.

Conclusions: The COVID-19 pandemic had significant effects on utilization of bariatric surgery. Our results suggest a small but significant shift towards outpatient bariatric procedures, and most pronounced for the gastric bypass. Overall, COVID-19 may have accelerated population health and value-based efforts to transition bariatric procedures from the inpatient to outpatient setting without a pronounced effect on widening disparities.
S029

Early Postoperative Weight Loss Predicts Nadir Weight and Weight Regain After Sleeve Gastrectomy and Roux-en-Y Gastric Bypass

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Background: Weight regain (WR) after bariatric surgery affects up to 20% of patients. Weight cycling, mediated by physiologic adaptations and epigenetic mechanisms, has been proposed as a potential explanation for this WR, however, reliable WR predictors have not been identified. Our study sought to examine the relationship between early postoperative WL, nadir weight, and WR following laparoscopic sleeve gastrectomy (SG) and Roux-en-Y gastric bypass (RYGB).

Methods: A retrospective review of prospectively collected data was conducted for morbidly obese patients who underwent RYGB or SG at a MBSAQIP center of excellence between 2012–2016 and had at least 4 years follow-up. Patient demographics, preoperative BMI, procedure type, and postoperative weight at 6, 12, 24, 36, and 48 months were recorded. Nadir weight was defined as the lowest recorded or reported weight by the patient during the postoperative period. Weight regain was defined as > 20% increase in weight from nadir. Linear and logistic regression models were used to determine the association between early postoperative WL with nadir weight and WR at 4 years after adjusting for age, gender, procedure type, and preoperative BMI.

Results: Data from 1,026 adults were reviewed; 76.8% were female with mean age of 44.9 ± 11.9 and mean preoperative BMI 46.1 ± 8. 74.6% had RYGB (n = 766) and 25.3% had SG (n = 260). Multivariable linear regression models showed that lower nadir weight was associated with increased WL at 6 months (Coef -2.16; 95% CI -2.51,-1.81), 1-year (Coef -2.33; 95% CI -2.58,-2.08), 2-years (Coef -2.04; 95% CI -2.25,-1.83), 3-years (Coef -1.95; 95% CI -2.14,-1.76), and 4-years (Coef -1.89; 95% CI -2.10,-1.68), all at the level of p = < 0.001. WR was independently associated with increased WL between 6 months and 1-year (Coef 1.59; 95% CI 1.05,2.14; p = < 0.001) and at 1-year (Coef 1.24; 95% CI 0.84,1.63; p = < 0.001) postoperatively. The multivariable logistic regression model showed significantly increased risk of WR at 4-years for patients with greater WL at 6 months (OR 1.20, 95% CI 1.08, 1.33; p = 0.001) and 1-year (OR 1.14; 95%CI 1.06, 1.23; p = < 0.001).

Conclusion: Our findings demonstrate that higher weight loss at 6 and 12 months after bariatric surgery may be risk factors for weight regain at 4 years. While these findings may be explained by the weight cycling theory, they also suggest that bariatric surgeons may need to follow more closely and provide additional treatment to this patient population to maximize their long-term success.

S034

Increasing Volume but Declining Resident Autonomy in Laparoscopic Inguinal Hernia Repair: An Inverse Relationship

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Introduction: With improvement in technology and technique, laparoscopic inguinal hernia (L IH) repair has become a valid option for repair of both initial and recurrent inguinal hernia. Both open and laparoscopic techniques need to be taught to surgical residents to prepare them for future independent practice. While residents more commonly perform open inguinal hernia (OIH) repairs independently, laparoscopic repairs tend to lead to less autonomy. We sought to examine the change in the distribution of hernia repair techniques and the respective trends in operative resident autonomy across the Veterans Affairs (VA) system.

Methods: Utilizing the VA Surgical Quality Improvement Program database, we examined inguinal hernia repairs based on the principle procedure code at all teaching VA hospitals from July 2004 to September 2019. All VA cases are coded for level of supervision at the time of surgery: attending primary surgeon (AP); attending scrubbed but resident is a primary surgeon (AR), and resident primary with attending supervising but not scrubbed (RP). Primary outcomes were the percentage of LIH versus OIH and resident autonomy over time.

Results: A total of 127,487 hernia repair cases were examined: 106,892 OIH (96,223 initial, 89,10 recurrent, and 1759 sliding) and 20,605 LIH (16,417 primary and 4188 recurrent). There were approximately 8000 to 9000 repairs performed each year, which slightly increased over time. During this time span, the proportion of LIH repairs increased from 9 to 28% (p < 0.001). RP cases decreased for LIH from 9 to 1% and for OIH from 17 to 4% while AP cases increased for LIH from 16 to 42% and for OIH from 18 to 30% (all p < 0.001).

Conclusions: LIH at VA hospitals have more than tripled over the past 15 years, now making up nearly one-third of all hernia repairs, most of which are initial hernias. Despite this increase, resident autonomy in LIH cases declined alarmingly. One reason may be the adoption of robotic surgery, however, laparoscopic versus robotic data is not available. The results demonstrate an urgent need to integrate enhanced minimally invasive training (laparoscopic and robotic) into a general surgery curriculum so that residents can be prepared for future independent practice.
S035

TRADITIONAL MARKER OF MALNUTRITION ASSOCIATED WITH WORSE OUTCOMES AFTER VENTRAL HERNIA REPAIR IN PATIENTS WITH HIGHER BMI

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Objective: Pre-operative nutrition is known to impact post-operative outcomes. However, an objective metric for assessing nutritional state is lacking. Ventral hernia patients, especially those with sarcopenic obesity, may be at higher yet unrecognized risk of preventable complications related to nutritional deficits. Measures of nutritional status are often considered post-operatively, missing the window of opportunity to reduce risk. We evaluated the relationship between current markers of pre-operative nutritional state and surgical outcomes in elective and emergency ventral hernia cases.

Methods: In a retrospective cohort study of prospectively collected institutional National Surgical Quality Improvement Program (NSQIP) data, we identified patients who had a ventral hernia repair (VHR) performed between 2018 and 2021 and had preoperative serum albumin levels recorded. Demographic information, procedure details, and outcomes were collected. Primary outcomes included length of stay, 30-day readmission rates, and discharge to rehab facilities. Secondary outcomes included any complication and/or wound complications.

Results: A total of 816 cases were evaluated. The mean albumin level was 4.08 ± 0.46; 9.1% of patients had low albumin, defined as < 3.5 g/dL. Those patients with low albumin had increased length of stay (p < 0.001), readmission rates (p = 0.002), and discharges to rehab (p < 0.001). On multivariate regression, a pre-operative albumin < 3.5 g/dL remained predictive of increased length of stay (p < 0.001). These trends persisted when stratifying by BMI > 30 and BMI > 35, suggesting worse functional outcomes in patients with sarcopenic obesity.

While albumin is classically thought of as a measure of nutrition, it is also a negative acute phase reactant that declines in states of acute inflammation, including sepsis. Indeed, when stratifying by low vs high albumin, significantly more patients with albumin < 3.5 were presenting emergently (p < 0.001). To minimize for potential confounders like an acute inflammatory response, patients with low albumin were stratified according to whether they were an elective or emergent case. Both elective and emergent cases were demographically similar including preoperative albumin (3.6 vs 3.1, p = 0.66) and BMI (29 vs 32, p = 0.89); however, emergent cases had increased length of stay (p < 0.001), readmission rates (p = 0.02), and discharges to rehab (p < 0.001).

Conclusions: Traditional markers of malnutrition such as pre-operative serum albumin may be insufficient to accurately risk stratify patients pre-operatively. More objective metrics to quantify nutritional status as well as a better understanding of nutrition-related phenotypes, including body composition, are required to identify patients who may benefit from peri-operative nutritional intervention to improve surgical outcomes.

S036

Outcomes of light and midweight synthetic mesh use in clean-contaminated and contaminated ventral incisional hernia repair: an ACHQC comparative analysis

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Introduction: Use of macroporous synthetic mesh in contaminated ventral hernia repair has become more frequent. The objective of this study is to compare the outcomes of ventral incisional hernia repair with permanent synthetic mesh in contaminated fields to those in a clean field.

Methods and Procedures: The Abdominal Core Health Quality Collaborative registry, a prospectively updated longitudinal hernia-specific national database, was retrospectively queried for adults who underwent open ventral incisional hernia repair using light or medium weight synthetic mesh and classified as clean (CDC Class I) or contaminated (CDC Class II/III). Univariate analysis was used to compare demographic information, hernia characteristics, and operative details. Odds-ratios (OR) were calculated using multivariate logistic regression for the primary outcome of 30-day SSI and secondary outcomes of 30-day SSO, SSO requiring procedural intervention (SSO-PI), and clinical recurrence at one year.

Results: 7219 cases met criteria for inclusion; 13.2% of these were contaminated. Clean and contaminated groups were similar in median age (59 vs 60 years), gender, race, nicotine use (9.3% vs 10.8%), subcutaneous flaps (31.9% vs 29.9%) and mesh location (inlay/onlay/sublay). Contaminated wounds were associated with higher ASA class, history of diabetes (25.3% vs 21.4%, p = 0.006), history of abdominal wall SSI (35% vs 19%, p < 0.001), history of MRSA infection (6.18% vs 2.8%, p < 0.001), as well as larger hernia width (median 12 cm vs 9.0 cm, p < 0.001), increased number of prior hernia repairs, prior mesh use, presence of a stoma (16.3% vs 0.5%, p < 0.001), increased operative time, and mesh placement in the preperitoneal (42.4% vs 37.9%, p = 0.014) or retromuscular (92.4% vs 80.6%, p < 0.001) position. Contaminated cases had higher rates of mesh infection (3.9% vs 0.8%, p < 0.001) and mesh removal (2.5% vs 7.3%, p < 0.001) at 1-year. 83.4% of patients had follow-up data at 30 days and 20.8% at 1 year. The adjusted OR for 30-day SSI in contaminated fields compared to clean was 2.603 (95% CI 1.959–3.459). OR for 30-day SSO was 1.275 (95% CI 1.017–1.600) and 2.355 (95% CI 1.817–3.053) for 30-day SSO-PI. OR for recurrence at one year was 1.489 (95% CI 0.892–2.487).

Conclusion: After adjusting for baseline differences, patients undergoing ventral incisional hernia repair using light or midweight synthetic mesh in contaminated fields have higher odds of 30-day SSI, SSO, and SSO-PI than those performed in clean wounds. The odds of recurrence are also higher and further studies with long term outcomes are needed to better evaluate the best treatment options for this patient population.
Which technique is better? A triple-arm comparison of inguinal hernia repair techniques.

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INTRODUCTION: Minimally invasive repair of inguinal hernias has become more prevalent over the last several decades. Although traditional open inguinal hernia repair is still practiced, laparoscopic and robotic approaches have been found to be safe and effective also, begging the question: which is the optimal repair? There is a paucity of data comparing the three approaches on unilateral, nonrecurrent inguinal hernias. The objective of our study is to present a large retrospective triple-arm outcome analysis between robotic, laparoscopic, and open unilateral, nonrecurrent inguinal hernia repairs at a single institution.

METHODS AND PROCEDURES: A total of 706 patients who underwent elective, non-recurrent inguinal hernia repair performed by eight general surgeons at a single institution from 2016 to 2019 were reviewed retrospectively. Patient baseline characteristics and postoperative outcome were examined by Kruskal Wallis or Chi-Square tests and Fisher’s Exact tests when appropriate. Benjamin–Hochberg method was used for pairwise comparison between procedure types. Resident involvement in the case was assessed and sub-group analysis performed to examine significant differences in OR time or postoperative outcomes.

RESULTS: There were 305 laparoscopic repairs, 207 robotic repairs, and 194 open repairs. Baseline comparison showed that open and laparoscopic repairs were performed on patients who are older (p = 0.03). There were no significant differences in complication rates (seroma, hematoma, surgical site infection, inguinodynia, and recurrence) between the three arms. Both robotic and open repairs had significantly longer operative times than laparoscopic repairs (p < 0.001). There was significantly less resident involvement in robotic repair when compared to open and laparoscopic repairs (p < 0.001). Resident involvement was associated with longer OR times (p = 0.001), but no significant difference in postoperative complications.

CONCLUSION(S): Our study demonstrates that all three repair techniques can be performed without significant differences in outcomes. There is likely an intrinsic bias to open inguinal hernia repair that selects for patients who are older or would not tolerate general anesthesia and/or intraperitoneal insufflation. Interestingly, operative time was not significantly different between open and robotic repair. This may be secondary to patients with larger incarcerated hernias being preferentially selected toward open repair. Given that there is no difference in outcomes amongst the three repairs, operative approach should be base off of surgeon preference and patient characteristics.
TEN-YEAR RECURRENCE AND COMPLICATIONS FOLLOWING VENTRAL HERNIA REPAIR IN A UNITED STATES COHORT

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Introduction: Ventral hernia repairs (VHRs) are very common operations in the United States, with high recurrence and complication rates reported in the literature. We sought to identify the 10-year complication and recurrence rate, as well as associated sociodemographic and operative characteristics associated with non-mesh or mesh-based VHRs.

Methods: This was an IRB-approved (2020H0317) retrospective cohort study of patients undergoing mesh or non-mesh VHR from 2009–2019 at a single tertiary-care institution. The electronic medical record was used to collect sociodemographic, clinical, and intraoperative details, and early (< 30 days) and long-term (> 30-day) postoperative complications. Up to ten-year follow-up was obtained for long-term complications, categorized as: hernia recurrence (HRR), major complications requiring emergency surgery (MCES), and non-recurrence procedural intervention (NRPI). Kaplan Meier survival curves were obtained for each long-term complication.

Results: Of the 291 patients included, the mean age at index operation was 52.10 ± 13.96 years (n = 287), 47.2% (n = 137/289) were female, 17.2% (n = 50/291) were Black/African American, 2.4% (n = 7/291) were Hispanic, 0.7% (n = 2/291) were Middle Eastern, and 0.3% (n = 1/291) were American Indian/Alaska Native. Almost half were publicly insured (n = 138/291). Of the index operations, 18.5% (n = 52/281) were for a recurrent hernia. Hernia types included: 56.0% (n = 163) incisional, 39.9% (n = 115) primary umbilical, 7.2% (n = 21) primary epigastric, 6.2% (n = 18) parastomal, and 0.7% (n = 2) Spigelian. Operative approaches included open (n = 170), laparoscopic (n = 120), and robotic (n = 8). Fascial closure was performed in 85.6% (n = 249/291) of cases and mesh was used in 67.4% (n = 196/291) of cases. The median follow-up time was 2253 days (interquartile range 1536–2966). There was a 13.1% (n = 38/291) rate of 30-day complications, including 3.4% (n = 10/291) surgical site infections and 14.1% (n = 41/291) surgical site occurrences. For long-term (> 30-day) complications, 31/291 patients had an HRR, 9/291 patients had an MCES, and 21/291 patients had an NRPI. At 10 years, the HRR-free survival probability was 55.62%, MCES-free survival probability was 82.25%, and NRPI-free survival probability was 89.96% (Fig. 1).

Conclusions: This preliminary analysis demonstrates a high incidence of HRR following VHR. Further analysis will elucidate specific patient and intraoperative factors like mesh type and location that may be associated with improved outcomes following VHR.
Presence of Refractory GERD-Like Symptoms Following Laparoscopic Fundoplication is Rarely Indicative of True Recurrent GERD

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Background: Laparoscopic fundoplication (LF) is the gold-standard surgical treatment for gastroesophageal reflux disease (GERD); however, fundoplication failure with recurrent GERD is a known complication, but the incidence of recurrent GERD-like symptoms and long-term fundoplication failure has been rarely reported. The purpose of this study was to identify the rate of recurrent pathologic GERD in patients with GERD-like symptoms following fundoplication. We hypothesized that a majority of patients with recurrent GERD-like symptoms that are refractory to medical acid suppression do not have evidence of fundoplication failure as indicated by a positive ambulatory pH study.

Methods: We tested this hypothesis in a retrospective cohort study of 353 consecutive patients undergoing LF for GERD between 2011 and 2017 at a large academic medical center. Baseline demographics, objective testing, GERD-HRQL scores, and follow-up data, collected by telephone interview, were collected in a prospective institutionally approved database. Those patients with return visits to clinic following the routine post-operative visit were identified (n = 136, 38.5%), and those with a primary complaint of GERD-like symptoms (n = 56, 16%) were included in this analysis. The primary outcome measure was the proportion of patients with a positive post-operative ambulatory pH study, defined as a DeMeester score greater than 14.7. Secondary outcomes included proportion of patients with symptoms managed with medical acid reducing medications, time to return to clinic, and need for reoperation. P-values < 0.05 were considered significant.

Results: Fifty-six (16%) patients returned during the study period for an evaluation of recurrent GERD-like symptoms with a median interval of 26 (14–51) months. Twenty-three patients (41%) were successfully managed expectantly or with acid reducing medications and did not require further evaluation. Thirty-three (59%) presented with GERD-like symptoms and failure of management with medical acid suppression and underwent repeat ambulatory pH testing. Of these, only five (9%) were found to have a DeMeester score of > 14.7. Ultimately, of those patients presenting with recurrent GERD-like symptoms, three (5%) underwent a recurrent fundoplication for recurrent pathologic GERD.

Conclusion: While fundoplication failure and recurrent GERD is a known complication of LF, the incidence of recurrent pathologic acid reflux is far lower than the incidence of GERD-like symptoms. Further, a low percentage of patients with recurrent GI symptoms require a revision of their fundoplication and a complete evaluation, including objective reflux testing, is critical to evaluating these symptoms.

Analysis of Morbid Obesity and its Impact on Anastomotic Leak after Esophagectomy

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Background: There are increasing rates of both morbid obesity and esophageal cancer within the United States population. Esophagectomy is increasingly needed to treat both benign and malignant diseases of the esophagus. This study analyzes the impact of body mass index (BMI) on anastomotic leak after esophagectomy.

Methods: This is a retrospective review of National Surgical Quality Improvement Program (NSQIP), including the esophagectomy-specific database, from 2016–2019 (4165 patients). Patients were stratified by BMI < 35 vs BMI > 35, with the primary outcome of leak after esophagectomy. Univariate analysis was performed for baseline demographics and outcomes. Logistic regression was used to determine the odds of leak for esophagectomy performed for all diagnoses (malignancy/dysphasia/other) as well as a subgroup analysis of patients who underwent esophagectomy specifically for malignancy/dysplasia (81.4% of total, 3390 patients).

Results: Of 4165 patients who underwent esophagectomy, 439 (10.5%) of patients had a BMI > 35 (Max 65). Patients with BMI > 35 were more likely younger (mean age 60 vs 64y, p < 0.001), white, female, nonsmoker, diabetic, have hypertension, and ASA ≥ 3. There were no differences between BMI groups for reason for esophagectomy (malignancy/dysphasia vs other), minimally invasive approach, conversion to open, mortality, and length of stay.

The BMI > 35 group reported higher operative times (p < 0.001), superficial surgical site infection (p < 0.001), return to operating room (p = 0.01), unplanned intubation (p = 0.04), blood transfusions (p = 0.04), DVT (p = 0.04), and leak (13.5% vs 10.1%, p = 0.01), on univariate analysis. However, BMI > 35 was not an independent predictor of leak, on multivariate analysis for all esophagectomy patients. Operative time, smoking and hypertension were independently predictive of leak. However, subgroup multivariate analysis of patients who underwent esophagectomy specifically for malignancy/dysplasia demonstrated that BMI > 35 was predictive of leak (OR 1.36, 95%CI 1.01–1.83), as well as operative time, hypertension, smoking, and DM.

Conclusion: Patients with a BMI > 35 reported greater anastomotic leak rates when compared to patients with a BMI < 35; Morbid obesity was not independently predictive of anastomotic leak for patients who underwent esophagectomy for all diagnoses however, was predictive of leak when esophagectomy was performed for malignancy/dysplasia, on subgroup analysis. The role of morbid obesity on possible risk of anastomotic leak should be considered with patients undergoing esophagectomy, particularly for malignancy.
Outcomes after Anti-Reflux Procedures: Nissen, Toupet, Magnetic Sphincter Augmentation or Antireflux Mucosectomy?

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INTRODUCTION: The purpose of the study is to compare patient reported outcomes between Laparoscopic Nissen Fundoplication, Laparoscopic Toupet Fundoplication, Laparoscopic Magnetic Sphincter Augmentation (MSA), and Antireflux Mucosectomy (ARM) in the treatment of gastroesophageal reflux disease.

METHODS AND PROCEDURES: This is a retrospective review of a prospectively maintained database that includes patients who underwent Nissen, Toupet, MSA, and ARM between 2008 and 2021. Pre-operative, intraoperative, and post-operative variables were compared between groups using the one-way ANOVA and chi-square tests with the Bonferroni correction for multiple comparisons. Reflux symptom index (RSI), Gastroesophageal Reflux Disease-Health Related Quality of Life questionnaire (GERD-HRQL), and Dysphagia scores were collected and compared using the Kruskal–Wallis test with Dwass, Steel, Critchlow-Fligner multiple comparisons.

RESULTS: Patients who underwent MSA and ARMs were younger than those who underwent fundoplication (Table 1). Pre-operative DeMeester scores were equivalent. Operative times were shorter in MSA and ARMs compared to both fundoplications but rate of intraoperative complications were similar. Length of stay was shortest after ARMs procedure, followed by MSA, then Toupet and Nissen. Patients who underwent ARMs had a faster return to activities of daily living (ADL) compared to those who underwent Nissen or Toupet. Hernia recurrence was higher in the Nissen group compared to Toupet but median follow up time was twice as long in this group. Quality of life metrics were equivalent between Nissen and Toupet at one, two, and five years of follow up. When compared to Nissen, GERD HRQL scores were higher after MSA at one year and RSI scores were higher at five years. When compared to Toupet, RSI scores were higher after MSA at two and five years.

CONCLUSION(S): More novel and less invasive antireflux procedures are faster and have shorter length of stay compared to traditional fundopilation. All antireflux treatments studied provide similar treatment resolution with low rates of dysphagia or gas bloat with the exception of MSA at certain time intervals.
COMPARATIVE ANALYSIS OF OPIOID USE BETWEEN OPEN AND ROBOTIC GASTRECTOMY

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Background: Minimally invasive surgery is associated with reduced time to functional recovery in various operations. However, the degree to which the robotic approach influences postoperative pain and opioid use after gastrectomy is unknown. The primary aim of this study was to delineate postoperative patient-reported pain scores and opioid use after robotic gastrectomy and compared to open gastrectomy for gastric cancer.

Methods: Patients with resected gastric cancer were identified from a prospectively maintained single-institutional database (November 2018 to August 2021). Clinical characteristics, short-term outcomes, inpatient oral morphine equivalent (OME) utilization (intraoperative, inpatient until 4 postoperative days), and pain scores were compared between open and robotic gastrectomy. Both groups were managed according to an enhanced recovery program in the perioperative period. Pain scores were measured for the duration of admission.

Results: Of 81 patients included, 50 underwent open and 31 underwent robotic gastrectomy. 35 (43%) underwent total, 42 (52%) underwent distal/subtotal, and 4 (5%) underwent proximal gastrectomy. All patients underwent transversus abdominus plane or quadratus lumborum regional block either via ultrasound or laparoscopy guidance with liposomal bupivacaine solution mixed with 0.25% bupivacaine before or at the initiation of the operation. Robotic gastrectomy patients had longer operation time (340 vs. 288 min), lower blood loss (50 vs. 138 ml), and shorter length of hospital stay (4 vs. 6 days) (all median, p < 0.001). There was no difference in the incidence of Grade ≥ IIa complications between the two groups ([robot] 3% vs. [open] 6%, p = 0.578). Intraoperative opioid use was not significantly different between the two groups ([robot] 49.0 vs. [open] 47.0, median; p = 0.480). Robotic gastrectomy patients used lower OME per day on each postoperative day (day 0–4, [robot] 59.0–5.0–2.5–0–0, vs. [open] 65.0 vs. [open] 169.5 mg, median; p = 0.035). There was no difference in daily maximum pain score between groups, except on day 4 ([robot] 1.2 vs. [open] 2.4, median; p = 0.035).

Conclusions: Robotic gastrectomy patients required lower daily OME during the first 4 postoperative days versus open gastrectomy patients, while both groups showed adequate postoperative pain control with the use of regional nerve blocks and our enhanced recovery protocol. These early results support the use of robotic approach for gastric cancer, when considered oncologically feasible, to minimize opioid use and further enhance patients' recovery.

Intraoperative EndoFLIP in Revision Foregut Surgery: Data Guided Decision Making Improves Outcomes

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Introduction: Minimally invasive revisional foregut surgery can be challenging and does not always lead to satisfying outcomes for the patient and the surgeon. EndoFLIP is a functional luminal imaging probe that uses impedance planimetry to assess distensibility at the esophagogastric junction (EGJ), which may guide intraoperative decision making in these complex cases. We aim to study the role of this technology in providing quantifiable data to aid in intraoperative decision making, and assess the ongoing role of EndoFLIP in primary foregut cases.

Methods: A retrospective review of a prospectively maintained database identified patients undergoing foregut surgery at a single academic center. EndoFLIP was used to measure distensibility index (DI) at the EGJ pre- and post-intervention. Patient factors included age, sex, BMI, and Charlson Comorbidity Index. Primary outcome was improvement in dysphagia for revision cases. Secondary outcomes included operative time, length of stay (LOS), readmission, need for additional intervention, symptom scores, PPI use, and patient overall satisfaction.

Results: A total of 54 consecutive patients undergoing revisional foregut surgery were identified. 17 (31.5%) underwent EndoFLIP (EndoFLIP) and the remaining 37 (68.5%) did not (noFLIP). 77.8% were female, mean age 58.8 years (range 19 – 80), average BMI 26.2 kg/m^2 (range 14.2 – 44.4). 48 (88.9%) patients were undergoing their first revisional surgery, and 6 (11.1%) undergoing their second. Median follow-up was 448.5 days (range 13 – 2813).

Overall, more EndoFLIP patients had resolution of their dysphagia: 64.3% vs 41.7% (p = 0.31). Patients with impaired motility on manometry had less post-intervention dysphagia in the EndoFLIP group compared with noFLIP at 26.7% vs 71.4% (p = 0.07). EndoFLIP patients also had more GERD-HRQL score improvement at 14.1 ± 14.4 vs 10.4 ± 15.0 (p = 0.48), and more improvement in overall satisfaction at 44.4% vs 29.5% (p = 0.52). LOS, readmission rates, and need for additional interventions did not differ between the two groups. Revisional patients with dysphagia resolution had average pre-intervention DIs of 3.3 ± 2.0, post-intervention DIs of 3.9 ± 1.3, with mean change of 1.2 ± 1.4. An additional 14 patients undergoing primary foregut surgery underwent EndoFLIP, which in 5 of these cases either changed intraoperative management or allowed for more precise tailoring of the wrap. Patients with improvement in GERD symptoms had average pre-DIs of 5.5 ± 1.9, post-DIs of 3.4 ± 1.3, and delta DIs of -2.0 ± 1.3.

Conclusion: EndoFLIP is a valuable and standardizable tool that optimizes dysphagia outcomes in revision foregut surgery.
Revision foregut surgery outcomes in patients with typical and atypical reflux

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Background: Revision laparoscopic anti-reflux surgery (RLARS) is effective in alleviating the typical symptoms of gastroesophageal reflux disease (GERD). Outcomes in patients with atypical GERD symptoms has not been well established. A composite Reflux Symptom Index (RSI) score greater than 13 indicates extraspheageal manifestation of pathological reflux. In this study, we analyzed the differences in quality-of-life (QOL) and perioperative outcomes between patients with atypical versus typical GERD who underwent RLARS.

Methods: A retrospective review was conducted of a prospectively maintained database of patients with pathologic reflux who underwent RLARS February 2003 and October 2019. The cohort was divided into two groups, those with typical versus atypical manifestation of GERD as defined by their RSI score. Patients with a RSI score of > 13 were assigned to the Atypical group and those ≤ 13 were assigned to the Typical group. Patient QOL outcomes were prospectively followed using the RSI survey. Significance was defined by p-value less than 0.05.

Results: A total of 133 patients (Typical 61, Atypical 72) were included in the final analysis. The two groups were similar (p > 0.05) in mean age (58.1 ± 13.3 vs. 55.3 ± 15.5 years), body mass index (29.6 ± 5.0 vs. 30.3 ± 5.4), female sex distribution (60.7% vs. 59.7%) and age adjusted Charlson score (1.76 ± 1.58 vs. 1.98 ± 1.94). The Typical group had a higher frequency of type III hiatal hernia (62.3% vs. 29.2%) and Collis gastroplasty (29.5% vs. 5.6%). The groups had similar rates of partial and complete fundoplication with similar mean length of stay (Typical: 3.0 ± 3.4 days vs. Atypical: 2.4 ± 1.7 days). After a mean follow-up of 30.2 ± 33.6 months, both groups reported similar rates of improvement in RSI outcome from baseline (58.1% vs 43.3%, p = 0.149). However, the RSI outcome at latest follow-up for the Typical group was significantly better than the Atypical group after RLARS.

Conclusion: Patients with typical and atypical GERD symptoms have a significant improvement in QOL outcomes. The typical group, however, demonstrated a significantly greater improvement in RSI scores. Therefore, highly selected patients with typical or atypical reflux may derive improvement in QOL outcomes after RLARS with minimal complications.

| Improvement in Reflux Symptom Index (RSI) score after revision surgery | Typical | Atypical | p-value |
|---------------------------------------------------------------|---------|---------|---------|
| Baseline RSI (mean ± SD) | 6.1 ± 3.0 | 27.3 ± 7.9 | < 0.001 |
| Follow-up RSI (mean ± SD) | 2.8 ± 5.3 | 15.9 ± 11.1 | < 0.001 |
| Percent Improvement | 58.1% | 43.3% | 0.149 |
SIMILAR HOSPITAL PROFITS WITH ROBOTIC ASSISTED HIATAL HERNIA REPAIR, DESPITE HIGHER OR SUPPLY COSTS

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Introduction: Robotic-assisted laparoscopic surgery has emerged as an alternative to traditional laparoscopy and may offer some clinical benefits when performing complex hiatal hernia repairs. Many institutions may choose to not perform robotic surgery because of perceived higher costs when they are already doing laparoscopy. We hypothesize that the robotic approach would yield a similar profit overall despite a possibly higher supply cost, while offering comparable outcomes to the traditional laparoscopic approach.

Methods: Financial and outcomes data from a single quaternary academic center was retrospectively reviewed from a prospectively collected database from July 2020 to May 2021. Laparoscopic hiatal hernia repairs and robotic-assisted repairs were compared for metrics including length of stay, operative time, hospital and supply cost, payments, and profits. Metrics of these two groups were compared using t-test analyses with significance set to $p < 0.05$.

Results: Seventy-three patients were included with 31 in the robotic group (42.5%) and 42 in the laparoscopic group (57.5%). There were no significant differences in length of stay (robotic mean 2.0 days, laparoscopic 2.55 days, $p = 0.09$) or operative time (257.6 min vs 256.7 min, $p = 0.48$) between the two approaches. The robotic approach was associated with higher supply costs ($2,655 vs $2,028, $p < 0.001$) and patient charges ($63,997 vs $56,276, p < 0.05$) (Figure). Despite higher costs associated with robotics, hospital profits were not different between the two groups ($7,462 vs $7,939, p = 0.42$).

Conclusion: Despite higher supply costs and charges for robotic-assisted hiatal hernia repair, hospital profits were similar when comparing robotic and laparoscopic approaches. Short term clinical outcomes were also similar. The choice of modality should be based on the preferences of individual institutions and surgeons.

Surgeon Experience with Insurance Barriers to Offering Gastric Bypass as an Evidence-Based Operation for Pathologic GERD

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Introduction: Obesity is an increasingly prevalent public health problem which is often associated with poorly controlled gastroesophageal reflux disease. Fundoplication has limited long-term efficacy in patients with morbid obesity and does not address additional weight-related comorbidities. The Roux-en-Y gastric bypass (RYGB) has been proven to be a superior option for effective and durable resolution of GERD in this patient population. Surgeons have reported that access to RYGB as surgical treatment for GERD is often limited by inadequate insurance benefits, but the magnitude and scope of this problem is unknown.

Methods: A 9-item survey evaluating surgeon practice and experience with insurance coverage for RYGB for GERD was developed and piloted by a SAGES Foregut Taskforce working group. This survey was then administered to the SAGES Foregut Taskforce as well as the SAGES Bariatrics and Foregut Facebook groups.

Results: 187 surgeons completed the survey. 89% reported using the RYGB as an anti-reflux procedure. 44% and 26% used a BMI of 35 kg/m2 and 30 kg/m2 respectively as a cutoff for the RYGB. 89% viewed the RYGB as the procedure of choice when addressing GERD in a prior bariatric surgery patient. 69% reported using the surgery to address recurrent reflux secondary to a failed fundoplication. 74% of responders experienced trouble with insurance coverage at least half the time the procedure was offered for GERD, and 8% reported they were never able to get approval for the procedure for GERD indications.

Conclusion: GERD and obesity are concomitant disease that are best addressed with RYGB. Insurance coverage is often limited by arbitrary and/or discriminatory policies which run contrary to evidence-based medicine. Patient advocacy is critical to improve access to appropriate medical care for GERD in patients with obesity.
The impact of mentorship on learning curves in transanal endoscopic microsurgery (TEM)

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Background: Transanal endoscopic microsurgery (TEM) has been widely adopted as an optimal technique for resection of select rectal neoplasms. TEM has technical challenges, including limited working space, narrow working channel, and reduced ability for instrument triangulation. It is unclear what the learning curve is for this technique. It is also unclear if this learning curve differs between mentored and non-mentored surgeons.

Objective: The purpose of this study was to characterize the learning curve for this technique, and to characterize the differences in learning curves between fellows and attending surgeons.

Methods: Prospective data from all TEM cases at our institution were reviewed as required for this study. Patient characteristics, tumor characteristics, operative details, and post-operative histology and outcomes were collected. Two unmentored surgeons, two mentored faculty surgeons, and four fellows were included. Operative time (OT) was the primary measure of proficiency. Restricted cubic spline curves were plotted to determine inflection points for OT by number of cases, and was adjusted for tumour size (cm²), tumour location, tumour height, peritoneal breach, and tumour recurrence status. Finally, we performed a multivariate regression to examine for factors associated with longer operative time for the first 50, 100 to 150, and beyond 150 cases.

Results: From March 2007 to May 2020, 945 TEM cases were performed. Mean OT was 52.4 min (± 30.7 min). There were low rates of bleeding (6.5%) and readmission (3.3%). Most of these procedures were for adenomas (52.2%), followed by adenoscarcinomas (35.2%). Fellows on average performed 37.4 cases during fellowship. Cubic spline analysis demonstrated that two unmentored surgeons reached a plateau in OT after approximately 150 cases, with a second plateau occurring after approximately 150 cases. The highest volume surgeons appeared to reach a plateau in OT after approximately 50 cases, with a second plateau occurring after approximately 100 cases. Fellows appeared to reach a plateau in their learning curve after approximately 100 cases. Fellows and attendings seemed to reach a plateau in their learning curve at approximately 20 cases, although 3 out of the 5 still seemed to be improving even towards the end of their fellowship.

Conclusions: Our retrospective review of four surgeons and four fellows is one of the largest series of reported TEM cases. Cubic spline analysis of TEM cases demonstrated that TEM is a technically challenging procedure that requires approximately 30 cases to become proficient. The number of cases to reach plateau was shorter among mentored surgeons compared to unmentored surgeons. Surgeons interested in developing a TEM program should obtain mentorship from surgeons experienced in TEM.

The use of laparoscopy for T4b colon cancer—are we playing with fire?

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Purpose: The laparoscopic approach for colon cancer has become widely accepted due to improved perioperative outcomes when compared to the open approach. However, its safety for T4 tumors, particularly for T4b tumors when local invasion occurs to adjacent structures, remains controversial. The aim of this study was to compare short and long-term outcomes in patients undergoing laparoscopic vs. open resection for T4a and T4b colon cancers.

Methods: A prospectively maintained, single institution database was queried to identify patients with pathological stage T4a and T4b colon adenocarcinomas electively operated on with curative intent between 2000 and 2012. Patients were divided into 2 groups based on the use of laparoscopy. Patient characteristics, perioperative and oncologic outcomes were compared.

Results: 119 patients (41 laparoscopic (L), 78 open surgeries (O)) met the inclusion criteria. No difference was observed in age, gender, BMI, ASA, and procedure between groups. Tumors treated by L resection were smaller than O (p = 0.003). No difference was observed in morbidity, mortality, reoperation or readmission between the groups. Length of hospital stay was shorter in L compared to O (6 vs 9 days, p = 0.005).

For all T4 tumors, conversion was necessary in 22% of the cases. However, when tumors were subdivided by pT4 classification, conversion was necessary in 4 of 34 (12%) pT4a patients vs 5 of 7 (71%) pT4b patients. In the pT4b cohort (n = 37), more tumors were treated by the open approach (30 vs 7). For pT4b tumors, the R0 resection rate was 94% (86% in L vs. 97% in O, p = 0.249). The use of laparoscopy did not impact overall survival, disease-free survival, cancer-specific survival, or tumor recurrence overall in T4 tumors and in T4a and T4b tumors respectively.

Conclusion: Laparoscopic surgery can be safely performed in pT4 tumors with similar oncologic outcomes as compared to open surgery. However, for pT4b tumors, the conversion rate is very high. The open approach may be preferable.
Long-term outcomes of self-expandable metallic stents as a bridge to surgery for obstructive and symptomatic primary tumors of stage IV colorectal cancer: A propensity-score analysis

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Introduction: Self-expandable metallic stent (SEMS) was introduced for the treatment of obstructive colorectal cancer (CRC) a few decades ago. However, its long-term outcomes remain controversial, especially for stage IV CRC. The aim of this study was to clarify the outcomes of SEMS as a “bridge to surgery” (BTS) for obstructive and symptomatic primary tumors in stage IV CRC by one-to-one propensity-score matching.

Methods and procedures: This retrospective cohort study was conducted at a single center from January 2007 to December 2017. Patients with obstructive and symptomatic primary tumors of stage IV CRC underwent primary resection (PR) or placement of a SEMS as a BTS. They were divided into SEMS and PR groups, and their short- and long-term outcomes were compared.

Results: In total, 52 patients were reviewed (SEMS group, 21; PR group, 31). Thirteen patients in both groups were matched using propensity scores. Patients in the SEMS group more frequently underwent laparoscopic surgery than those in the PR group (77% vs. 8%, p = 0.001) and fewer of them underwent stoma creation (8% vs. 38%, p = 0.16). The two groups showed no significant differences in perioperative and pathological outcomes. The 3-year overall survival was not significantly different between groups (41% vs. 31%, p = 0.19).

Conclusion: As a BTS, the use of SEMS for obstructive and symptomatic primary tumors in CRC stage IV can be a comparable option to PR in terms of short- and long-term outcomes, and yields better quality of life with respect to surgical procedures or stoma creation.

Safety of Robotic Surgical Management of Non-Elective Colectomies for Diverticulitis Compared to Laparoscopic Surgery

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INTRODUCTION—The utilization of minimally invasive surgery (MIS) in a non-elective setting remains controversial with minimal data focused on using robotics. The objective of this study is to evaluate the short-term outcomes for non-elective robotic colectomies for diverticulitis compared to laparoscopic procedures.

METHODS—All patients in ACS-NSQIP who underwent colectomy for diverticulitis between 2012 and 2019 were identified by targeted CPT codes and diagnosis codes. The cohort was narrowed to only MIS and non-elective cases. Patients with disseminated cancer, ascites, and ventilator dependence were excluded. The procedures were grouped by approach. The Fisher Exact test was used to examine the association of pre-operative variables with procedure type (laparoscopic vs robotic) as well as the univariable association of procedure type with outcomes. Covariates with p < 0.1 were entered into multivariable logistic regression models for 30-day mortality, postoperative septic shock, and reoperation.

RESULTS—A total of 6880 colectomies were evaluated (Laparoscopic = 6583, Robotic = 297). The robotic group included more females (53.4% vs 60.3%, p = 0.020), white patients (79.7% vs 86.2%, p = 0.001), preoperative bowel prep (54.0% vs 29.8%, p = 0.001), mechanical bowel prep (OR = 0.614, p = 0.006), antibiotic prophylaxis (OR = 0.907, p = 0.016), and increased operative time (OR = 1.002, p = 0.001), dependent functional status (OR = 2.205, p = 0.001), mechanical bowel prep (OR = 2.657, p = 0.007), dependent functional status (OR = 2.667, p = 0.003), and preoperative transfusions (OR = 3.182, p = 0.019), emergency status (OR = 2.241, p = 0.010), and higher ASA classification (OR = 3.170, p = 0.035), abnormal WBC (OR = 1.883, p = 0.046) were independent predictors for mortality. The independent predictors for reoperation included increased BMI (OR = 1.020, p = 0.033), CHF (OR = 3.100, p = 0.005), smoking (OR = 1.656, p = 0.001), higher ASA classification (OR = 1.601, p = 0.003), mechanical bowel prep (OR = 0.614, p = 0.006), antibiotic bowel prep (OR = 0.657, p = 0.035), and increased operative time (OR = 1.002, p = 0.017). The independent predictors for septic shock included CHF (OR = 3.953, p = 0.001), dependent functional status (OR = 2.246, p = 0.018), HTN (OR = 2.205, p = 0.001), emergency status (OR = 1.932, p = 0.004), preoperative sepsis (OR = 3.415, p < 0.001), mechanical bowel prep (OR = 0.416, p = 0.002), and increased operative time (OR = 1.003, p = 0.016).

CONCLUSIONS—When controlling for confounders, robotic approach was not a predictor for increased risk of mortality, reoperation or septic shock. Robotic surgery is a feasible option for the acute management of diverticulitis.
Ambulatory Colectomy: a Pathway for Advancing the Enhanced Recovery Protocol

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Historically, non-ambulatory colectomy has been the standard. As Enhanced Recovery After Surgery protocols have led to decreased length of stay, the concept of ambulatory colectomy has developed. However, indications, protocols, and limits have yet to be explored. With recent technological advancements, enhanced mechanisms for patient education, and emerging means of communication, the opportunity for same day discharge (SDD) after colectomy has become feasible.

We conducted a retrospective review on ambulatory colectomies spanning from 2/1/2019–8/31/2021. Patients were considered candidates for SDD if they were reliable, had social support, elective minimally invasive surgery, no major comorbidities, and overall healthy. Following the patient’s operation, they met strict requirements in the Post Anesthesia Care Unit for discharge, including: tolerating intake, voiding, pain controlled on oral medication, stable vitals, and ambulating. They were monitored closely via tele-health mechanisms over 7 days. Within the first week, they were seen for evaluation.

We identified sixty-nine (n = 69) patients who met criteria and underwent SDD after colectomy. The population ages ranged 21–82 years old. Of the 69 patients reviewed, only one patient was readmitted, 1.4% (0.014). All procedures performed in this study were done via a robotic approach, with no intraoperative complication. TAP block was performed by anesthesia. The population was evenly distributed by sex, with 33 male and 36 female patients. Patient sex or consult time associated with the procedure did not play a role in determining compatibility with SDD. The most frequently performed procedures included: low anterior resection (46.4%) and right hemicolectomy (15.9%), Table 1.

We feel that extensive patient and family education, an uncomplicated operation, communication and collaboration between the surgical team, anesthesia, and nursing staff is essential in providing safe and effective surgical care for SDD. We feel that these aspects are crucial in providing safe minimally invasive SDD colectomy.

### VTE Patient Characteristics

| Category          | Sex | Age | Surgery* | Type | Time to VTE diagnosis (d) |
|-------------------|-----|-----|----------|------|--------------------------|
| Malignant         | M   | 55  | M1 LAR   | PE/DVT | 15                       |
|                   | F   | 45  | RHC      | PE    | 24                       |
|                   | M   | 54  | RHC      | PE/DVT | 26                       |
|                   | F   | 71  | APR      | PE    | 16                       |
| Benign            | F   | 62  | Sigmoidectomy | PE/DVT | 22                       |
|                   | M   | 75  | TAC      | PE    | 28                       |
|                   |     |     |          |       |                          |

*APR: abdominoperineal resection, LAR: low anterior resection, RHC: right hemicolectomy, TAC: total abdominal colectomy.

**Conclusion:** Clinically significant VTE within 30 days after discharge after major colectomy was rare regardless of histology or surgical approach. Risks of post-operative VTE after colectomy may be overstated and recommendations for prolonged prophylaxis may not be justifiable in most, even cancer patients.
SINGLE-PORT ROBOTIC SURGICAL PLATFORM FOR COLECTOMIES: A PHASE II CLINICAL TRIAL

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Introduction: The promise of minimally invasive single port colectomy has been tempered by the technical challenges of performing it. A novel single port flexible robot has been developed to address these challenges. This study analyzes our initial experience performing single port robotic colectomies.

Methods: This is a prospective phase II trial of 42 consecutive patients undergoing single port robotic right colectomy (SP rRC) or anterior resection (SP rAR). Primary endpoints were conversion to open surgery or significant adverse events. Secondary outcomes included intraoperative complications, estimated blood loss, transfusion requirements, incision size, operating time, length of stay, time to flatus, time to low residue diet, and morbidities.

Results: Between October 2018 and August 2021, SP rAR (n = 34) and SP rRC (n = 8) were performed on 31 women and 11 men. Mean age was 58.9 years (36–84) and mean BMI was 26.4 (20.6–37.9). There were no conversions to open surgery. 93% of cases were performed via the SP robot with no laparoscopic ports. The mean incision size was 4.85 cm (3.5–7 cm). Mean EBL was 82 mL (10–370 mL). There were no transfusions. There were no mortalities and one Clavien-Dindo Grade IV complication (anastomotic leak and delirium tremens). Other morbidities included two seromas and one ileus.

Mean post-operative course (days) was as follows: flatus 2.05 (1–6), BM 2.17 (1–6), clears 0.69 (0–7), solids 2.14 (1–8), LOS 3.6 (1–13). All patients were discharged to home.

Mean lymph node harvest of the 10 cancer patients was 30 (15–66). All margins were negative with no short-term local recurrence (mean follow up 5.6 months).

There was no significant difference in docking time, operation time, return of flatus and bowel movement, or length of stay between SP rRC versus SP rAR. The 4 morbidities (9.5%) occurred in the SP rAR group (p > 0.05).

Conclusion: This phase II trial confirms that single port robotic colectomy is feasible for SP rRC and SP rAR and can be performed safely with good clinical results. The operation has a low conversion rate and minimal complications. More experience and multi-institutional studies will be required to corroborate these findings, but the initial results are impressive and encouraging.

Racial Disparities in Rectal Cancer Management: Are we Providing Equal Care?

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Introduction: Disparities in rectal cancer treatment ranging from preoperative care to surgical management have been reported, especially between African American and White patients. Evaluating the impact of disparities in the surgical management of rectal cancer in other racial/ethnic groups is necessary to improve postoperative outcomes. We believe there are disparities in the treatment of rectal cancer in racial minorities that impact care.

Methods and Procedures: Patients were identified using National Surgical Quality Improvement Project (NSQIP) participant user file alongside the targeted proctectomy (2016–2019) file. Patients undergoing surgical resection for ICD9/10 codes for rectal cancer were included. Current procedural terminology codes were used to identify surgical procedures. Patients were categorized by race into White, Black, Asian, and White-Hispanic. Propensity score matching accounting for known variables that impact surgical outcomes were included in the analysis (age, BMI, gender, tobacco, diabetes mellitus, surgical procedure, stage, tumor location, and neoadjuvant therapy).

Results: We identified 1,387 patients, of which 79.7% were White, 7.9% Black, 6.1% Asian, and 6.3% Hispanic. From 994 (71.7%) patients with advanced rectal cancer (LARC), only 73.1% received neoadjuvant therapy. On unadjusted analysis, Asian patients had significantly higher postoperative ileus rates and length of stay. After propensity score matching, Asian patients presented with a significantly higher rate of postoperative ileus (p = 0.033), length of hospital stay (p = 0.018), radial margin positivity (p = 0.001), and reoperation rate (p = 0.023). Black patients had significantly lower reoperation rates (p = 0.001) when compared to their White counterparts.

Conclusions: In a propensity score match study using national data, Asian patients had worst oncological outcomes when compared to their White counterparts. No other significant differences were found in Black or Hispanic patients. Comparative studies evaluating trends over time and a greater number of minority patients included in large databases are warranted in order to identify barriers in care for minorities.
A Matched Comparative Analysis of Outcomes after Colectomy for Diverticular Disease vs. Colon Cancer in Older Adults: An American College of Surgeons National Surgical Quality Improvement Project (ACS-NSQIP) Study

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Introduction: As the population ages, there is increasing demand for elective colorectal resections in older adults. This increased demand is occurring amidst a need to reduce healthcare utilization, improve surgical quality, and reduce overall costs. The colorectal indications that consume the majority of resources in older adults are colon cancer and diverticular disease. Better risk stratification and prospective planning for these cases could improve clinical and financial outcomes. However, no work to date has assessed which disease is more valuable to target more resources on. Better risk stratification and preoperative planning could greatly impact outcomes. Further work will quantify improvements in clinical and financial outcomes for diverticular disease after implementing the proposed changes.

Methods: This was a retrospective cohort study using the Nationwide Inpatient Sample (NIS) database. Adult patients (18–85 years) who underwent inpatient colorectal surgery with a primary diagnosis of CRC from 1993–2016 were identified using ICD-9 codes. The main outcome was rate of in-patient colorectal surgery for CRC over time. The secondary outcome was urgent colorectal resection or stoma on the same admission. Discharge-level weights were used to generate national estimates. Simple and multiple linear regression were used to describe trends in in-patient colostomies for CRC and identify predictors of change over time. Multiple logistic regression was used to identify predictors of urgent surgery.

Results: Overall, 80,389 patients underwent in-patient colostomies for CRC, with a significant decline from 7.6/100,000 in 1993 to 2.9/100,000 admissions in 2016 (R² = 0.9696) (figure-1a). Mean age at inpatient colorectal surgery has also significantly declined from 69 ± 12.5 to 62 ± 12.5 years (p < 0.001) (figure-1b). Patients aged 45–75 had the highest rate of inpatient colostomies (61.6%), while patients <45 and >75 had 5.6% and 32.8%, respectively. Most patients had Medicare/medicaid insurance (68.8%) and were white (73.5%), while 49.6% were male and 29.8% were in the lowest income quartile. After accounting for clinically relevant covariates, number of comorbidities (p < 0.001), age < 45 (OR 2.6, 95% CI 2.5–2.9), weight loss (OR 5.1, 95% CI 5.0–5.1), obesity (OR 2.5 95% CI 2.4–2.5), female gender (OR 3.5, 95% CI 3.3–3.7), self-pay/no insurance (OR 2.0, 95% CI 1.8–2.1), and white race (OR 1.25, 95% CI 1.2–1.3) were significantly associated with inpatient colorectal surgery for CRC over time (p < 0.001). On the same admission as in-patient colorectal surgery, 60.9% underwent urgent surgery. Urgent surgery was significantly associated with female gender (OR 1.2, 95% CI 1.1–1.24), age > 75 (OR 1.07, 95% CI 1.0–1.12), private insurance (OR 1.3, 95% CI 1.2–1.4), obesity (OR 1.1, 95% CI 1.0–1.2), and metastatic disease (OR 1.4, 95% CI 1.1–1.7).

Conclusion: The rate of in-patient colorectal surgery for CRC is decreasing over time. Predictors for in-patient colorectal surgery over time include young (<45) age, female gender, self-pay/no insurance, obesity and having more comorbidities. Urgent surgery for CRC is common in these patients.
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**Americas Minimally Invasive Liver Resection (AMILES) Database**

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**Background:** Multi-center collaborations allow surgeons to transcend limitations inherent to single-institution studies. To amalgamate real-world data and set benchmarks for surgical outcomes, we have established the Americas Minimally Invasive Liver Resection Database (AMILES).

**Methods:** We created a web-based database of relevant variables to track outcomes of laparoscopic and robotic liver resection in North and South America. Data from the registry was accessed on Jan 15, 2021 and a descriptive statistical analysis was performed.

**Results:** Data entry commenced on Oct 26, 2019. To date, 1762 cases have been entered into the database from 10 institutions in the US and Canada (median case per institution = 140, range 1–449). Among cases in the database there are 354 wedge resections (< 1 segment), 204 left lateral sectectomy/n, 120 left hepatectomies, 136 right hepatectomies. The most common diagnosis for surgery was colorectal liver metastases (n = 508), "other" (n = 595) and hepatocellular carcinoma (n = 385). 112 (6.3%) patients had undergone prior liver surgery, 368 patients (20.9%) had pre-operative chemotherapy and 34 patients (1.9%) underwent pre-operative portal vein embolization. The initial operative approach was laparoscopic in 1062 cases (60.3%), hand-assisted in 414 cases (23.5%) robotic in 286 cases (16.2%) and which differed significantly between institutions (p < 0.001 Fisher’s exact). The median number of lesions resected was 1 (range 1–39) and the median lesion size was 24 mm (range 1-91 mm). Overall, the conversion rate was 7.7% (n = 136) with the most common reason for conversion being inadequate visualization of the operative field (n = 40, 2.3%), followed by bleeding (n = 24, 1.4%). Forty-one (2.3%) were converted from laparoscopic to hand-assist, and 95 cases (5.4%) were converted from lap/robotic to open. Intra-operative ultrasound was utilized in 1381 case (78.4%) and Pringle was used in 194 cases (11%). Two hundred and sixty-three patients underwent concurrent ablation (14.9%) with 133 microwave (7.5%) and 128 radio-frequency (7.3%) ablations.

**Conclusions:** AMILES is a large MIS liver registry presently containing data from 8 institutions in North America comprised of cases collected retrospectively and prospectively. As more institutions join the collaboration and more prospective cases accrue, this powerful resource will produce benchmarks for expected short and long-term outcomes of minimally invasive liver resection.

**S211**

**Does Metabolic Syndrome Effect the Perioperative Outcomes of Patients Undergoing Robotic Hepatectomy? A Propensity Score Matched Analysis**

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**Introduction:** Metabolic syndrome is a known risk factor for postoperative complications after ‘open’ hepatectomy. Literature analyzing perioperative outcomes of patients with metabolic syndrome undergoing a minimally invasive hepatectomy is limited. Herein, we sought to determine if metabolic syndrome significantly impacts the perioperative course and outcomes of patients undergoing robotic hepatectomy.

**Methods:** Out of 279 patients prospectively followed after robotic hepatectomy, we propensity score matched (by age ± 5 years and IWATE score ± 1) 37 patients with and 37 without metabolic syndrome; ‘metabolic syndrome’ was assigned when patients had a BMI ≥ 28.8 kg/m2, diabetes, and hypertension. Perioperative outcomes of patients were compared utilizing Student’s t-test/Mann-Whitney U-test and Fisher’s exact test with significance determined at a p-value ≤ 0.05. The data are presented as median(mean ± SD).

**Results:** 70% of patients underwent hepatectomies classified as ‘advanced’ or ‘expert’ level of complexity using IWATE. Patients who had metabolic syndrome vs. those without had greater BMI (p < 0.0001) and lesser Child–Pugh score (p < 0.0001) (Table) without differences in MELD score, cirrhosis status, operative duration, operative EBL, postoperative complications (e.g., ascites, wound infection, bile leak), length of stay, 30-day readmissions, and 60-day mortality (Table).

**Conclusion:** In our study, metabolic syndrome had no impact on intra- or postoperative complications or outcomes. We believe that the robotic approach may mitigate the adverse effects of metabolic syndrome for patients undergoing robotic hepatectomy.
Synchronous major hepatic resection with primary colorectal cancer increases risk of organ space infections

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Introduction: One quarter of patients with colorectal cancer present with metastases, most commonly to the liver. Traditionally these patients underwent resection of the primary colorectal lesion followed by chemotherapy and hepatic resection. With improvement of outcomes in hepatic surgery, there has been a shift to simultaneous resection of both the primary colorectal cancer and hepatic metastases in a single operation. Several studies from high volume centers have demonstrated similar outcomes between the two approaches. The goal of this study is to determine if synchronous resection increases risk of surgical site infections (SSIs).

Methods and procedures: We conducted a cross-sectional retrospective analysis of the targeted hepatectomy NSQIP database from 2014–2019. The primary outcome was surgical site infections stratified into superficial, deep, organ space, and wound dehiscence. We performed univariate logistic regression to determine if there were higher odds of SSIs in patients undergoing hepatic resection concurrently with primary colorectal resection. Subsequently, we performed multivariable logistic regression to assess the effect of synchronous hepatic resection on the outcome while controlling for potential confounders and including relevant covariates. Additionally, we performed stratified analyses by size of hepatic resection (partial, total left, total right, and trisegmentectomy).

Results: Of the 7,445 patients included in the study, 431 (5.8%) underwent synchronous resection and 7,014 metachronous resection. On average, synchronous resections prolonged surgery by 62 min. There was no difference in superficial and deep SSIs between the groups; however, there was a significant difference in organ space SSIs. Patients undergoing synchronous resection had 1.51 times the odds of developing an organ space SSI (OR = 1.51, 95%CI = 1.10, 2.17, p = 0.04) compared to patients with metachronous resection on multivariate analysis. Patients undergoing a lobectomy concurrently with a colorectal resection had 2.30 times the odds of developing an organ space SSI (OR = 2.30, 95% CI = 1.20, 6.86, p = 0.010).

Conclusions: Prior studies demonstrated that synchronous resections are safe in properly selected patients with no difference in long-term outcomes. Few studies have explored immediate perioperative outcomes between the two approaches. After controlling for confounders, we demonstrate that synchronous resection with major hepatic surgery increases the risk of organ space SSIs. This study does not distinguish whether the organ space SSI was a result of the colon or liver resection. Future studies should elucidate the precise source of organ space SSIs in order to decrease the risk of this adverse outcome. Nevertheless, surgeons should be aware of this risk and discuss this with patients pre-operatively.

PREOPERATIVE TRANSVERSUS ABDOMINIS PLANE BLOCK DECREASES INTRAOPERATIVE OPIATE USE DURING MINIMALLY INVASIVE CHOLECYSTECTOMY

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Introduction: The ongoing epidemic of prescription opioid abuse is one of the most pressing health issues in the United States today. Consequently, analgesic adjuncts, such as multimodal drug regimens and regional anesthetic blocks (like transversus abdominis plane (TAP) block), have been introduced to the perioperative period in hopes of decreasing postoperative opioid use. However, the effect of these interventions on intraoperative opioid use has not been examined. We hypothesized that preoperative TAP block would be associated with decreased intraoperative opioid use during minimally invasive cholecystectomy.

Methods and Procedures: This was a retrospective review of minimally invasive cholecystectomies performed at a single large academic institution between June 2018 and January 2021. Perioperative data, including operative time and medication administration were collected. Intraoperative opioid medications were used to calculate a total morphine equivalent dose (MED) for each patient and adjusted for operative time. Univariate analysis and multivariate linear regression were performed to determine factors affecting intraoperative opioid requirements. The regression model included analgesic adjuncts and clinically relevant patient characteristics.

Results: A total of 138 patients were included in the analysis, 53 (38.4%) received an ultrasound-guided TAP block, after intubation and prior to incision, and 85 (61.9%) did not receive preoperative TAP blocks. On univariate analysis, preoperative acetaminophen (p = 0.006), celecoxib (p = 0.003), and gabapentin (p = 0.008) were associated with decreased intraoperative opioid use, but not intraoperative ketorolac (p = 0.211). Preoperative TAP block (0.201 MED/min) was also associated with decreased intraoperative opioid use compared to no preoperative block (no block or postoperative block) (0.319 MED/min, p < 0.001). Multivariate linear regression demonstrated that preoperative TAP block was the only adjunct significantly associated with decreased intraoperative opioid use (mean difference = -0.096 MED/min, p = 0.002).

Conclusion: The use of preoperative TAP block was associated with decreased intraoperative opioid use during minimally invasive cholecystectomy and should be considered for routine use. Future research should investigate whether preoperative TAP blocks and a subsequent decrease of intraoperative opiates, also result in a decrease in postoperative opiate use and improvements in postoperative outcomes.
MINIMAL INVASIVE TREATMENT HAS REDUCED MORTALITY IN SEVERE PANCREATITIS—AT THE COST OF LONGER HOSPITAL STAY AND MORE CASES OF POST-PANCREATITIS-DIABETES

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Objective: Treatment strategies for severe acute pancreatitis has evolved from open surgical interventions towards minimal invasive interventions. This change has been enabled by improved radiologic methods, foremost CT-scan. In our hospital, the minimal invasive approach has been fully adapted since 2009. The aim of this study was to evaluate treatment results for severe acute pancreatitis in our hospital, comparing two time periods; 2000–2007 (previous) with 2010–2017 (recent).

Method and Procedures: Retrospective study of case files in a single center. Severe pancreatitis was defined as organ failure for > 48 h. Patients with verified pancreatitis and > 48 h ICU-stay were included. Age, hospital stay, ICU stay, all interventions/procedures, mortality and post-pancreatitis diabetes were recorded.

Results: A total of 89 patients were identified, 45 in the previous group and 44 in the recent group. There was no difference in age (median 57 y (16–82)) or ASA-score between the groups and no difference in ICU-stay, median 5d (2–67). During 2000–2007, open necrosectomy was performed in 5 patients, no patient had transgastric drainage. During 2010–2017 no open necrosectomies were performed, 10 patients had transgastric drainages and 7 percutaneous (3 with combined techniques). Among patients who had open necrosectomy 4/5 died. No patient died after transgastric drainage. Open necrosectomy correlated with mortality (p = 0.014).

Mortality was significantly lower in the recent group where 3/44 patients (7%) died compared with 12/45 (27%) in the previous group (p = 0.012). The 3 patients who died in the recent group were older than those who died in the previous group, median 80 y (79–82) compared with 65y (30–79) (p = 0.018) Total hospital stay was significantly longer in the recent group (median 25.5 d (6–224)) vs 18 d (2–130) p = 0.030. Post-pancreatitis diabetes occurred in 14/41 survivors in the recent group compared with 6/34 in the previous group (p = 0.101), these survivors had longer hospital stay than non-diabetic survivors, both overall (p = 0.005) and within the recent group (p = 0.041). Comparing the two groups, including both survivors and deceased, significantly more patients in the recent group had diabetes after 1 year, 14/44 compared with 6/45 (p = 0.003), indicating that survivors in the recent group survived at the cost of diabetes. Within the recent group, survivors with diabetes were younger than those without diabetes (p = 0.032) and had longer hospital stay (p = 0.03).

Conclusions: Mortality from severe pancreatitis decreased significantly with minimal invasive treatment strategies. This was accompanied by longer hospital stay and more cases of post-pancreatitis diabetes.

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Modern Trends in Minimally Invasive versus Open Hepatectomy for Colorectal Liver Metastasis: An Analysis of ACS-NSQIP

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Introduction: Complete surgical resection of colorectal liver metastasis (CRLM) provides the best opportunity for prolonged survival. Eligibility for metastasectomy has expanded with technical advancements such as parenchymal-sparing hepatectomy (PSH). Meanwhile, enthusiasm for MIS approaches has increased, though this technique may be preferentially utilized for solitary wedge resection as PSH often requires deep and accurate dissection with ultrasound guidance. Recent trends in integration of MIS and open approaches within the context of PSH and tumor specific characteristics are not well described. The purpose of this study is to characterize modern trends in open versus MIS approaches to PSH and anatomic hepatectomy for CRLM within a nationwide cohort.

Methods and Procedures: The American College of Surgeons’ National Quality Improvement Program (ACS-NSQIP) was used to investigate trends in MIS versus open hepatectomy for CRLM from 2015–2019. We analyzed baseline clinicopathologic and disease-related characteristics, comparing open to MIS approaches. Trends over the study period were examined, focusing on PSH versus anatomic resection.

Results: A total of 7460 patients undergoing hepatectomy for CRLM were identified (1375 MIS, 6085 open). Patients had similar clinicopathologic features between the two groups, but patients undergoing open resection more commonly had a preoperative bleeding disorder (4.3% vs. 2.5%, p = 0.003). Patients undergoing MIS resection less frequently received neoadjuvant therapy (50.8% vs. 63.8%, p < 0.001), concurrent intraoperative ablation (14.9% vs. 21.2%, p < 0.001), intraoperative Pringle maneuver (16.3% vs. 31.5%, p < 0.001), or biliary reconstruction (0.9% vs. 1.9%, p = 0.040). Patients with tumors < 2 cm (33.6% vs. 25.8%, p < 0.001) or only one tumor (47.3% vs. 32.1%, p < 0.001) more commonly underwent MIS. Total number of MIS and open partial hepatectomies both significantly increased over the study period, but open partial hepatectomy is increasing at a greater rate than MIS (p = 0.0002) (Fig. 1). Rates of anatomic resections have remained the same, most open (> 87.0%). For patients with ≥ 1 concurrent partial hepatectomy, the rate of increase for open resection was significantly greater than for MIS resection (p = 0.0004). Patients undergoing > 2 concurrent partial hepatectomies are nearly twofold more likely to undergo an open operation (OR 1.94, 95% CI 1.56–2.38).

Conclusions: Hepatectomy for CRLM has increased over time, largely attributed to an increase in partial hepatectomies, translating to increased use of PSH. Current trends suggest MIS approaches appear to be increasing, but selectively implemented for patients with less technically demanding disease characteristics. This represents a call to action for further development and dissemination of MIS techniques for more complex resections.
Hand-Assisted Laparoscopic Surgery in Distal Pancreatectomy: Outcomes compared to Open and Laparoscopic approaches

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Introduction: Hand-assisted distal pancreatectomy technique has been suggested as an adjunct to the laparoscopic approach to facilitate difficult dissections, control unexpected bleeding, and/or shorten operative time. The aim of this study was to compare surgical outcomes between open vs. hand-assisted vs. laparoscopic distal pancreatectomies.

Methods: We included and compared patients undergoing elective distal pancreatectomy by open (OPD), hand-assisted (HALS), or laparoscopic (LDP) approaches in the distal pancreatectomy-targeted NSQIP database from 2014 to 2018. Descriptive and multivariate analysis were performed to compare postoperative outcomes.

Results: Among 6275 patients, 54.9% (n = 3447) underwent OPD, 12.7% (n = 802) HALS, and 32.2% (n = 2026) LDP. In general, there were no differences in baseline comorbidities among groups including age, smoking status, and functional status. However, patients who underwent OPD were more likely to be diabetic, have a higher ASA class (p < 0.0001), more preoperative weight loss (6.9% vs. HALS:4.9% vs. LDP:3.0%; p < 0.0001) and history of bleeding disorder (4.0% vs. HALS:2.7% vs. LDP:2.3%; p = 0.002). Total operative time was slightly longer for OPD 198 min vs. HALS 193 min vs. LDP 193 min; p = 0.051. Superficial surgical site infection rates were higher among the OPD and HALS groups (2.8% vs. 2.3%; respectively) compared to LDP (1.2%). Postoperative sepsis rates were higher in HALS (4.1%) compared to OPD and LPD groups (3.5 vs. 2.2% respectively; p < 0.008). Reoperation was more frequent in the OPD and HALS versus LPD group (2.6, vs. 2.2 vs. 1.5 respectively; p = 0.04).

Conclusion: While patients undergoing elective distal pancreatectomy benefit from minimally invasive surgeries in general, our results suggest a benefit for using the pure laparoscopic vs. the HALS approach, without a significant difference in operative times.

Single Center Experience With Minimally Invasive Distal Pancreatectomy Over 10-Years

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Introduction: Surgical experience and technology continues to evolve in the field of pancreatic surgery, and minimally invasive (MIS) distal pancreatectomy has now become the standard of care. To date, there are very few reports comparing the different available modalities.

Objective: To assess differences in perioperative outcomes, oncologic soundness and safety between three MIS modalities for distal pancreatectomy.

Participants: All patients who underwent MIS distal pancreatectomy performed by the senior author at Cedars-Sinai Medical Center between 2010 and 2020 were analyzed using a prospective database. Clinical and oncologic outcomes were compared between totally laparoscopic (TL), laparoscopic-assisted (LA) and robotic distal pancreatectomy (RDP).

Results: 159 MIS distal pancreatectomies were performed during the study period, consisting of 30 TL, 85 LA and 44 RDP. There were no significant differences in BMI or gender ratio between the groups. Patients in the LA group were older (median age 72, p < 0.05). There was no significant difference in length of hospital stay (LOS), pancreatic fistula rate, 60-day morbidity, or 60-day readmission rate between the three groups. Of the preoperative variables, pancreatic adenocarcinoma diagnosis was predictive of a longer LOS on multivariate analysis (OR 1.2, p < 0.001) compared to other cases. In cases of pancreatic adenocarcinoma, all 3 groups had high rates of R0 resection (90% to 100%). The LA group had a higher lymph node yield (12.3 in LA vs. 10.1 in TL and 11.0 in RDP, p < 0.05).

Conclusions: All three MIS techniques demonstrated comparable short and long term outcomes. For adenocarcinoma patients, despite having a longer LOS, there was no oncologic advantage of one modality over another. As the field continues to evolve, it should be noted that laparoscopic and laparoscopic-assisted distal pancreatectomy is as safe and effective as the robotic approach, and should remain a part of every HPB surgeon’s armamentarium.
MAGNETIC RESONANCE ELASTOGRAPHY OF CHRONIC PANCREATITIS IN PATIENTS UNDERGOING TOTAL PANCREATECTOMY AND ISLET AUTOTRANSPLANTATION

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Introduction: Currently, imaging with endoscopic ultrasound (EUS), MRCP or CT are most commonly used to aid the diagnosis of chronic pancreatitis (CP). These methods, however, have not proven sensitive for early diagnosis of CP amongst those who might benefit from total pancreatectomy with islet autotransplantation (TPIAT). We hypothesized that stiffness values obtained from magnetic resonance elastography (MRE) imaging may detect pancreatic fibrosis and therefore could be an additional diagnostic tool for early CP. The objective of this pilot study was to compare MRE stiffness values to histopathologic findings in patients with CP who underwent TPIAT.

Methods and procedures: Twelve patients aged 18–75 years, who were referred to our medical center for assessment of CP including MRINRCP as part of their evaluation, were invited to participate in this pilot study to also acquire MRE data during their clinically indicated MRE/MRCP exam. Patients provided informed consent. MRE stiffness values were obtained from different regions of the pancreas; while head and tail were most commonly assessed, the body, neck, and uncinate process were also evaluated in some patients. Patients subsequently underwent TPIAT, at which time multiple biopsies of the explanted pancreas were obtained from 11 of 12 patients. To evaluate for CP, the pancreas biopsies were stained with hematoxylin–eosin and trichrome to further evaluate for fibrosis. This histologic data was then compared to the corresponding MRE data to determine if MRE could predict histologic fibrosis.

Results: Forty-one pancreatic biopsy specimens from 11 patients were analyzed. Histologic diagnosis consistent with CP was observed in 23 (54.76%) of 42 specimens. The averaged MRE stiffness observed was 0.95 (IQR: 0.86 to 1.05). A two-way ANOVA revealed there was not a statistically significant interaction between the highest/most severe histologic fibrosis score observed among pancreatic biopsy specimens and observed averaged MRE stiffness scores (Fig. 1a, F = 4.80, p = 0.04) or the highest observed MRE stiffness score (Fig. 1b, F = 1.66, p = 0.26) within a specific patient.

Conclusions: MRE stiffness scores were not associated with histologic fibrosis severity in patients with early-stage CP or recurrent acute pancreatitis undergoing TPIAT.

Laparoscopic liver resection: A tool to improve outcomes in obese patients requiring liver resection

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Introduction: Obesity is a pandemic, that is not only a risk factor for fatty liver disease and potential cirrhosis, but also poses technical challenges intraoperatively and has been demonstrated in peer-reviewed literature to contribute to increased postoperative morbidity. Use of minimally invasive surgery in obese patients, increased with advancements in laparoscopic liver surgery and has led to more obese patients undergoing laparoscopic liver resections. Outcomes in this cohort remains under-evaluated, especially when utilized in the non-academic setting. The current study evaluated laparoscopic liver resection outcomes in obese patients in a community health system.

Methods: All patients undergoing laparoscopic liver resection by a single surgeon at flagship hospital of the community health system, between 2013 and 2020 were included in this retrospective review. Patients were classified based on body mass index (BMI), and obese patients = BMI ≥ 30 kg/m2. Univariate analysis, using Fisher exact test, two-tailed t-test and Chi-square test utilized to identify associations between obesity and intra-operative and post-operative complications. Multivariate analysis using logistic regression, to determine association with composite complication (including bile leak, infection, bleeding and cardiorespiratory complication) was performed. Secondary outcomes included estimated blood loss (EBL), conversion to open surgery, 90-day reoperation and readmission. P-value < 0.05 was considered significant.

Results: Overall 90 patients underwent laparoscopic liver resection during this 7 year period; non-obese = 52 and obese = 38. No statistically significant differences in baseline characteristics between non-obese and obese groups including age (56.8 ± 11.6 vs. 53.1 ± 15.1 years, p = 0.21), female gender (53.8% vs. 60.5%, p = 0.53) and ASA (3.02 ± 0.54 vs. 3.13 ± 0.53, p = 0.33), 73% non-obese and 80.9% obese patients had a malignant diagnosis.

On univariate analysis, no statistically significant differences noted in non-obese and obese groups: EBL (416.2 ± 641.9 cc vs. 373.9 ± 348.4 cc; p = 0.69), operative time (167 ± 74 vs. 150 ± 61 min; p = 0.84), bile leak (4.1% vs. 2.6%; p = 0.1), post-operative bleeding (4.1% vs. 2.6%; p = 0.1), infection (4.1% vs. 0%; p = 0.5), cardiorespiratory complication (12.2% vs. 10%; p = 0.1), complication Clavien grade (p = 0.87) or conversion to open surgery (5.7% vs. 5.3%; p = 0.1). No statistically significant differences were noted in length of stay (5.87 ± 11.89 vs. 4.26 ± 2.47 days, p = 0.42), 90-day reoperation (2% vs. 0%, p = 0.01) and 90-day readmission rates (4.1% vs. 2.6%; p = 0.01) of non-obese versus obese groups. Multivariate analysis showed no significant association with composite complication score (p = 0.079, 95% confidence interval = 0.19–0.89) after adjusting for alcohol abuse, neoadjuvant therapy and prior liver surgery.

Conclusion: Laparoscopic liver resection is a key technique in improving outcomes in obese patients that require liver resection. Larger prospective multicenter studies are warranted to externally validate these findings.

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