Surgical Quality, NSQIP and ERAS – Hosted by the CT Surgical Quality Collaborative

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Assessment of Resident Confidence Following Vascular Surgery Anastomosis Simulation

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Introduction: The traditional method of surgical education is centered around honing skills in the operating room setting in a progressive fashion. However, evolution of surgical residency including implementation of work-hour restrictions, increasing complexity of surgical cases and technological advancements necessitate that resident education must extend beyond the OR. Furthermore, growing public scrutiny of surgical outcomes and the fear of litigation have served to further diminish resident participation in surgical operations compared to decades prior. In response to these constraints, surgical simulation has emerged as an indispensable tool in learning surgical skills. Simulation allows repetitive, independent practice of fundamental skills in a patient-safe environment. Furthermore, it provides a low-consequence environment in which residents can practice both technical and cognitive skills. Vascular surgery is a specialty which requires a unique subset of skills. The delicacy with which one must handle vascular tissue, the suture type and instruments utilized necessitate residents have extensive practice to master the skill of successful arterial anastomosis. The objective of this study was to examine the impact of vascular anastomosis simulation on resident performance and confidence.

Method(s): Fourteen general surgery trainees, ranging from PGY-1 to PGY-5, from Stamford Hospital participated in an attending-guided vascular anastomosis clinic to practice an end-to-side anastomosis. Prior to the vascular simulation, residents completed an anonymous, voluntary questionnaire with questions focused on their confidence levels with the instruments and skills required for successful completion of an anastomosis. Residents were then proctored to perform an anastomosis using a simulation model. The questionnaire was re-administered following completion of the vascular anastomosis clinic to evaluate residents' progression in knowledge, comfort-level, and confidence in performing vascular anastomosis.

Results: Fourteen residents participated in the anastomosis clinic, with ten residents completing both the pre- and post-clinic survey. The majority of residents (9) had no prior experience with a vascular simulation. Prior to the anastomosis clinic, residents (9) rated their ability to explain the steps of an anastomosis as less than average, with 4 residents rating this as 'very poor' and 5 residents rating their ability as 'poor'. Two residents rated their ability as 'average' with no residents rating their ability as 'above average' or 'excellent'. 80% (8/10) of residents reported an improved ability after the simulation, with two residents reporting their ability as unchanged. Ten residents reported the clinic as helpful (4) or very helpful (6) in their ability to explain the steps of an anastomosis. Prior to the simulation clinic, trainees rated their comfort level with performing an anastomosis as either 'very

uncomfortable' (3) or 'uncomfortable' (8). After completion of the clinic, 60% of trainees reported an increased level of comfort while three residents reported their comfort level as unchanged. The majority of residents reported an improved level of confidence tying with 6-0 prolene (6) and operating while wearing loupes (7) after the anastomosis clinic compared to prior. 70% of trainees reported an improvement in their confidence in setting up an end-to-side anastomosis after completion of the simulation compared to prior, with three residents reporting their confidence as unchanged.
Conclusions: Self-rated procedural competence improved for the majority of residents after completion of the vascular simulation clinic. Trainees rated the clinic as helpful or very helpful in their ability to explain the steps of anastomosis creation.

Comparing COVID and Pre-COVID Colorectal ERAS Outcomes and Compliance: a Look at the Impact of COVID on Perioperative Surgical Services

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Introduction: Enhanced Recovery After Surgery (ERAS) is a multimodal, multidisciplinary approach to the care of the surgical patient aimed at reducing the physiologic stress of surgery. Protocol compliance, continuous auditing, feedback among the multidisciplinary team, and an adequately trained staff are essential to harness the beneficial effects of ERAS. External factors such as adequate access to healthcare, social and financial resources, and organizational oversight also impact ERAS efficacy. The COVID epidemic has negatively impacted both access to care as well as the delivery of care clinically, operationally, and financially in the United States. The surgical impact has yet to be fully quantified. While the benefits of ERAS in pre-COVID conditions are well established, the impact of COVID on ERAS delivery, compliance and surgical outcomes have yet to be qualified. This study assesses the impact of COVID on the ERAS pathway in a robust colorectal program with a well established ERAS program.

Methods: This retrospective single center study was conducted to assess the impact of COVID on surgical outcomes for patients undergoing elective colorectal surgery following ERAS protocol from 2017-2022. Patients undergoing surgery between March 1, 2020 and June 1, 2022 (n=318) were classified as "COVID" patients. These patients were compared to the most recent 318 patients undergoing colorectal surgery prior to March 1, 2020, who were classified as the "Non-COVID" patients. Information was collected from data entered into the ERAS Interactive Auditing System provided by the ERAS society. ERAS compliance, 30 day complications, readmission, and mortality were compared. Nursing administrational data was also collected. Baseline characteristics, outcomes, and administrative variables were analyzed for differences in patient populations. χ^2 analysis with Fischer's exact test, Student's t test, logistic regression, and MANOVA with an α=0.05 were used to compare treatment groups. All testing was two-sided.

Results: The baseline characteristics of "COVID" and "Non-COVID" patient groups were comparable except for BMI (28 vs 29, p=.019). There was no statistical difference in length of stay (4.1d and 4.2d, p=.75). 30 day readmission (12% and 7.2%, p=.05) and 30 day complication rate (15% and 8.2% p=.017) were significantly different. Compliance of all pre-operative, intra-operative, and post-operative ERAS elements did not differ significantly between the two groups. Nursing turnover and patient to nurse ratio were significantly higher and volume of nursing staff was significantly lower during the COVID period.

Conclusion: The ERAS program that had hitherto COVID been highly effective in reducing surgical complications lost efficacy during the COVID period. The detrimental impact of COVID included increased complications and increased readmissions. Factors such as compliance with ERAS protocol components and differences in patient population were assessed and found to be comparable during the two time periods. With equally comorbid and equally compliant patients, systematic differences must account for poorer surgical outcomes during the COVID pandemic. In the COVID period, there was a significantly higher nursing turnover, a significantly higher patient to nurse ratio, and a significant decrease in the absolute number of nurses. A stressed hospital workforce can translate into decreased delivery of services, time with patients, continuity of care, and staff that is unfamiliar or improperly suited to our specific surgical population. While the cause of COVID's negative impact on surgical outcomes is multifactorial and while there are many intangibles external to the hospital environment that cannot be measured (eroded support system, isolation, financial stress associated with COVID), the quantifiable impact of COVID on hospital staff provides some actionable explanation. Further work must be done to fully quantify the impact of COVID and qualify the causes.

Increased Morbidity of Patients with Pervasive Developmental Disorders Undergoing Appendectomy

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Introduction: Pervasive developmental disorders (PDD) are some of the most common diagnosed childhood neurodevelopmental disorders and demonstrate a vulnerable population in our healthcare system. Few, if any, studies have examined surgical outcomes for this population of patients as adults. Here we attempt to describe patterns of outcomes related to appendectomies in adult patient with PDD.

Method(s): The National Inpatient Sample from 2016-2019 was queried for patients that underwent appendectomy based on procedural classification system codes. Only the first 10 procedures were considered within the database. Patients with PDD as well as outcomes were identified utilizing international classification of disease version 10. Patients were excluded if they were less than 18 years of age. The primary outcome was to evaluate the odds of perforation on presentation in the PDD group. Secondary outcomes include evaluating length of stay (LOS), ileus, and infection in the PDD group compared to the general population.

Results: There were a total of 120,084 individuals undergoing appendectomy were identified. There were a total of 181 patients with the diagnosis of PDD within that group. The average age of patients in the PDD group was 31.2 years old compared to 47.8 years old in the non-PDD group ($p<0.001$). Patients in the PDD group had a higher odds of perforation (2.0, 1.3-3.2) compared to the non-PDD group. The odds of ileus and infection were also elevated for patients in the PDD group compared to the non-PDD group. LOS was evaluated for perforated and non-perforated appendicitis. We found that patients with PDD had a significantly longer LOS at 6.5 days in the non-perforated appendicitis group ($p<0.003$). In the perforated appendicitis group, the LOS for patients with PDD was longer at 7 days compared to 4.5 days, however was not significant ($p<0.143$).

Conclusion(s): There is an increased likelihood of morbidity in adults with PDD presenting with appendicitis and undergoing an appendectomy. Furthermore, patient's with PDD are found to have an increased LOS. Clinicians should use this information as an indicator for increased risk in this population.

Effects of Physician Education on the Identification of Moderate and Severe Malnutrition at a Single Center Suburban Community Hospital

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Introduction: Malnutrition is a major contributor to increased morbidity and mortality, decreased function and quality of life, and increased frequency and length of hospital stay. Recently, the Office of the Inspector General investigated various healthcare systems and found that hospitals that had overbilled Medicare $1billion by incorrectly assigning severe malnutrition diagnoses codes to inpatient hospital claims. Current practices at our institution identify patients as high risk for moderate and severe malnutrition through screening tools and by a registered dietitian (RD) using the American Society for Parenteral and Enteral Nutrition (ASPEN) guidelines. However, unless malnutrition is documented by a physician, it cannot be coded and further acted upon. This potentially results in significant hospital losses and increased morbidity and mortality for patients.

Method(s): We hypothesize that physician-driven resident education on ASPEN criteria and documentation will lead to improvements in resident knowledge about protein calorie malnutrition (PCM) and subsequently improve the rate of correctly identifying moderate and severe protein calorie malnutrition. The study is a mixed retrospective and prospective quality improvement project using Electronic Medical Record data, newly implemented EMR alerts, and resident education. Surveys were conducted before and after resident education assessing comfort level with documenting malnutrition according to ASPEN criteria. Further analysis then compared diagnostic accuracy of hospital coded malnutrition before and after our intervention.

Results: Pre and post-test surveys were conducted with two common questions, two unique pre-test questions and one unique post-test question. These questions were developed in conjunction with the registered dieticians. The initial results showed poor pre-

education understanding of documenting malnutrition according to ASPEN guidelines by residents (73% poor, n=25, 24% average, n=8) and discomfort with assessing malnutrition based on significant weight loss and edema (20% poor n=7, 79% average, n=27). Understanding improved following resident-guided education assessing malnutrition based on significant weight loss and edema (68% average n=17, 28% excellent n=7, p=.002) and with regards to documentation of ASPEN criteria (56% average, n=14 and 44%, n=11 excellent p<.001). All residents surveyed believed that they would change their practice of documentation of ASPEN guidelines (100%, n=25).

Question	Response	Pretest (n=34)		Posttest (n=25)		p-value
		Count	%	Count	%	
How comfortable do you feel with assessing malnutrition based on significant weight loss or edema	Poor	7	20.6	1	4.0	0.002
	Average	27	79.4	17	68.0	
	Excellent	0	0.0	7	28.0	
Do you know how to document malnutrition according to the ASPEN guidelines?	Poor	25	73.5	0	0.0	<0.001
	Average	8	23.5	14	56.0	
	Excellent	1	2.9	11	44.0	

Table 1. Group comparison between pre-test and post-test survey questions

Conclusion(s): Resident nutrition education is currently lacking in medical education. Residents had low levels of confidence in assessing malnutrition according to ASPEN criteria, but those confidence levels improved after education on ASPEN guidelines and documentation practices.

Enhanced Recovery After Surgery Reduces Postoperative Opioid Use in Colectomy Patients

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Introduction: Patients undergoing colorectal surgery require a multimodal post-operative pain regimen. Reducing the need for opioids in this setting is desirable to avoid gastrointestinal adverse effects and to accelerate and enhance overall recovery. We hypothesize utilization of a robust and comprehensive protocol for enhanced recovery after surgery (ERAS) for colorectal operations can help practitioners provide patients adequate post-operative pain control with reduced opioid use.

Methods: In 2017, Stamford Hospital initiated a colorectal ERAS protocol, with steps occurring prior to hospital admission, on the day of surgery, intraoperatively, during post-anesthesia care, and post-operatively. The protocol covers management of comorbidities (such as smoking), serum glucose control, deep venous thrombosis prophylaxis, antimicrobial precautions, bowel preparation, fluid management, catheter and device management, wound dressing and care, activity and ambulation, diet advancement, patient education, nausea control, and pain management, including nerve block, non-opioid medication, opioid medication, and adjunct therapy options. Protocol details are available upon request. Institutional review committee approval was granted and a single center retrospective chart review was conducted to compare the post-operative in-hospital opioid use between patients undergoing colorectal surgery at Stamford Hospital during the year preceding initiation of the ERAS protocol (pre-ERAS) versus during the first year of its implementation (post-ERAS).

Results: The pre-ERAS and post-ERAS patient groups were equivalent in size (N=106 for each). There were no significant differences between groups with respect to age, gender, medical comorbidity, reason for surgery, operative time, or surgical approach (laparoscopic versus open). Opioids used for post-operative in-hospital pain management included intravenous (IV) or per os (PO) hydromorphone, IV morphine, transdermal fentanyl, immediate (IR) or sustained (SR) release oxycodone, oxycodone-acetaminophen (percocet), hydrocodone-acetaminophen (lortab), or tramadol. Dosages were converted to morphine milligram (mg) equivalents (MMEs) for comparison. Post-ERAS patients had 67.8% reduction in MMEs of opioids used relative to pre-ERAS patients (6,108.5 versus 18,989 mg, respectively). *Cont. next page...*

Pre-ERAS Opioid Totals			MME Conversion	
PO Hydromorphone	30	mg	4	120
IV Hydromorphone	780.8	mg	20	15616
IV Morphine	56	mg	3	168
Transdermal Fentanyl	450	mcg		0
Oxycodone IR	655	mg	1.5	982.5
Oxycodone SR	960	mg	1.5	1440
Percocet	15	mg	1.5	22.5
Lortab	64	tabs	10	640

Table 1. Pre-ERAS opioid use, showing a total of 18,989 mg in MMEs.

Post-ERAS Opioid Totals			MME Conversion	
PO Hydromorphone	78	mg	4	312
IV Hydromorphone	62.7	mg	20	1254
IV Morphine	20	mg	3	60
Oxycodone IR	2625	mg	1.5	3937.5
Tramadol	5450	mg	0.1	545

Table 2. Post-ERAS opioid use, showing a total 6,108.5 mg in MMEs.

Conclusions: These findings suggest a comprehensive ERAS protocol significantly reduces opioid use in colectomy patients without compromising pain control. Further investigation is warranted to evaluate the generalizability and utility of such a protocol for other index surgeries.

Factors Associated with ICU Admission after Component Separation – A NSQIP Analysis

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Introduction: Closure after a complex ventral or incisional hernia can be obtained using an abdominal wall component separation. Patients undergoing this abdominal wall reconstruction can lead to postoperative complications resulting in a post operative intensive care unit (ICU) admission. We investigated the epidemiology associated with post operative ICU level of care in patients that underwent ventral or incisional hernia repair with a component separation procedure (CS).

Method(s): The American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) database between 2012 and 2019 was used to identify patients that had underwent CS. The CPT code of 15734 was used to identify patients that underwent CS. Emergent and outpatient procedures along with individuals undergoing additional abdominal surgery were part of the exclusion criteria. Patients that required ICU level of care post operation were identified by the need for continued ventilator support and individuals that underwent cardiac arrest. Multivariable logistic regression was used to identify factors that contributed to post operative ICU admission in these patients undergoing component separation.

Results: 17,805 patients were identified that underwent CS. Amongst these, 347 patients (1.95%) resulted in post operative ICU level of care per criteria delineated above. We found that plastic surgeons perform component separation have a lower odds of post operative ICU admission (OR 0.53, 0.36-0.76). Furthermore, we found that patients 65 years and older have a higher odds of ICU admission (OR 1.38, 1.10-1.74). Smokers (OR 1.89, 1.48-2.39), patients with diabetes (DM) (OR 2.02, 1.59-2.55), body mass index (BMI) greater than 30 (OR 1.89, 1.49-2.42), chronic obstructive pulmonary disease (COPD) (OR 3.99, 3.01-5.24), congestive heart failure (CHF) (OR 3.43 1.22-7.85), ASA score of 3 or 4 (OR 3.22, 2.42-4.35) all had an increased odds of requiring post operative ICU level of care.

Conclusion(s): From our review of the ACS NSQIP database, we determined factors that showed increased morbidity and the need for post operative ICU level of care in patients that underwent CS. Most notably, we found that patients with a history of COPD, CHF, DM along with an elevated BMI and ASA score of 3 or 4 had a higher odds of requiring post operative ICU level of care. Furthermore, individuals undergoing CS by a plastic surgeon compared to general surgeons have a lower odds of post operative ICU level of care needs. This information can be used by clinicians as in indicator of increased risk in patients undergoing CS.

Preoperative Risk Factors for Deep Vein Thrombosis in Patients Undergoing Lysis of Adhesions: A 5-Year NSQIP Analysis

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Introduction: Conservative management including nil per os and nasogastric tube decompression remains the primary treatment of small bowel obstruction. Patients are often immobile in bed due to gastric decompression. These patients are often at elevated risk for multiple complications including poor nutrition and worsening of chronic conditions. Due to the immobility, it was hypothesized they would have higher risks for deep vein thrombosis (DVT) during their admission. Given the increased risk posed by surgery for the development of DVT, an attempt was made to identify potential risk factors which increased this risk for DVT in patients undergoing lysis of adhesions.

Methods: A retrospective review was conducted utilizing the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) from 2015-2019. Patients were identified based on Current Procedural Terminology (CPT) codes for lysis of adhesions including 44004, 44180, 58660, and 58740. Patients were excluded if they were less than 18 years of age. Patients with deep vein thrombosis (DVT) requiring treatment were identified based on the variable "othdvt" provided by NSQIP. Preoperative risk factors identified on univariate analysis to be statistically significant were utilized in multivariable analysis for odds of DVT. A subgroup univariate analysis analyzing patients undergoing minimally invasive approach was also conducted.

Results: A total of 25,083 patients were identified who underwent lysis of adhesions as their primary procedure. A total of 238 (0.98%) of patients had a DVT during their admission. Univariate analysis showed multiple variables to be significantly associated with DVT including increased age, male gender, diabetes, history of chronic obstructive pulmonary disease (COPD), presence of ascites, hypertension requiring medications, disseminated cancer, preoperative transfusion, preoperative renal failure, steroid use, preoperative septic shock, American Society of Anesthesiologists (ASA) classification greater than 2, emergency procedure, and increased number of days prior to operation. On multivariate analysis increased age, male gender, COPD, ascites, hypertension requiring medication, disseminated cancer, preoperative septic shock, and ASA classification greater than 2 all remained significant. On subgroup analysis of patients with minimally invasive approach (n=8,743) increased age, smoking status, COPD, ascites, hypertension requiring medication, disseminated cancer, preoperative septic shock, ASA greater than 2, emergency procedure and increased days from admission to operation were all associated with DVT.

Conclusion: We identified multiple variables previously known to be associated with higher risk for DVT including age, gender, and malignancy. Patients with chronic conditions such as chronic obstructive pulmonary disease, ascites, and ASA classification greater than 2 were also identified to be at an elevated risk. Comparable results were seen in subgroup analysis of patients undergoing minimally invasive lysis of adhesions. Practitioners should consider close monitoring and diligence in preoperative prophylaxis in these patients.

Time to Tracheostomy in a Community Hospital Through the COVID-19 Pandemic

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Introduction: Earlier tracheostomy in patients who require long term mechanical ventilation is associated with shorter ICU stay, duration of sedation, and lower mortality. However, during the early COVID-19 pandemic, optimal timing of tracheostomy was a contentious topic, given the need to balance the benefits of early tracheostomy with the risk of transmission to healthcare providers. This review aims to assess how practices changed over the course of the pandemic as new guidelines were implemented and familiarity with COVID-19 management improved.

Methods: Retrospective chart review was performed at a single community hospital to identify patients with COVID-19 who ultimately received tracheostomies over the course of hospital stay. Patients were separated by wave of COVID-19 outbreak, defined by three periods: Wave 1 (March-June 2020), Wave 2 (November-December 2020), and Wave 3 (January-April 2021). Data examined

included length of time on ventilator, planned or unplanned extubation, subsequent reintubation, time to tracheostomy, and mortality while ventilated. Continuous data was analyzed using ANOVA.

Results: The study reviewed the charts of 31 patients who received tracheostomies for prolonged ventilator requirement secondary to COVID-19 infection. The Wave 1 group contained 20 patients and had an average of 30.4 days to tracheostomy. Wave 2 contained 5 patients, with 19.8 days to tracheostomy. Wave 3 contained 6 patients, with 16.7 days to tracheostomy. Among waves, there was a distinct improvement in time to tracheostomy ($p=0.028$) as the COVID pandemic progressed.

Conclusions: As the pandemic progressed, our institution became better equipped to respond and effectively manage the symptoms of COVID-19. One of these measures is seen in a shortened time to tracheostomy for those requiring long term vent management.