

DON'T WAIT, OPERATE! LATE CHOLECYSTECTOMY IN PREGNANCY IS ASSOCIATED WITH PREGNANCY RELATED ADVERSE OUTCOMES

Melissa A. Kendall, MD; Tyler Zander, MD;
Emily Grimsley, MD; Johnathan Torikashvili, BS;
Jose J. Diaz, MD; Thomas Herron, MD; Paul Kuo, MD, MS, MBA
University of South Florida

Introduction: Delayed intervention for acute cholecystitis (AC) is associated with higher costs, longer length of stay (LOS), and more operative complications. Time to intervention and outcomes has not been evaluated in pregnant patients. We aim to evaluate the association between time to intervention and pregnancy related adverse outcomes (PRAO).

Methods: New York Statewide Planning and Research Cooperative System inpatient dataset was queried for adult pregnant patients presenting with AC from 2016 to 2020. Exclusion criteria included patients who received a cholecystectomy prior to admission, had a concurrent diagnosis of choledocholithiasis or gallstone pancreatitis, or were in labor on admission. Early cholecystectomy (EC) was defined as occurring within 72 hours of admission, and late cholecystectomy (LC) at ≥ 72 hours after admission. Univariable analysis was performed.

Results: 203 patients were included: 71 in their first trimester, 103 in their second, and 29 in their third. The rate of spontaneous abortions in second trimester was higher in patients who underwent LC, compared to EC (6 vs. 0%, $p < 0.05$); there was no statistically significant difference for first or third trimester patients. Regardless of trimester, length of stay (5 (5-7) vs 2 (2-3)) and total charges (\$60,249.04 (44,359.9-\$84,291.68) vs \$32,692.15 (23,176.45-\$48,094.84)) were higher in the LC group ($p < 0.001$).

Conclusion: For pregnant patients with AC, LC is associated with longer LOS and higher total charges. Pregnant patients in the second trimester who underwent LC had higher rates of spontaneous abortion, indicating EC is should be offered for second trimester patients.

DRIVING ADOPTION: PERSPECTIVES DIFFER ON LAP COMMON BILE DUCT EXPLORATION FOR ACS AND MIS SURGEONS

Maggie Bosley, MD; Elizabeth C. Wood, MD;
Juhi Saxena, BS; Gabriel Cambroner, MD; Gloria Sanin, MD;
Lucas P. Neff, MD; Ranjan Sudan, MD
Washington University in St. Louis

Introduction: Choledocholithiasis (CDL) is frequently encountered in emergency general surgery and need for endoscopic clearance can extend hospital stays and drive-up costs. Laparoscopic common bile duct exploration (LCBDE) can mitigate this problem but requires greater adoption. Outreach efforts must begin by understanding practice patterns, attitudes, and barriers. Acute care surgeons' (ACS) perspectives on LCBDE are not well described and this technique has generally been viewed as an advanced minimally invasive skill. Therefore, we surveyed and compared ACS and minimally invasive (MIS) surgeons on CDL management.

Methods: A survey of CDL management preferences was developed by content experts and distributed by email to members of the Society of American Gastrointestinal and Endoscopic Surgeon (SAGES) and the American Association for the Surgery of Trauma (AAST). Results were analyzed utilizing descriptive statistics.

Results: A total of 543 US surgeons performing laparoscopic cholecystectomy completed the survey (ACS=124, MIS=175). Similar proportions of ACS and MIS surgeons preferred to manage choledocholithiasis by LCBDE (27% vs 28%). A majority (86%) of both cohorts asserted that ERCP and laparoscopic cholecystectomy (LC) would be associated with increased length of stay as compared to LCBDE+LC. MIS surgeons perform cholangiogram more frequently than ACS surgeons (Figure 1). A greater percentage of ACS surgeons favored LCBDE than MIS (58% vs 49%, $p=.02$). Neither group felt that routine LCBDE would negatively affect patient referral patterns (11% vs 6%, $p=0.13$). A third of MIS surgeons felt that LCBDE was too time consuming versus 25% of ACS surgeons ($p=0.37$). When asked if LCBDE is a difficult skill to master, 56% of MIS surgeons agreed compared to only 32% of ACS surgeons ($p<0.01$).

Conclusion: LCBDE is underutilized by both ACS and MIS surgeons, but ACS surgeons are more apt to advocate for surgical management of CLD. Courses and educational content designed to teach these techniques may drive adoption in ACS and decrease healthcare costs and lengths of stay. Understanding surgeon perspectives can enhance outreach to target audiences.

PROGNOSTIC PERFORMANCE OF THE PREHOSPITAL NATIONAL EARLY WARNING SCORE (pNEWS) IN PATIENTS WITH ACUTE ABDOMEN SYNDROME

Yutaro Sakaguchi, MD; Keishi Yamaguchi MD, PhD;
Chikara Watanabe, MD; Ichiro Takeuchi MD, PhD
Yokohama City University Medical Center

Introduction: The National Early Warning Score (NEWS, Fig.1) is utilized in emergency departments and rapid response teams as a prognostic indicator for acute illnesses. It has been reported that the prehospital NEWS (pNEWS), based on vital signs assessed before transportation, may be associated with in-hospital mortality. The aim of this study was to compare pNEWS and in-hospital mortality among patients undergoing emergency surgery for acute abdomen.

Methods: This retrospective observational study was conducted on patients aged 16 years or older who underwent emergency abdominal surgery at a tertiary care center from April 2020 to August 2023. The primary outcome assessed was in-hospital mortality, with the predictive performance of pNEWS evaluated using receiver operating characteristic (ROC) analysis.

Results: Fifty-two patients underwent emergency laparotomy for acute abdomen, resulting in an in-hospital mortality rate of 7.7% (4/52). Half of the patients had gastrointestinal perforation, followed by bowel obstruction. Non-survivors included cases of gastrointestinal perforation, bowel obstruction, and bowel ischemia, all of which were associated with NEWS of 7 points or higher. The area under the ROC curve for pNEWS(Fig.2) was 0.779 with a cut-off value of 7(sensitivity 1.000, specificity 0.625).

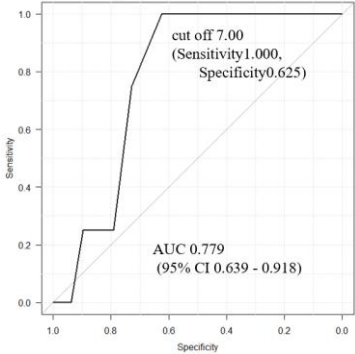
Conclusion: The pNEWS may be a useful prognostic tool for assessing acute abdomen cases before transportation.

Fig.1 National Early Warning Score (NEWS).

Physiological parameters	3	2	1	0	1	2	3
Respiratory Rate	≤ 8		9-11	12-20		21-24	≥ 25
Oxygen Saturations	≤ 91	92-93	94-95	≥ 96			
Any Supplemental Oxygen		Yes		No			
Temperature	≤ 35.0		35.1-36.0	36.1-38.0	38.1-39.0	≥ 39.1	
Systolic Blood Pressure	≤ 90	91-100	101-110	111-219			≥ 220
Heart Rate	≤ 40		41-50	51-90	91-110	111--130	≥ 131
Level of Consciousness				A			V, P, or U

A: alert, V: voice, P: pain, U: unresponsive

Fig.2 Diagnostic Ability and Test Performance of NEWS to Predict Mortality.



THE SECOND VICTIM IN EMERGENCY SURGERY: THE TOLL OF HOSPITALIZATION ON INFORMAL CAREGIVERS

Emna Bakillah, MD; Cristina Micale, BS;
Megan Grabill, BA; J. Walker Rosenthal, BS; Andrea Bilger, MPH;
Niels Martin, MD; Catherine E Sharoky, MD, MSCE
Perelman School of Medicine at the University of Pennsylvania

Introduction: Emergency general surgery (EGS) patients are usually hospitalized unexpectedly, often with complex conditions and chronic post-discharge needs. The impact of EGS hospitalization on informal caregivers (e.g. family members) is unknown. We aimed to explore how an EGS hospitalization impacts the lives of informal caregivers and identify specific stressors of hospitalization.

Methods: We conducted 30-minute semi-structured interviews of EGS patients and their caregivers at a single academic center (April–October 2023) using purposeful sampling to include adult EGS patients hospitalized ≥ 7 days. Patients identified their primary caregiver for participation. Interviews were completed until thematic saturation was reached, coded in duplicate, and analyzed using a modified grounded theory approach. All participants also completed the 36-Item Short Form Heath Survey (SF-36), a validated quality of life (QoL) questionnaire, to assess perceived QoL during hospitalization. The SF-36 scores are standardized on a 100-point scale, with the worst score being 0 (poor QoL) and the best being 100 (excellent QoL).

Results: Of 26 total participants, 17 were patients and 9 were caregivers. All caregivers were family members, with most identifying as a patient's child. Most caregivers were female (mean age 44.9y \pm 15.0y). Caregivers displayed profound decrease in QoL, most significantly in the following domains: vitality, role limitations due to emotional problems, and mental health. (Figure 1) The most common caregiver stressors in qualitative analysis included emotional stress secondary to the patient's EGS condition, difficulties with travel, financial concerns, and job security. (Figure 2)

Conclusion: EGS hospitalization has a profound impact on informal caregivers, most of whom are female family members. QoL was impacted in all domains with the largest impact on energy and mental health. Future steps should include targeted interventions that address logistic concerns and offer formalized emotional support for EGS caregivers. Optimizing the mental and physical health of EGS caregivers may aide in sustained recovery of patients after EGS hospitalization.

RESTRICTING ROUTINE DAILY CBC ORDERING IS SAFE AND EFFECTIVE IN TRAUMA AND ACUTE CARE SURGERY PATIENTS

Elise Presser, MD, MS, ScM; Joshua Sznol, MD, MSPH;
Andrew Esposito, MD, MHS; Kevin M. Schuster, MD, MPH
Yale University

Introduction: A nationwide shortage of phlebotomy tubes caused a level I trauma center to limit ordering of complete blood counts (CBCs) and remove recurring order options. This restriction was used as a natural experiment evaluating elimination of routine CBCs on surgical outcomes.

Methods: Acute Care Surgery (ACS) Service patients were evaluated for 60 months before and 4 months after the restriction. Patient demographics, admission characteristics, and outcomes were extracted from patient charts and the NSQIP database. Pre- and post-restriction patients were compared.

Results: Analysis included 9,372 patients, 8755 pre-restriction and 617 post-restriction. For all admissions, the number of CBCs performed per admission was significantly reduced post-restriction (6.99 vs 6.1, $p=0.011$) and when normalized to length of stay (LOS), (1.26 vs 1.12, $p<.001$). There was no significant change in other labs, imaging studies performed, antibiotic days, LOS, or 30-day mortality (Table). There was a significant reduction in transfusion of packed red blood cells per admission, from 3.95 units to 2.95 units ($p=0.018$). In patients who underwent an operation, the rate of 30-day re-admission was lower post-restriction ($p=.029$).

Conclusion: Restricting the ability to order multiple CBCs reduced the number of CBCs, did not adversely affect outcomes, and may have reduced transfusions and readmissions.

	Before Restriction (n=8755)	After Restriction (n=617)	p-value
Length of Stay (days)	5.96	6.09	0.748
Age (years)	58.86	59.60	0.391
CBC count per admission	6.99	6.10	0.011
CBC per day	1.26	1.12	<0.001
BMP count per admission	6.50	6.22	0.455
Minimum Hemoglobin (g/dl)	10.72	10.68	0.748
Xray count per admission	3.51	3.52	0.955
CT count per admission	2.69	2.54	0.184
MR count per admission	0.28	0.29	0.953
US count per admission	0.55	0.56	0.793
Transfused units/admission	3.95	2.95	0.018
30 day readmissions	1.15	1.13	0.736
Ventilator days	5.62	5.29	0.763
Antibiotic days	4.49	4.93	0.773

DO ALL PENETRATING ZONE II HEMATOMAS REQUIRE SURGICAL EXPLORATION: A SECONDARY ANALYSIS OF AN AAST-SPONSORED MULTICENTER STUDY

Galinos Barmparas, MD; Soren Keihani, MD; Aricia Shen, MD;
Babak Sarani, MD, FACS; Jeremy B. Myers, MD, FACS;
AAST Genito-Urinary Trauma Study Group
Cedars-Sinai Medical Center

Introduction: Classic teaching is to explore penetrating zone II hematomas to rule out active renal bleeding and/or ureteropelvic injury. The objective of this study was to characterize the need for surgical intervention in penetrating renal trauma. We hypothesized that a large proportion of penetrating renal injuries do not require surgical intervention for bleeding control, and therefore, routine surgical exploration is not needed.

Methods: This was a secondary analysis of a AAST sponsored prospective observational trial that enrolled patients with high-grade renal injuries (III-VI-V) at 14 trauma centers from 01/2014 to 02/2017. Adult (≥ 18 years) patients with penetrating injuries were selected and stratified according to their initial management as: 1) nonoperative (NOM), including interventional radiology (IR), 2) operative (OR) without initial CT imaging, and OR with initial CT imaging (OR-CT). The primary outcome was requirement for surgical intervention for bleeding control. Secondary outcomes included delayed surgical or IR re-intervention for bleeding control. Standard statistical tools were utilized for this descriptive study.

Results: A total of 255 patients met inclusion criteria. The median age was 28 years, 87% were male, and median ISS was 25. Overall, 14% underwent NOM, 49% required emergent OR, and the remaining 37% required OR after an initial CT (OR-CT.) Surgical intervention to control renal bleeding was required for 6% of NOM, 74% of patients requiring emergent OR, and 38% of patients with OR-CT. Overall, of those requiring intervention (n=130), 59% required a nephrectomy, and 25% required a nephrorrhaphy.

Conclusion: Nonoperative management is frequently employed for high-grade penetrating renal injuries, and even when exploratory laparotomy is required, intervention to control bleeding from the kidney is not universally required, especially when preoperative imaging is available. Further studies are required to characterize the subset of patients that would require routine exploration of zone II hematoma following penetrating trauma.

MACHINE LEARNING IDENTIFICATION OF PERSONALIZED PATIENT RISK FACTORS FOR PROLONGED LENGTH OF STAY AFTER TRAUMA LAPAROTOMY

Michael Cobler-Lichter, MD; Jessica Delamater, MD;
 Larisa Shagabayeva, MD; Matthew Fastiggi, MD; Zoe Weiss, MD;
 Brianna L. Collie, MD; Nicole Lyons, MD; Luciana Tito, MD;
 Jonathan P. Meizoso, MD, MSPH; Nicholas Namias, MD;
 Carl I. Schulman, MD; Kenneth Proctor, PhD
 Ryder Trauma Center - Jackson Memorial Hospital

Introduction: Trauma laparotomy patients often experience prolonged hospital length of stay (PLOS). Previous studies have relied on standard statistical analyses to identify contributing factors for PLOS, but machine learning (ML) algorithms can discern complex interactions and nonlinear relationships among variables, capturing unique patient trajectories. By assigning individualized relative weights to features, ML can enhance accuracy and provide a nuanced understanding of PLOS determinants. This study tests the hypothesis that ML can predict PLOS and provide personalized risk profiles for individual patients.

Methods: Patients from the American College of Surgeons Trauma Quality Improvement Project database (TQIP) who received a laparotomy within 90 minutes of arrival were included. ML models were created to predict a greater than 90th percentile length of stay (LOS). Patients with missing data for LOS were excluded. A game theoretical approach was used to estimate the relative significance of each variable towards the final prediction.

Results: Of 5,481,046 patients in TQIP from 2017 to 2021, 74,806 met inclusion criteria. Median LOS was 7 days and 90th percentile LOS was 28 days. A gradient-boosted decision tree model performed the best with area under the receiver-operator curve of 0.920. The most impactful predictor variables are displayed in Fig 1.

Conclusions: ML can identify patients at high risk of PLOS. Direct electronic medical record implementation can identify the most important factors contributing to PLOS in each individual patient and prospective implementation may allow for personalized care plans tailored to each patient's risk profile. This algorithm is designed to improve over time and can capture complex non-linear relationships that may not be apparent to humans or standard statistics.

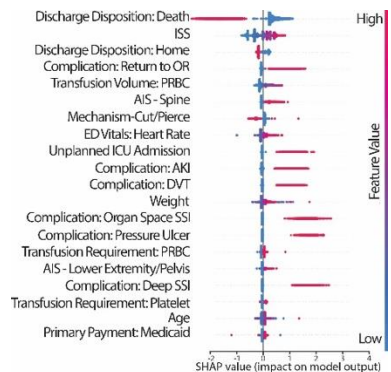


Figure 1: Shapley additive explanation (SHAP) methods to assess feature importance. Each point represents an individual case, and the grouping of points demonstrate how that variable contributes to the model's outcome prediction for each individual case.

REBOA IN SHOCKED PENETRATING ABDOMINAL TRAUMA PATIENTS: IMPACT ON OUTCOMES

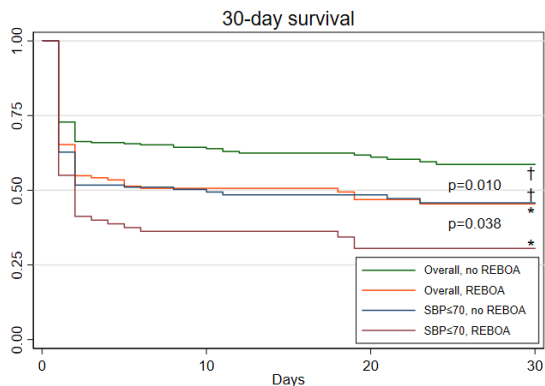
Justin Hatchimonji, MD, MBE, MSCE; Diane N. Haddad, MD, MPH;
 Lydia Maurer, MD; Phillip Dowzicky, MD, MSHP;
 Andrew Benjamin, MD; Niels D. Martin, MD; Patrick Reilly, MD;
 Jay Yelon, DO; Mark J. Seamon, MD
 University of Chicago

Introduction: The role of Resuscitative Endovascular Balloon Occlusion of the Aorta (REBOA) in trauma is debated. We hypothesized that the use of REBOA for patients presenting in shock after penetrating abdominal trauma is associated with delay to laparotomy and increased mortality.

Methods: We used 2017-2021 Trauma Quality Improvement Project (TQIP) data to identify adult (≥ 16 years) penetrating abdominal trauma patients with systolic blood pressure (SBP) ≤ 90 mmHg undergoing laparotomy. REBOA was defined by ICD-10 code, with a procedure timestamp preceding or simultaneous to laparotomy incision. We propensity score matched REBOA to non-REBOA patients on demographics, mechanism, injury characteristics and severity, solid organ injury, abdominal vascular injury, SBP, heart rate, and GCS motor score. Outcomes were time to incision, transfusion requirements, complications, and in-hospital mortality. We additionally performed a survival analysis stratified by presenting SBP.

Results: There were 148 REBOA patients with complete data for matching to 286 non-REBOA patients. Among patients with REBOA timestamps preceding laparotomy incision, there was a delay to laparotomy (time to incision 40 [31, 50] vs 33 [23, 43.5] minutes, $p=0.001$). Overall, REBOA was associated with increased transfusion volume (median [IQR] pRBCs 5,125 [2,100, 9,100] vs 2,500 [1,050, 5,450] ccs in the first 4 hours, $p<0.001$), leg amputations (3.4% vs 0.4%, $p=0.010$), and mortality (53.4% vs 42.7%, $p=0.034$). The mortality relationship persisted among patients presenting with SBP ≤ 70 mmHg (Figure).

Conclusion: REBOA for patients in shock after penetrating abdominal trauma is associated with delay to operation, greater transfusion requirement, leg amputation and mortality. Our data support the need for expeditious definitive hemorrhage control in these patients.



REFINING KIDNEY ORGAN INJURY SCALING: EVIDENCE-BASED UPDATES TO THE AAST RENAL TRAUMA GRADING

Sorena Keihani, MD, MSCI; Gail T. Tominaga, MD; Rano Matta, MD;
Joel A. Gross, MD; Chris Cribari, MD; Krista L. Kaups, MD, MS;
Marie Crandall, MD, MPH, FACS; Rosemary Kozar, MD;
Nicole L. Werner, MD, MS; Ben L. Zarzaur, MD, MPH;
Michael Coburn, MD, FACS; Jeremy B. Myers, MD, FACS
University of Utah

Introduction: The American Association for the Surgery of Trauma (AAST) introduced the Organ Injury Scale (OIS) for kidney injuries in 1989, primarily based on anatomic and operative findings. The OIS was updated in 2018 and added important radiologic findings. With the near-universal use of CT scans for initial trauma assessment and the widespread adoption of non-operative management for renal trauma, further refinement of the OIS is necessary.

Methods: A multidisciplinary workgroup of trauma surgeons, urologists, and radiologists reviewed the kidney OIS and developed a consensus aligned with recent literature. Priorities in the process were assigning injury grades to better predict the need for therapeutic interventions and provide objective measures to assign injury grades based on imaging, operative, and pathologic findings.

Results: Key modifications to the kidney OIS include: increasing the cutoff for laceration length from 1 cm to 2.5 cm or greater for Grade III injuries; introducing a 3.5 cm hematoma rim size cutoff for Grade III injuries; and focusing more on active bleeding (defined by presence of vascular contrast extravasation) in grade IV injuries. The term "shattered kidney" is replaced with "multi-fragmented kidney", now defined as the presence of three or more parenchymal fragments separated by blood or fluid. Urinary extravasation is also downgraded to grade III due to its high rates of spontaneous resolution and limited need for intervention.

Conclusion: We present an updated kidney OIS based on the contemporary evidence-based data and collaborative efforts of a multi-disciplinary group. The emphasis of the updated OIS is on the overall need for interventions depending on the modality used for diagnosis. These revisions align with the widespread adoption of CT imaging and the growing acceptance of non-operative management for renal trauma across all grades.

VARIATION AMONG TRAUMA CENTERS IN THE USE OF ANGIOEMBOLIZATION AND SPLENECTOMY RATE IN ISOLATED HIGH-GRADE BLUNT SPLENIC INJURIES

Makoto Aoki, MD, PhD; Yohei Okada, MD, PhD; Shokei Matsumoto, MD; Morihiro Katsura, MD, MPH; Kazuhide Matsushima, MD
National Defense Medical College Research Institute

Introduction: Many US trauma centers have recently adopted splenic angioembolization (SAE) as an adjunct in patients with high-grade blunt splenic injuries (BSI) undergoing non-operative management (NOM). However, it remains unclear whether the use of SAE is associated with successful NOM. We hypothesized that trauma centers with higher rates of SAE would have decreased splenectomy rates for high-grade BSI.

Methods: This is a retrospective cohort study using data from the ACS-TQIP database (2013-2021). We included patients (age ≥ 16 years) with isolated high-grade BSI (Abbreviated Injury Scale: 3–5) treated at trauma centers that admitted ≥ 10 high-grade BSI cases during the study period. Study patients were classified into three groups based on the percentage of patients undergoing SAE: 0% (no-SAE centers); 1% to 39.9% (low-SAE centers); and more than 40% (high-SAE centers). The cutoff for high SAE centers ($\geq 40\%$) represented the 90th percentile for trauma center SAE use. Hierarchical logistic regression controlling for clustering at the hospital level was performed to examine the association between trauma center SAE use and splenectomy rate.

Results: A total of 7,434 patients with isolated high-grade BSI were included (no-SAE: 375 from 23 centers, low-SAE: 5,792 from 267 centers, high-SAE: 1,267 from 60 centers). The median percentage of SAE use was 23.2% (IQR: 11.9-34.8) (**Figure**). Overall splenectomy rates were 14.4%, 9.8%, and 7.3% in the no-SAE, low-SAE, and high-SAE centers, respectively. After adjusting for hospital case mix, low-SAE and high-SAE centers were associated with decreased odds of splenectomy compared with no SAE centers (OR: 0.71, 95%CI: 0.51-0.99 and OR: 0.57, 95% CI: 0.38-0.85, respectively).

Conclusions: Our results suggest that trauma centers with higher rates of SAE use had lower splenectomy rates in patients with isolated high-grade BSI.

