President Session | Presentation 1

A MULTICENTER, BLINDED RANDOMIZED CONTROLLED TRIAL OF ROBOTIC VERSUS LAPAROSCOPIC VENTRAL HERNIA REPAIR

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Background: There has been a recent widespread performance of and publication on robotic ventral hernia repair (RVHR). A national database study demonstrated decreased hospital stay with RVHR compared to laparoscopic repair (LVHR). However, no randomized controlled trial (RCT) has evaluated RVHR.

Objective: We hypothesized that RVHR compared to LVHR is associated with fewer days in the hospital 90-days post-operative.

Methods: In this blinded, multicenter RCT, patients scheduled to undergo elective VHR were randomized to RVHR or LVHR and stratified by surgeon. Primary outcome was days in hospital within 90-days post-operative. Secondary outcomes included emergency room visits, operating room time, wound complications, hernia recurrence, reoperation, quality of life (QOL), and costs from the healthcare system perspective. Outcomes were assessed through frequentist (negative binomial, generalized linear or logistic regression) and Bayesian analyses.

Results: A total of 124 patients were enrolled and randomized: 65 underwent RVHR and 59 LVHR. Patients from both groups were similar at baseline. Ninety-day follow-up was completed in 123 patients (99.2%). There was no difference in days in hospital between the two groups (median 0 vs 0 days; RR=0.90 [95%CI=0.37-2.19]; p=0.822). On secondary outcomes, no differences were noted in emergency room visits, wound complications, hernia recurrence, or reoperation. However, RVHR had longer operative duration (141 vs 77 minutes; coefficient=62.89 [95%CI=45.75-80.01]; p=<0.001) and increased healthcare costs ($15,864 vs $12,954; RR=1.21 [95%CI=1.07-1.38]; p=0.004). In addition, RVHR had clinically important differences in enterotomies (3% vs 0%; p=0.996) and less median improvement in early post-operative QOL (3 vs 15, p=0.060). On Bayesian analysis, RVHR had a 78% probability of being associated with more enterotomies while LVHR had a 97% probability of having greater improvement in early post-operative QOL.

Conclusion: Both RVHR and LVHR have similar 90-day postoperative hospital stays. However, RVHR increased operative duration, healthcare costs, and risk of enterotomy while LVHR had a greater improvement of patient QOL.

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Table. Intraoperative and one month post-operative clinical outcomes

	RVHR N = 65	LVHR N = 58	P-Value	RR (95% CI)[ǂ]
Conversion to open VHR, No. (%)	1 (1.5%)	1 (1.7%)	0.842	0.76 (0.05-11.47)
Days in hospital at 90-days (Categories), No. (%) 0 days 1 day 2 days >3 days	 50 (76.9%) 9 (13.8%) 4 (6.2%) 2 (3.1%)	 49 (84.5%) 4 (6.9%) 1 (1.7%) 4 (6.9%)	0.280	-
Number of patients readmitted, No. (%)	1 (1.5%)	3 (5.2%)	0.245	0.27 (0.03-2.43)
Number of patients with ER visits, No. (%)	7 (10.8%)	5 (8.6%)	0.658	1.28 (0.43-3.75)
Wound complication, No. (%) SSI SSO	13 (20.0%) 0 (0%) 13 (20.0%)	11 (19.0%) 1 (1.7%) 10 (17.3%)	0.946 0.998 0.819	1.02 (0.51-2.08)
Recurrence, No. (%)	0 (0%)	0 (0%)	1.000	ǂǂ
Reoperation, No. (%)	0 (0%)	1 (1.7%)	0.998	ǂǂ
Clavien-Dindo complications, No. (%)	14 (21.5%)	11 (19.0%)	0.802	1.10 (0.54-2.24)
Change in QOL Scores (mAAS), median (IQR)	3 (40)	15 (42)	0.060	-

RVHR: Robotic ventral hernia repair; LVHR: Laparoscopic ventral hernia repair; RR: Relative risk; VHR: Ventral hernia repair; ER: Emergency room; SSI: Surgical site infection; SSO: Surgical site occurrence; QOL: Quality of life; mAAS: Modified Activity Assessment Scale Survey (range from 1 = poor to 100 = perfect, MCID = 7); IQR: Interquartile range

[ǂ]LVHR represents the control for relative risk calculation

[ǂǂ]Unable to calculate relative risk due to no observations in one arm

President Session | Presentation 2

CENTER VARIATION IN INFECTION PREVENTION PRACTICES AND SURGICAL SITE INFECTION RATES IN INFANTS: A MULTI-CENTER COHORT STUDY

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Background: Surgical site infections (SSIs) remain the leading cause of postoperative morbidity in infants, and best practices for SSI prevention remain elusive.

Objective: We aimed to determine SSI rates within a large cohort of infants undergoing gastrointestinal surgery and describe the utilization of various infection prevention strategies by different centers.

Methods: Data were collected on all infants (age <1) who underwent gastrointestinal surgery at 16 children's hospitals between 8/1/2017-1/31/2018. Infants who underwent non-emergent procedures and survived ≥48 hours after surgery were included in the analysis. Gastrointestinal surgeries included tracheoesophageal fistula repairs, gastrostomy tube (GT) placements or closures, fundoplications, intestinal procedures, gastroschisis/omphalocele repairs, exploratory laparotomies, and anorectal malformation repairs. The primary outcome, SSI, included superficial, deep and organ/space infections. Descriptive statistics and univariate analyses were utilized, with $p<0.05$ considered significant.

Results: SSI occurred in 46 of 915 operations (5%), but SSI rate varied by procedure: 18% of tracheoesophageal fistula repairs, 7% of intestinal procedures, 6% of combined GT/fundoplications, 3% of GTs, and 2% of gastroschisis/omphalocele repairs. Centers performed a median of 42.5 eligible cases during the study period (range 5-128), and the median institutional SSI rate was 4% (range 0-19%). Utilization of surgical prophylactic antibiotics, bowel preparation, and preoperative baths varied significantly between centers, while selection of surgical skin preparation agents varied both between and within centers (Figure). Perioperative normothermia was maintained in only 68% of cases overall, with individual centers ranging from 48-100%. Other SSI prevention measures were rarely documented as having been utilized, such as changing gowns (n=2), gloves (n=7), drapes (n=1), or instruments (n=2) prior to closure.

Conclusion: Surgical site infection rates varied significantly between centers. High inter- and intra-institutional variation was observed in the utilization of various infection prevention strategies. Practice standardization and increased utilization of recommended infection prevention practices may improve outcomes in this population.

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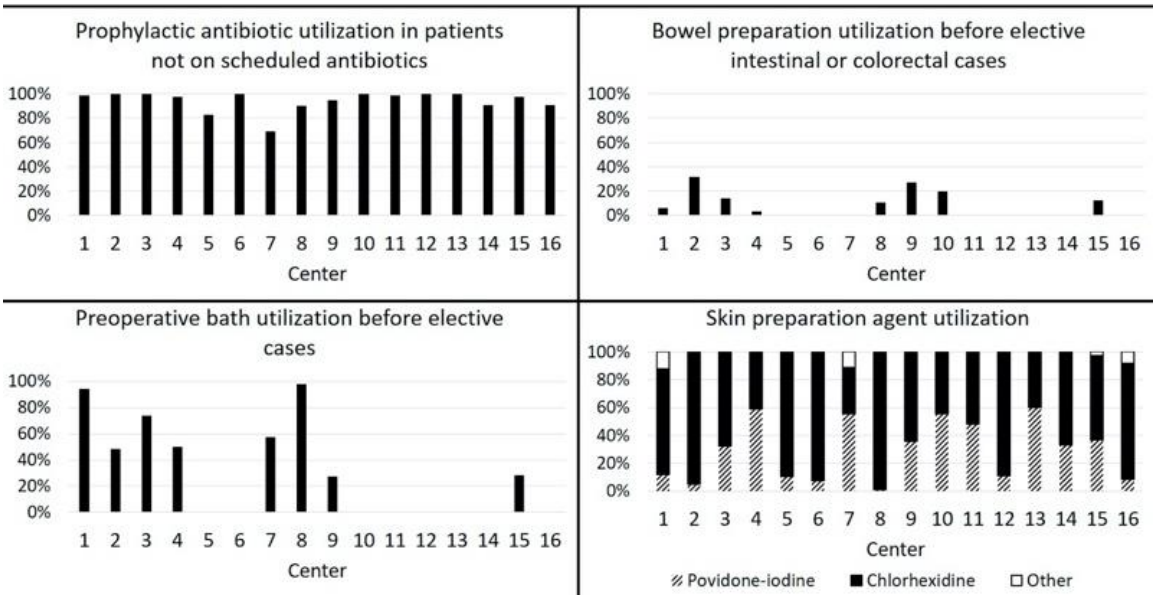
Figure: Between-Center Variation in Utilization of Various Surgical Site Infection Prevention Strategies



President Session | Presentation 3

IMPACT OF MULTIPLE COMPLICATIONS ON FAILURE TO RESCUE AFTER INPATIENT PEDIATRIC SURGERY

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Background: Failure to rescue (FTR), or a patient death after a postoperative complication, has been described across numerous surgical specialties, is currently a national quality indicator, and is believed to be an important contributing factor to variation in mortality across US hospitals. However, little is currently known about FTR after pediatric surgery or the impact of multiple postoperative complications in children. Given important differences in characteristics between pediatric and adult hospitals, as well as the unique physiology of pediatric patients, adult FTR data may not generalize to pediatric populations.

Objective: To characterize complication and FTR rates after inpatient pediatric surgery and to evaluate the association between an increasing number of complications and FTR.

Methods: A retrospective cohort study of 200,554 patients within the National Surgical Quality Improvement Program – Pediatric database who underwent inpatient surgical procedures (2012-2016). Patients were stratified as having undergone either high (≥1%) or low (<1%) mortality risk procedures and further categorized based on the number of postoperative complications (0, 1, 2, or ≥3). The association between the number of postoperative complications and FTR was evaluated with multivariable logistic regression.

Results: Total mortality was 1,239 (0.62% of all cases). Within the cohort, 14.0% and 11.7% of patients undergoing low risk surgery (n=179,345) had any postoperative complication and a major complication, respectively (total 13.8%). Rates after high risk surgery were 12.5% and 9.7%. FTR rates (Figure) increased incrementally with the number complications after low (overall—1.4%; 1—0.9%; 2—4.1%; ≥3—8.9%) and high risk surgery (overall—17.1%; 1—13.6%; 2—27.1%; ≥3—35.6%). FTR rates for low (overall—1.7%; 1—1.0 %; 2—7.1%; ≥3—15.6%) and high risk surgery (overall—21.9%; 1—17.5%; 2—35.6%; ≥3—44.0%) were more pronounced after major complications. There was a dose-response relationship between the number of complications and the odds of FTR for both low (no complication [ref]; 1—Odds Ratio [OR] 3.49 [95% CI 2.74-4.44]; 2—OR 9.43 [6.87-12.95]; ≥3—OR 27.31 [18.88-39.51]) and high risk surgery (1—OR 3.32 [2.64-4.17]; 2—OR 6.93 [4.92-9.76]; ≥3—OR 19.83 [11.98-32.82]).

Conclusion: Among pediatric surgical patients undergoing either high or low mortality risk procedures, FTR demonstrates a dose-response relationship with the number of postoperative complications. These findings not only demonstrate complications have an important, detrimental impact on postoperative pediatric surgical outcomes, but also suggest an appreciable level of risk even for surgical procedures that might be perceived as 'minor'. This information should prompt providers to proactively re-evaluate the clinical status of a patient with an initial complication and can be used to inform preoperative discussions and clinical decision-making.

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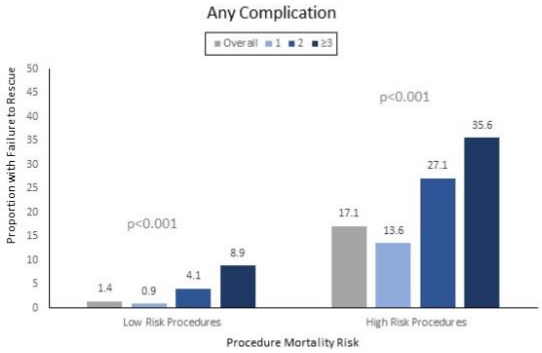
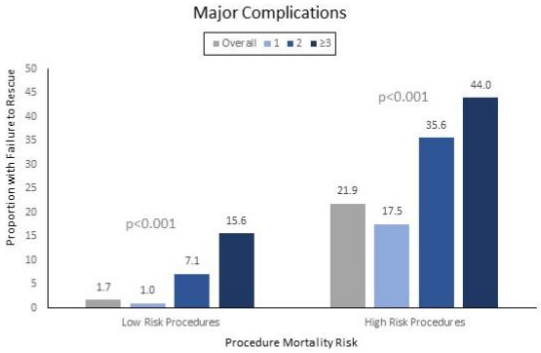

Any Complication
Overall
1
2
≥3
Proportion with Failure to Rescue
50
45
40
35
30
25
20
15
10
5
0
p<0.001
p<0.001
1.4
0.9
4.1
8.9
17.1
13.6
27.1
35.6
Low Risk Procedures
High Risk Procedures
Procedure Mortality Risk


Major Complications
Overall
1
2
≥3
Proportion with Failure to Rescue
50
45
40
35
30
25
20
15
10
5
0
p<0.001
p<0.001
1.7
1.0
7.1
15.6
21.9
17.5
35.6
44.0
Low Risk Procedures
High Risk Procedures
Procedure Mortality Risk

President Session | Presentation 4

A MULTI-INSTITUTIONAL, PROSPECTIVE, RANDOMIZED, DOUBLE-BLIND, PLACEBO-CONTROLLED PHASE IIB TRIAL OF THE TUMOR LYSATE, PARTICLE-LOADED, DENDRITIC CELL (TLPLDC) VACCINE TO PREVENT RECURRENCE IN HIGH-RISK MELANOMA PATIENTS

MB Faries, RC Chick, DF Hale, PM Kemp Bohan, AT Hickerson, TJ Vreeland, JW Myers, JL Cindass, TA Brown, J Hyngstrom, AC Berger, JW Jakub, JJ Sussman, M Shaheen, GT Clifton, T Wagner, GE Peoples

Background: Despite advances in immunotherapy including checkpoint inhibitors, recurrence rates in advanced melanoma remain high. A novel personalized vaccine strategy may prevent recurrences in patients with high risk melanoma. The TLPLDC vaccine uses yeast cell wall particles (YCWP) to load autologous tumor lysate into autologous DC.

Objective: Here, we present the primary analysis of a randomized trial of the TLPLDC vaccine to prevent recurrence in patients with resected stage III/IV melanoma.

Methods: Disease-free melanoma patients were randomized 2:1 to the TLPLDC vaccine vs. unloaded YCWP and autologous DC at 0, 1, 2, 6, 12, 18 months. The protocol was amended to allow concurrent checkpoint inhibitor therapy once approved for the adjuvant setting. The primary endpoint was 24-month disease-free survival (DFS). The pre-specified per treatment (PT) analysis included only patients completing the primary vaccine/placebo series at 6 months without recurrence. Kaplan-Meier analysis was used to determine 24-month disease-free and overall survival estimates. The primary analysis occurred 24 months after the last patient enrolled.

Results: 144 patients were randomized (103 vaccine, 41 control). There were no clinicopathologic or treatment differences between groups. Therapy was well-tolerated with 31.7% of placebo patients and 35.9% of TLPLDC patients experiencing a related adverse event (>90% grade 1 or 2). There was no significant difference between the TLPLDC and placebo arms for 24-month DFS in the intention-to-treat analysis (38.5% vs 27%, p=0.974). In the PT analysis, 24-month DFS was significantly improved in the TLPLDC group compared to placebo (62.9% vs 34.8%; HR 0.52, 95% CI 0.27-0.98, p=0.041) (Figure 1). The 24-month overall survival for TLPLDC vs. placebo was 86.4% vs 75.1%, p=0.15.

Conclusion: This randomized phase IIb trial of the TLPLDC vaccine to prevent recurrence in stage III/IV resected melanoma patients shows the vaccine is safe and improves DFS in patients who complete the primary vaccine series. Since checkpoint inhibitor therapy is now standard in the adjuvant setting for advanced melanoma, these findings will be investigated in a phase III trial of TLPLDC + checkpoint inhibitor vs. checkpoint inhibitor alone in patients with advanced, surgically resected melanoma.

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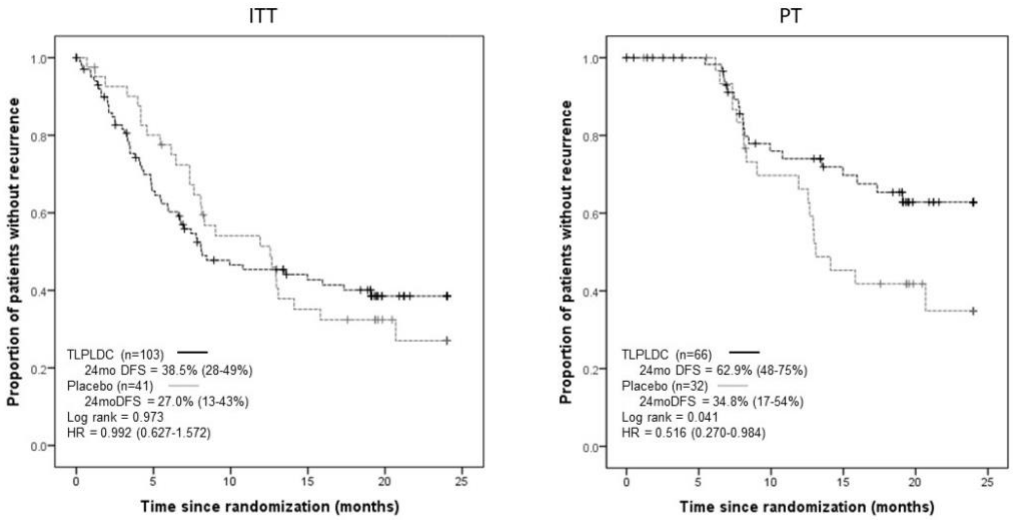

Figure 1. Kaplan-Meier curve demonstrating 24-month disease-free survival between TLPLDC and placebo, intention-to-treat analysis (left) and per-treatment analysis (right). Kaplan-Meier disease-free survival estimates are displayed with 95% confidence interval and compared with log-rank. Hazard ratio is displayed as HR (95% confidence interval).

President Session | Presentation 5

BLUNT TRAUMA WHILE ON DIRECT ORAL ANTICOAGULANT: IS OBSERVATION WARRANTED IF INITIAL HEAD CT IS NEGATIVE?

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Background: At our trauma center, patients suffering blunt trauma on novel oral anticoagulants (NOAC) who could otherwise go home are kept in observation for 24 hours given concerns for delayed intracerebral hemorrhage (ICH) even if an initial CT head was negative.

Objective: The purpose of this study was to re-evaluate that practice. We hypothesized that patients on NOACs would have a lower probability of delayed ICH compared to patients on warfarin.

Methods: Patients on warfarin or NOACs who were placed in observation with a negative initial CT head from January 1, 2014 through July 1, 2019 were included. Primary outcome was rate of delayed ICH, determined by repeat CT head or evidence of neurologic decline. Outcomes assessed using Bayesian generalized linear model and a prior created by systematic review of the literature including three studies with a similar patient population (Battle 2017, Riccardi 2017, Cohan 2019).

Results: A total of 54 patients met inclusion criteria – 32 NOAC and 22 warfarin. There was no difference in age (NOAC median age 79 years [IQR 65, 85] versus warfarin 82 years [IQR 73, 87], p=0.341), sex (NOAC 47% woman versus warfarin 59% woman, p=0.377), or race/ethnicity (NOAC white 84% versus warfarin 82%, p=0.386) between the two groups. The most common mechanism of injury was fall (NOAC 88% versus warfarin 91%, p=0.651). Medical comorbidities and indications for anticoagulation are provided in the Table. Neither group suffered a delayed ICH. All repeat head CT were negative (NOAC 3 repeat CT head versus warfarin 5 repeat CT head). Meta-analysis of the three included studies resulted in a posterior probability of 72% that NOACs were associated with lower rates of delayed ICH compared to warfarin (RR 0.994, 95% credible interval 0.970–1.017). After updating the prior with our current data, the posterior probability that NOAC were associated with lower rates of delayed ICH compared to warfarin increased to 74% (RR 0.993, 95% credible interval 0.971 – 1.016).

Conclusion: Updating available literature using single institution data increased the probability that NOACs were associated with lower rates of delayed ICH compared to warfarin from 72% to 74%. Combined with the overall low rate of delayed ICH in each group throughout the literature, we plan to no longer protocolize the 24 hour observation of patients suffering blunt trauma with a negative initial CT head who could otherwise go home.

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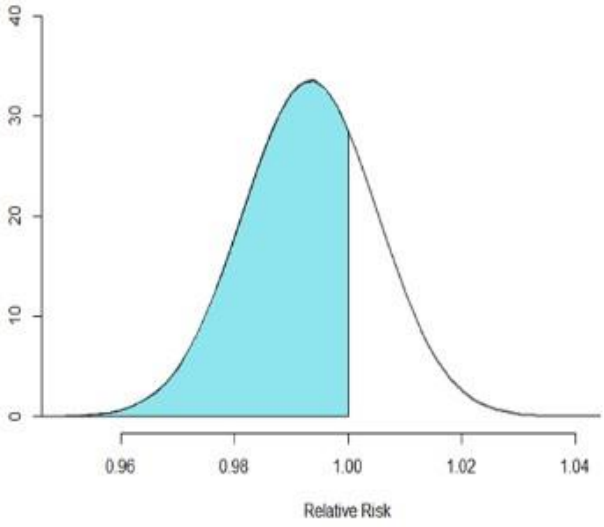
Table. Medical Comorbidities and Anticoagulation Information			
	DOAC (n=32)	Warfarin (n=22)	p-value
Medical Comorbidities			
Atrial fibrillation	21 (66%)	14 (64%)	0.880
VTE	10 (31%)	6 (27%)	0.753
DM	10 (31%)	4 (18%)	0.354
CVA	4 (13%)	3 (14%)	1.000
Anticoagulation Information			
Indication Atrial fibrillation VTE Other	 18 (56%) 8 (25%) 6 (19%)	 14 (64%) 3 (14%) 5 (23%)	 0.727
Admission INR	1.2 (1.1, 1.5)	2.2 (1.6, 2.5)	0.002



President Session | Presentation 6

THE AGE-DEPENDENT ASSOCIATION OF OCCULT HYPOPERFUSION AND POOR OUTCOMES AFTER TRAUMATIC INJURY

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University of Texas HSC - Houston

Background: Occult hypoperfusion (OH), or global hypoperfusion with normal vital signs, is a risk factor for poor outcomes in elderly trauma patients. The physiologic response to trauma and hemorrhage may be altered in elderly patients, making recognition of hypoperfusion by traditional vital signs inadequate.

Objective: We evaluated the hypothesis that OH is associated with worse outcomes than shock in both young and elderly trauma patients.

Methods: A single-center cohort study of adult (≥16 years) trauma patients 2016-2018 with a base excess (BE) measured on arrival was performed. Perfusion states were defined as: Shock if heart rate (HR)>120 or systolic blood pressure (SBP)<90; OH if BE<-2, HR<120, and SBP>90; and normal for all others. Patients were stratified as young (<55 years) or elderly (≥55). The primary outcome was a composite of mortality or serious complication including unplanned intensive care unit admission or return to operating room, acute renal failure, acute respiratory distress syndrome, or cardiac arrest. Bayesian multivariable regression with clinically sound covariates was utilized to assess the relationship between arrival perfusion state and outcomes. Sensitivity analyses were performed adding BE<-2 to the definition of shock and using modified definitions of elderly at 5 year increments.

Results: Of 3,126 included patients, 855 were elderly. Elderly were more likely to be female, white, and injured bluntly and arrived with higher arrival systolic blood pressure, lower heart rate, and higher base excess ($p<0.05$). Rates of shock (31% and 33%) and OH (23% and 25%) were similar in elderly than young patients, respectively. Rates of major complication (11% and 6%) and mortality (27% and 8%) were higher in elderly than young patients, respectively. OH on arrival was associated with a higher risk of mortality or complication than normal perfusion regardless of age group (Table). Compared to shock, OH was associated with a RR 1.65 (95% CI 0.99-2.84) of poor outcome in the elderly and a RR 0.41 (95% CI 0.28-0.59) of poor outcome in younger patients. Findings were similar using the modified shock definition including BE<-2. Furthermore, between ages 45 and 50, there was a notable increase in the association of OH with poor outcome. For patients above 45 years, there was a 52% posterior probability (RR 1.01, 95% CI 0.68-1.51), but above 50 years there was a 96% posterior probability that OH is associated with increased mortality or complication when compared to shock (RR 1.50, 95% CI 0.94-2.46). Defining elderly above age 60 or 65 revealed similar findings.

Conclusion: In elderly, but not younger, patients, OH is associated with worse outcomes than shock. This relationship may become clinically apparent between the ages of 45 and 50 years and suggests an age-dependent physiologic change in the response to trauma. More attention is necessary to the diagnosis and treatment of all hypoperfused states in elderly patients.

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Table: Bayesian Multivariable Analysis of Arrival Perfusion and Outcome

		Young (<55 years)		Elderly (≥55 years)	
		Relative Risk of Mortality or Major Complication (95% Credible Interval)	Posterior Probability*	Relative Risk of Mortality or Major Complication (95% Credible Interval)	Posterior Probability*
Compared to Normal Perfusion	OH	1.83 (1.15-2.96)	>99%	1.73 (1.11-2.67)	>99%
	Shock	4.46 (2.97-6.89)	>99%	1.05 (0.59-1.77)	57%
Compared to Shock	Normal	0.22 (0.14-0.34)	<1%	0.95 (0.56-1.67)	43%
	OH	0.41 (0.28-0.59)	<1%	1.65 (0.99-2.84)	97%

Adjusted for age, sex, trauma type, and injury severity score, defined a-priori
**Posterior Probability that Perfusion State Increases Mortality or Major Complication*

AN EDUCATIONAL INTERVENTION REDUCES THE QUANTITY OF OPIOIDS PRESCRIBED FOLLOWING GENERAL SURGERY

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Brooke Army Medical Center, San Antonio

Background: Significant variability exists in opioid prescribing practices among surgeons and can result in the prescription of excessive opioids. Diversion of prescribed opioids significantly contributes to the current national opioid epidemic. Further, opioid dependence can develop after short courses of treatment.

Objective: This study evaluated the ability of a single educational intervention on appropriate prescription quantities and pain management strategies to reduce opioid quantities prescribed following general surgical procedures.

Methods: This retrospective study evaluated opioid prescribing practices at a single hospital prior to and following a 30-minute lecture for all general surgery residents in an academic program. The lecture discussed the Michigan Surgery Quality Collaboration opioid prescribing guidelines, multimodal analgesia, and methods for counseling patients on post-operative pain. The quantity of opioid prescribed normalized to oral morphine equivalents (OME), type of opioid prescribed, additional non-opioid pain medications provided, and number of refills requested were evaluated for common general surgical procedures. Patients aged 18-89 who underwent a breast excisional biopsy (EB), mastectomy (M), laparoscopic appendectomy (LA), laparoscopic cholecystectomy (LC), open umbilical hernia repair (OUHR), unilateral/bilateral open inguinal hernia repair (OIHR), or unilateral/bilateral laparoscopic inguinal hernia repair (LIHR) were included. Patients who had been prescribed an opioid within 6 months prior to surgery, underwent additional surgery within 3 months, or experienced a postoperative complication were excluded. 12 months of data prior to and 6 months of data following the intervention were collected.

Results: 695 and 378 patients pre- and post-intervention were included, respectively. Following the intervention, median amount of OME prescribed decreased for each procedure: 150mg to 75mg for EB ($p<0.001$), 225mg to 150mg for M ($p=0.85$), 150mg to 86mg for LA ($p<0.001$), 150mg to 82mg for LC ($p<0.001$), 150mg to 103mg for OUHR ($p<0.001$), 175mg to 100mg for OIHR ($p=0.001$), and 200mg to 113mg for LIHR ($p<0.001$). Fewer patients received an opioid alone (25.9% prior, 10.6% post) and more patients received an opioid and two adjuncts (6.2% prior, 37.8% post) ($p<0.001$). More patients received oxycodone (23.3% prior, 59.8% post) as opposed to an acetaminophen-containing opioid (64.5% prior, 31.0% post) ($p<0.001$). The percentage of patients requiring refills decreased (7.5% prior, 2.1% post) ($p=0.001$).

Conclusion: A single educational intervention reduced the amount of OME prescribed following uncomplicated general surgical procedures. Patients were more frequently discharged with multiple non-opioid medications without an increase in requested opioid refills. These results suggest that educating resident physicians on evidence-based guidelines for multimodal postoperative pain control is effective and warranted.

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Comparison of Oral Morphine Equivalents Prescribed Pre- and Post-Intervention

Surgery	OME Prescribed Pre-Intervention, median (IQR)	OME Prescribed Post-Intervention, median (IQR)	Median Reduction, %	*p* -value
Excisional Biopsy/Lumpectomy	150.0 (90.0, 225.0)	75.0 (67.5, 142.5)	50.0%	< 0.001
Mastectomy	225.0 (112.5, 268.1)	150.0 (75.0, 150.0)	33.3%	0.85
Laparoscopic Appendectomy	150.0 (100.0, 225.0)	86.3 (75.0, 150.0)	42.5%	<0.001
Laparoscopic Cholecystectomy	150.0 (112.5, 225.0)	82.3 (75.0, 150.0)	45.1%	<0.001
Open Umbilical Hernia Repair	150.0 (100.0, 225.0)	102.5 (75.0, 112.5)	31.7%	<0.001
Open Inguinal Hernia Repair	175.0 (150.0, 225.0)	100.0 (75.0, 150.0)	42.9%	0.001
Laparoscopic Inguinal Hernia Repair	200.0 (150.0, 281.3)	112.5 (75.0, 150.0)	43.8%	<0.001

OME: oral morphine equivalent; IQR: interquartile range.

SURGICAL INTERN BOOT CAMP - DOES A PRE - RESIDENCY COURSE HELP INTERNS?

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Texas Tech University HSC - El Paso

Background: Surgical training has evolved over the years, ACGME outlined six core competencies that need to be accomplished during the five years of training. Increasing oversight of medical students and junior residents has led to revamping of teaching curricula nationwide to encompass the six core competencies.

Objective: The general surgery boot camp at our institution aimed to enhance the abilities of the incoming interns and also increase their confidence of performing day-to-day tasks expected of interns in the clinical setting. We hypothesized that a "boot camp" given at the beginning of resident training and at six-month follow-up would improve resident confidence levels on specific aspects of the six competencies.

Methods: The interns underwent two boot camps – a summer and a winter boot camp. The summer boot camp (SBC) included didactics, simulations and practical assessment sessions. The SBC spanned over two days; a total of ten hours of didactics and ten hours of simulations and practical assessments. The SBC was held a week prior to incoming interns assuming clinical duties. The interns were given self-assessment questionnaires before and after the boot camp. Winter boot camp spanned over half a day of practical assessments.

Results: Five interns (mean age = 29 years) were included in this study. No gender differences were noted in any outcome variable. We conducted repeated measure ANOVAs for pretest, posttest, and six-month follow-up with significant differences found for patient care, technical skills, interpersonal skills, and practice-based learning. Data analysis also shows significant differences in the interns' self-assessment of skills. There was a significant difference in self-assessment scores for one-handed knot tying, mean=2.0 before and mean=3.0 after ($p<0.05$), and two handed knot tying, mean=2.0 before and mean=3.4 after ($p<0.05$). Interns perception of their skills for arterial line placement, chest tube placement and performing a breast ultrasound were significantly better ($p<0.05$).

Conclusion: Many medical schools have adopted a pre-residency training model for students going into surgery. The transition from being a student to a resident can be abrupt, because responsibilities and decision-making can become more demanding once clinical duties begin. Interns are expected to function as independent healthcare providers while attempting to master the ACGME's clinical competencies.

This data shows that training incoming interns prior to them commencing clinical duties offers the dual advantage implementing and improving knowledge and skills taught into day-to-day patient care. The current study suggests that these exercises can increase confidence in their clinical and interpersonal skills.

Table 1: *Repeated measures ANOVA for pretest, posttest and follow-up confidence levels*

Measure	*df*	*F*	η^2	*p*
Patient Care and Medical Knowledge	2	66.071	.943	<.001
Technical Skills	2	39.079	.907	<.001
Interpersonal Skills and Communication	2	20.104	.834	.001
Practice-based Learning and Improvement	2	6.597	.623	.020*

**Note.* Pairwise contrasts were conducted and found to be insignificant

ONE ADDITIONAL STEP IN LAPAROSCOPIC VENTRAL HERNIA REPAIR IMPROVES PATIENT OUTCOMES: A MULTI-CENTER, BLINDED RANDOMIZED CONTROL TRIAL (NCT02363790)

N Dhanani, K Bernardi, O Olavarria, J Holihan, L Kao, T Ko, J Roth, S Tsuda, K Vaziri, M Liang
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Background: Observational studies have reported conflicting results with primary fascial closure (PFC) versus bridged repair during laparoscopic ventral hernia repair (LVHR).

Objective: To determine if when evaluated in a randomized controlled trial (RCT), PFC compared to bridged repair would improve patient quality of life (QoL).

Methods: In this multi-center, blinded randomized controlled trial (RCT), patients scheduled for elective LVHR (hernia defects 3-10 centimeters) were randomized to PFC versus bridged repair. Primary outcome was change in QoL after LVHR using a validated, hernia-specific survey (1=poor and 100=perfect QoL) measuring pain, function, cosmesis, and satisfaction. Secondary outcomes were post-operative surgical site occurrences (hematoma, seroma, surgical site infection, and wound dehiscence), abdominal eventration, and hernia recurrence. The trial was powered to detect the previously determined minimum clinically important difference in QoL change (7 points) between study groups. Outcomes were compared with Mann-Whitney U test or chi-square.

Results: A total of 129 patients underwent LVHR and 107 (83%) completed median follow-up of 24 months (range: 9-42). Baseline health and hernia characteristics were similar between the two groups. Both groups had on average a significant improvement in QoL, but patients in the PFC group had a 12-point higher average improvement compared to bridged repair (41.3±31.5 versus 29.7±28.7, p=0.047). There were no differences in secondary outcomes between groups (Table).

Conclusion: This is the first RCT demonstrating that PFC with LVHR significantly improves patient QoL without increasing complications. Based upon this study and the existing body of evidence, CMS should create a CPT code to incentivize surgeons to perform PFC during LVHR.

Table: Patient Outcomes				
Characteristic	**Total N=123**	**PFC N=61**	**Control N=62**	**P-Value***
OR duration[a] (minutes)	81.0 (39.3)	88.3 (39.4)	75.4 (38.4)	0.063
Hospital length of stay[b] (days)	0 (0,1)	0 (0,1)	0 (0,0)	0.203
Surgical site occurrence	24 (19.5%)	8 (13.1%)	15 (24.2%)	0.256
Hematoma	3 (2.4%)	0 (0.0%)	3 (4.8%)	
Seroma	19 (15.4%)	7 (11.5%)	12 (19.4%)	
Surgical site infection	1 (0.8%)	1 (1.6%)	0 (0.0%)	
Readmission	7 (5.7%)	4 (6.5%)	3 (4.8%)	0.730
Reoperation	2 (1.6%)	1 (1.6%)	1 (1.6%)	0.991
Recurrence	8 (6.5%)	6 (9.8%)	2 (3.2%)	0.131
Clinical Eventration	16 (13.0%)	7 (11.5%)	9 (14.5%)	0.616
Follow-up (months)[c]	24 (9-42)	23 (13-42)	24 (9-42)	0.287
*P-value < 0.006 considered significant after Bonferroni correction. [a]Mean (±SD) [b]Median (IQR) [c]Median (Range) Control: Bridged Closure, OR: Operating Room, PFC: Primary Fascial Closure				

Surgical Potpourri I Session | Presentation 10

HOW BLUE ARE YOU? QUANTIFYING HYPOXIA IN CONGENITAL DIAPHRAGMATIC HERNIA PULMONARY PARENCHYMA

Gupta, V.S., Zhaorigetu, S., Jin, D., Berg, N., Eltzschig, H., Lally, K.P., Harting, M.T.
University of Texas HSC - Houston

Background: In congenital diaphragmatic hernia (CDH), pathophysiologic pulmonary dysfunction occurs secondary to pulmonary hypertension and hypoplasia. Clinically, these processes often manifest as hypoxia. While clinically predictable, the underlying pulmonary cellular and molecular changes in CDH remain enigmatic, limiting our ability to measure efficacy in novel therapies.

Objective: Our objective was to characterize the degree of hypoxia and hypoxia-inducible factor (HIF) expression in the nitrofen CDH model.

Methods: Pregnant Sprague-Dawley rats were fed 100mg of nitrofen dissolved in 1mL of olive oil on gestational day 9.5, while rats in the control group were fed the same dose of olive oil only. At birth, 300µg/100µL of Hypoxyprobe was administered intraperitoneally to all pups. Control pups were maintained either in an environment of normoxia (21% O2) or hypoxia (BioSpherix P130, 4% O2) for 1 hour. CDH pups were maintained in normoxia. Left lungs were collected at 1 hour of life. The extent of parenchymal hypoxia was assessed by immunofluorescence. The relative expression of HIF-1α and HIF-2α were measured by western blotting. Comparative statistics were performed using GraphPad Prism (ANOVA & t test).

Results: CDH pulmonary parenchyma showed a significantly increased degree of hypoxia at birth compared to controls. There was a greater than 5x increase in Hypoxyprobe detection in 4% hypoxemic pups compared to control pups ($p<0.01$); CDH pups had 20x more Hypoxyprobe intensity than controls ($p<0.01$) (FIGURE). The relative expression of HIF-1α was 4-fold higher in CDH pups ($p=0.005$). HIF-2α expression was also increased, with 2x greater expression in CDH lungs compared to controls ($p=0.0012$).

Conclusion: In rodents, CDH lung tissue shows significantly increased levels of hypoxia compared to control lungs and lungs of pups exposed to 4% O2. These findings are consistent with the clinical findings, where infants with CDH can be difficult to oxygenate and are persistently hypoxic. Moreover, relative expression of HIF-1α and HIF-2α were increased in CDH lung tissue compared with controls, suggesting that the hypoxia causes upregulation of both HIF pathways. These data reveal mechanisms of cellular hypoxia signaling alterations which may be initiated prenatally and provide critical parameters for assessing response to therapies. Moreover, these observations represent critical early postnatal or prenatal therapeutic targets.

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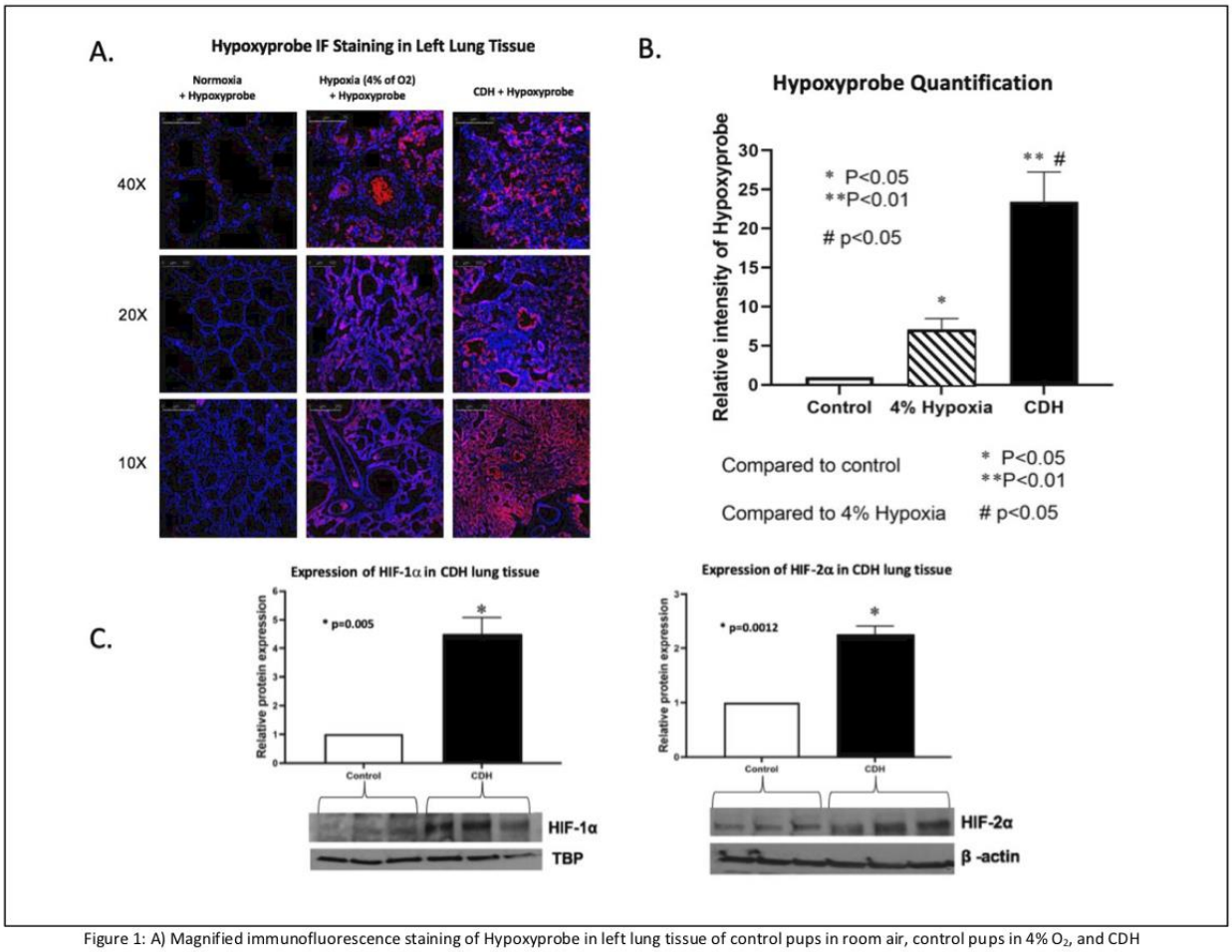

Figure 1: A) Magnified immunofluorescence staining of Hypoxyprobe in left lung tissue of control pups in room air, control pups in 4% O_2, and CDH pups in room air B) Bar graph showing significant differences in Hypoxyprobe intensity between groups C) Bar graphs and western blot images

MULTIDISCIPLINARY TREATMENT TEAMS DECREASE PEDIATRIC LIVER RESECTION COMPLICATIONS

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Baylor College of Medicine

Background: Liver resection (LR) in children for primary hepatic malignancies is a high risk procedure with well-reported high rates of morbidity (≈30%). Multidisciplinary teams (MDT) have been proposed in the treatment of patients with high risk disease processes in an effort to ensure proper patient selection, improve outcomes, and minimize perioperative morbidity and mortality. In an effort to decrease mobidity following pediatric LR, we implemented a MDT for the treatment of primary hepatic tumors made up of two dedicated surgeons, pathologists, hepatologists, oncologists, and radiologists.

Objective: The aim of our study was to evaluate our outcomes and complications rates before and after the implementation of a MDT for the treatment of hepatic malignancies and determine the effect of complications on overall and event-free survival.

Methods: A retrospective chart review was performed on all patients less than 18 years of age who underwent LR at our institution between 2002 and 2019. Demographic, histological, outcome, intraoperative, and long-term followup data were collected in addition to perioperative complications that were graded according to the Clavien-Dindo (CD) and CLASSIC (C) scoring systems with major complications being defined as Grade 3 and above. Statistical analysis included logistic regression and Kaplan-Meyer analysis

Results: A total of sixty-six (66) patients underwent LR for primary hepatic malignancy. The most commonly encountered malignancy was hepatoblastoma accounting for fifty-five (83%) patients. Other pathologies included undifferentiated embryonal sarcoma, lyphoma, hepatocellular carcinoma, and rhabdoid tumor. A total of nine patients (13%) experienced a major perioperative complication with two patients (3%) experiencing perioperative mortality. After the implementation of a MDT the major perioperative complication rate (CD/C≥3) for primary liver resections decreased from 17% to 8%. The rates of all complications (CD/C 1-5) also dropped from 50% to 35%. Extent of resection was not associated with with an increased rate of major complications (p=.06). Patients who experienced major complications were noted to be significantly older at diagnosis (median age 2051 vs 1466 days, p=0094). Patients who experienced a major complication were more likely to have recurrence of disease (OR 20.8 p=.03). Patients who experienced a major complication experienced a statistically worse 3-year event free survival (p=.0004) but with no difference in overall survival (p=.71).

Conclusion: Our results demonstrate the ability to minimize previously reported high complication rates associated with pediatric liver resection with the implementation of a dedicated MDT. These data provide evidence for regionalization of care for children with primary liver malignancies to tertiary centers for hepatic resection. In children undergoing LR for primary malignancies, major complications are associated with increased rates of disease recurrence.

PATIENT REPORTED OUTCOMES AFTER EMERGENT LAPAROTOMY: OPPORTUNITIES FOR IMPROVED POST-OPERATIVE QUALITY OF LIFE

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Background: Emergent laparotomy is a morbid procedure with high risk of complications. Intraoperative decisions are often focused on prevention of these complications including surgical site infections (SSIs), hernia, and chronic pain. Patient reported outcomes (PROs) provide important information regarding physical, mental, and social well-being; however, to date, there have been no studies assessing the effect of post-operative complications on quality of life (QoL) outcomes for patients undergoing emergent laparotomy.

Objective: We hypothesized that definitive laparotomy (DL), absence of SSI, and skin closure at the conclusion of the operation are associated with higher postoperative QoL scores in patients undergoing emergent laparotomy.

Methods: A single center observational study of adult patients (>15 years) undergoing emergent laparotomy by the emergent general surgery or trauma surgery services from June 2018 to August 2019. Patients were approached between 2 weeks and 1 year postoperatively via telephone or in person in the hospital or outpatient clinic and surveyed using the modified Activities Assessment Scale (mAAS). The mAAS is a validated, 13-question abdominal wall specific QoL survey which captures information regarding mood, lifestyle, and physical activity. Cumulative scores were normalized to a scale of 1 to 100, with 1 representing poor QoL and 100 representing high QoL. Based on prior studies, a score of >=80 is considered normal. Patients were stratified by development of SSI, receipt of damage control laparotomy (DCL), and skin management. Demographics, operative details, and outcomes were obtained via chart review. CDC definitions of superficial SSI (sSSI) and organ/space SSI (OS-SSI) were utilized. Univariate and multivariable Poisson regression analyses were performed.

Results: Of 68 patients who completed surveys, the majority were male (66%), had traumatic injuries (74%), and a median age of 37.5 (IQR 20-55). The median mAAS was 48 (IQR 19–76), with 18 patients reporting normal QoL. On univariate analysis, a higher QoL score was associated with having undergone DL, absence of sSSI or OS-OSSI, and closed skin (Figure). After controlling for age, sex, and time from surgery to survey, absence of sSSI (RR 1.13, 95% CI [1.0-1.28], p=0.06), absence of OS-SSI (RR 1.30, 95% CI [1.19-1.42], p<0.001), closed skin (RR 2.03, 95% CI [1.19-3.46], p=0.01), and DL (RR 1.25, 95% CI [1.21-1.29], p<0.001), were associated with better QoL.

Conclusion: A majority of patients reported poor QoL in the early post-operative period. Absence of surgical site infection, closed skin and definitive laparotomy are associated with higher QoL scores. PROs should be incorporated into clinical decision-making in order to improve patient centered care.

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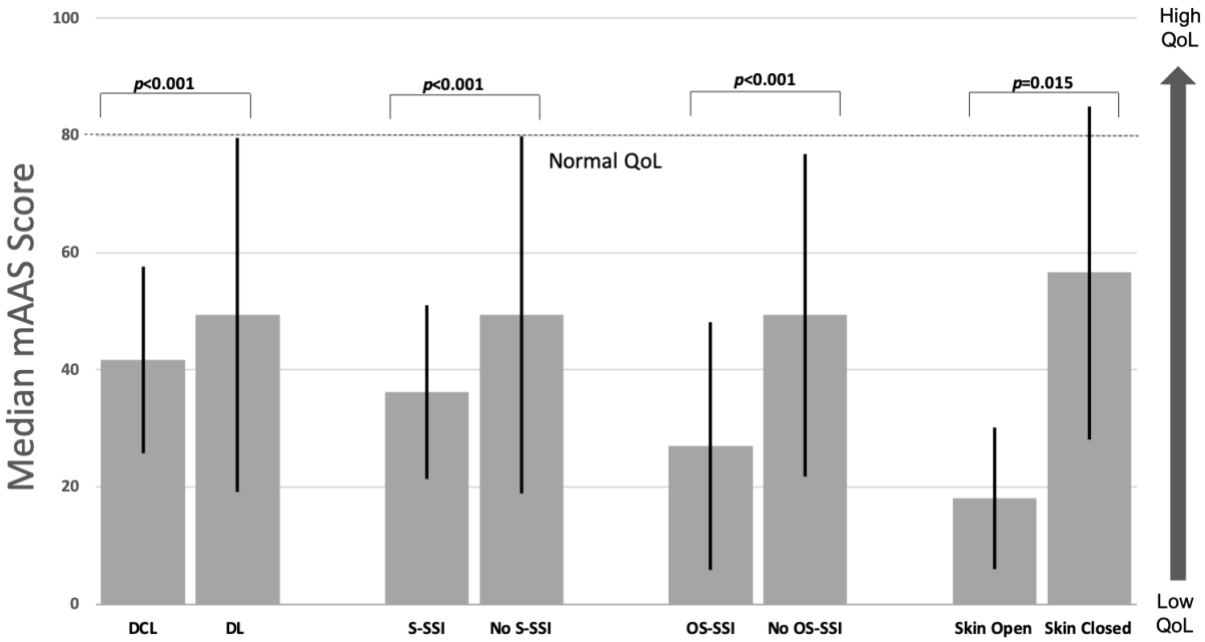
100
80
60
40
20
0
Median mAAS Score
p<0.001
p<0.001
p<0.001
p=0.015
Normal QoL
DCL
DL
S-SSI
No S-SSI
OS-SSI
No OS-SSI
Skin Open
Skin Closed
High QoL
Low QoL

GASTROINTESTINAL COMPLICATIONS AFTER OPEN THORACOABDOMINAL AORTIC ANEURYSM REPAIR

W Frankel, S Green, H Amarasekara, Q Zhang, O Preventza, S LeMaire, J Coselli
Baylor College of Medicine

Background: At present, few studies have described the burden and impact of gastrointestinal (GI) complications after open thoracoabdominal aortic aneurysm (TAAA) repair. As hybrid and endovascular techniques for TAAA repair continue to evolve, it is important to establish benchmarks for the incidence and impact of GI complications on outcomes after open repair.

Objective: The aim of the present study was to describe the incidence and impact of GI complications after open TAAA repair during our nearly three-decade experience with this operation.

Methods: We retrospectively analyzed data from 3,587 open TAAA repairs performed at our center between 1991 and 2019. We used univariate and multivariable analyses to identify pre- and intra-operative factors associated with GI complications–including GI bleeding, ischemia, obstruction, and acute pancreatitis–after open TAAA repair. Adverse event was defined as operative death or persistent (present at hospital discharge) stroke, paraplegia, paraparesis, or renal failure necessitating dialysis.

Results: GI complications developed after 213 (6%) repairs. GI complications were less likely to occur after extent I repair compared to repairs that involved infrarenal abdominal aortic segments (extents II-IV; P=0.003). GI complications were associated with higher rates of endarterectomy, stenting, or bypass of branch vessels (51% vs 42%, P=0.01). The rate of selective visceral perfusion utilization was similar in those who did and those who did not develop GI complications. Independent predictors of GI complications included increasing age, increasing aortic clamp time, splenectomy, aortic rupture, and non-extent I repair (Table). The rates of operative death (34% vs 7%) and adverse event (44% vs 13%) were significantly higher (P<0.001) in those who developed GI complications, and these patients had prolonged hospitalization (29 days vs 11 days, P<0.001). Short-, mid-, and long-term survival rates were significantly lower in patients who developed GI complications (P<0.001; Figure).

Conclusion: Although uncommon, GI complications carry a morbid prognosis after open TAAA repair and may signal the impending development of other adverse events. Optimization of risk factors and development of adjunctive techniques to reduce morbidity and mortality from these complications warrants further study.

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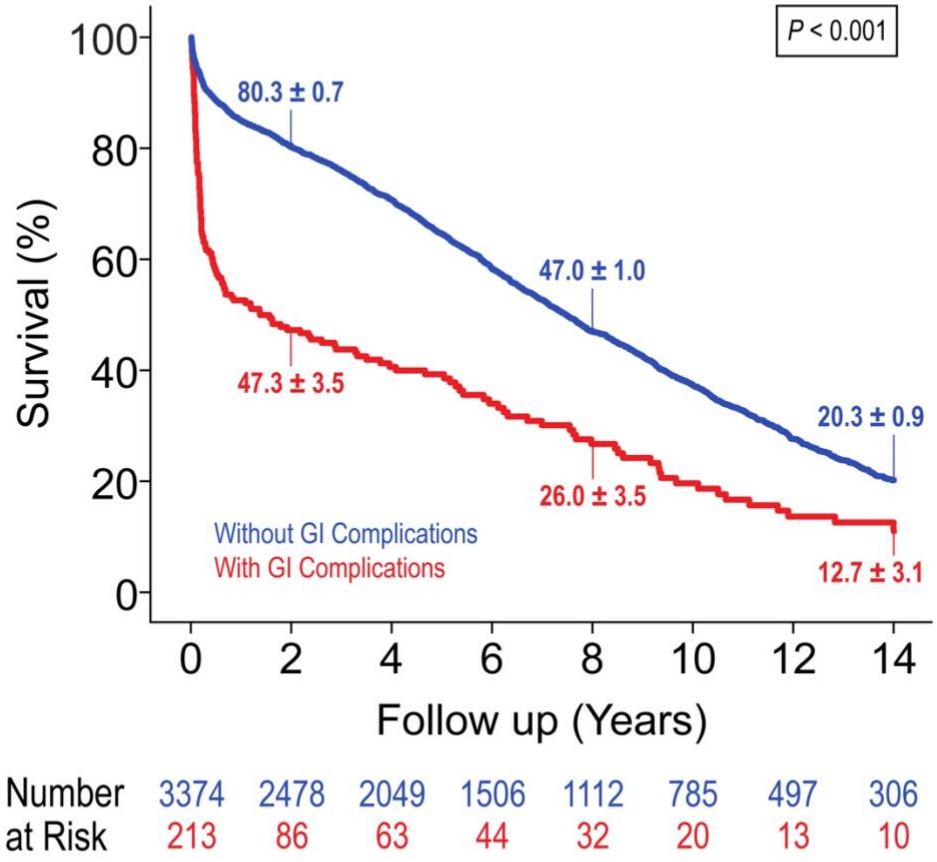
P < 0.001
80.3 ± 0.7
47.0 ± 1.0
20.3 ± 0.9
47.3 ± 3.5
26.0 ± 3.5
12.7 ± 3.1
Without GI Complications
With GI Complications
Survival (%)
100
80
60
40
20
0
0
2
4
6
8
10
12
14
Follow up (Years)
Number at Risk
3374 2478 2049 1506 1112 785 497 306
213 86 63 44 32 20 13 10

ARE RATES OF PERFORATED APPENDICITIS DIFFERENT IN BORDER COUNTIES IN TEXAS?

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Background: Background: Appendicitis is a common surgical emergency and a delay in treatment can lead to perforation which can progress to abdominal sepsis. In the advanced disease states, appendicitis can increase morbidity, cost, and length of hospital stay. Socioeconomic and geographical factors play a role in the accessibility to healthcare and timing to treatment. The Texas-Mexico border remains an understudied territory in terms of surgical emergencies. Our hypothesis is that there is an increased rate of perforated appendicitis in border counties (BC) when compared to non border (NonBC) in Texas.

Objective: To determine if there is an increased rate of perforated appendicitis in border counties (BC) when compared to NonBC in Texas.

Methods: Methods: The Texas Inpatient and Outpatient Public Use Database File (PUDF) was queried for the years 2016-2017 using International Classification of Diseases (ICD) Version 10 codes for appendicitis, perforated appendicitis, and ICD-10 procedure codes and Current Procedural Terminology codes for open and laparoscopic appendectomies. Patients with perforated appendicitis aged 18-88 were included. We examined demographics including: age, sex, race, ethnicity and location. In addition, we looked at admission and discharge diagnosis, cost, length of stay, discharge status, and complications. Continuous variables were assessed using a t-test, and summarized using means and standard deviation. Categorical variables were assessed using a Chi-Square test, adjusted ratios (odds vs risk vs prevalence) will be calculated from appropriate regression models, and reported with a 95% confidence interval and p-value with significance at 5%.

Results: Results: There were 77,944 patients that were operated on for acute appendicitis during the study period. 7245 were located in border counties. There was not a significant difference in length of stay (LOS) between BC and NonBC (3.2 days vs 3.3, p=0.21). Hispanics made up 75.6% of the population of BC and only 31.1% of NonBC. Most admissions were emergency admissions for both groups. There was not a significant difference in perforation for NonBC vs BC (10.3% vs 12.3%, $p < 0.001$). Patients undergoing laparoscopic appendectomy (n=35,008) vs open (n=881) had a lower LOS (6 days vs 8.6 days). There was no difference in rates of laparoscopic vs open in terms of race or ethnicity.

Conclusion: We found no difference in LOS, rates of laparoscopic vs open appendectomy by race or ethnicity, or perforation between patients in NonBC when compared to BC. Our hypothesis of a higher rate of perforated appendicitis was wrong.

DOES ACTIVE PERINATAL MANAGEMENT OF SACROCOCCYGEAL TERATOMA IMPROVE OUTCOMES?

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Background: Advances in fetal imaging have improved the ability to prenatally assess and intervene in infants diagnosed with sacrococcygeal teratomas (SCT).

Objective: The purpose of this study was to determine if active perinatal management of fetuses with severe SCT improves outcomes.

Methods: A retrospective review of fetuses and newborns evaluated for SCT between January 2005 and April 2019 (H-26009) was completed. Prenatal findings, operative treatment, and postnatal outcomes were collected. Data were analyzed using descriptive statistics, chi-square analysis, and non-parametric tests.

Results: We identified 38 patients with SCT meeting criteria for inclusion. There were 26% (10/38) Type I, 39% (15/38) Type 2, 29% (11/38) Type 3, and 5% (2/38) Type 4. Most, 87% (33/38), were prenatally diagnosed at a median age of 22w3d (IQR: 20w4d – 24w3d). Median tumor-volume to fetal weight ratio (TFR) was 0.13 (IQR: 0.04 – 0.43). Seven patients underwent fetal intervention (FI); including 4 amnioreductions, 2 open fetal resections (OFR), and 1 early delivery. There was no difference in TFR for patients who underwent FI (FI: 0.18 vs No FI: 0.09, p = 0.18). Indications for FI included high output cardiac failure, fetal hydrops, and polyhydramnios. All fetuses who underwent FI survived with no difference in long-term complication rate compared to those not receiving FI (FI: 43% vs No FI: 33%, p = 0.6) (Table 1). Overall, 8 patients died and 88% (7/8) of them had a complicated SCT (cardiac complications, hydrops, and/or ruptured tumors). FI was not offered due to risk of mortality and/or morbidity, fetal demise at presentation, or parental wish. All patients with poor outcomes had a TFR of > 0.12 at 24 weeks gestation.

Conclusion: Active perinatal management of fetuses with severe SCT can improve overall outcomes and TFR may assist in identifying at risk fetuses.

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Table 1. Complication Rate per SCT Diagnosis

PMA at Diagnosis	TFR	Hydrops	Cardiac Complication	PMA at Birth	Intervention/Outcome
Fetal Intervention					
21w0d	0.05	No	No	34w6d	Amnioreduction/Survival
24w6d	0.18	No	No	30w0d	Amnioreduction/Survival
19w0d	0.30	Yes	No	33w0d	Amnioreduction/Survival
20w0d	0.48	No	Yes	36w5d	Fetal Resection/Survival
23w0d	0.5	Yes	Yes	35w0d	Fetal Resection/Survival
31w0d	0.55	No	Yes	32w0d	Early delivery/Survival
24w3d	0.68	No	Yes	28w2d	Amnioreduction/Survival
No Fetal Intervention					
20w0d	0.03	No	No	37w4d	No Intervention/Survival
19w4d	0.06	No	No	39w2d	No Intervention/Survival
23w3d	0.02	No	No	38w4d	No Intervention/Survival
	0.02	No	No	38w6d	No Intervention/Survival
25w6d	0.03	No	No	39w0d	No Intervention/Survival
22w3d	0.15	No	No	36w1d	No Intervention/Survival
22w3d	0.38	No	No	27w	No Intervention/Survival
21w4d	0.04	No	No	39w3d	No Intervention/Survival
27w2d	0.06	No	No	35w0d	No Intervention/Survival
24w0d	0.07	No	No	31w0d	No Intervention/Survival
22w6d	0.09	No	No	38w0d	No Intervention/Survival
25w1d	0.1	No	No	34w0d	No Intervention/Survival
33w5d	0.12	No	Yes	36w0d	No Intervention/Survival
22w2d	0.125	No	No	35w0d	No Intervention/Survival
20w3d	0.14	No	No	26w5d	No Intervention/Survival
20w3d	0.15	No	No		No Intervention/ND
24w0d	0.18	No	No	36w0d	No Intervention/Survival
22w3d	0.19	Yes	No		No Intervention/IUFD
22w3d	0.22	No	No	36w1d	No Intervention/Survival
24w3d	0.26	No	No	37w5d	No Intervention/Survival
20w5d	0.3	Yes	No		No Intervention/ IUFD
35w6d	0.42	No	No	39w0d	No Intervention/Survival
21w0d	0.44	No	No	25w0d	No Intervention/Survival
18w5d	1.8	Yes	Yes		No Intervention/ND
21w0d	0.52	No	Yes		No Intervention/IUFD
31w0d	0.55	No	No	31w0d	No Intervention/Survival
20w0d	0.71	Yes	Yes		No Intervention/IUFD
15w0d		No	Yes		No Intervention/IUFD
33w6d		No	No	33w6d	No Intervention/Survival
39w0d		No	No	41w0d	No Intervention/Survival

*Intrauterine Fetal Demise (IUFD), Neonatal Death (ND)

Mini-Talk II Session | Presentation 16

ProBNP IS A POTENTIAL BIOMARKER FOR CONGENITAL DIAPHRAGMATIC HERNIA-ASSOCIATED CARDIAC DYSFUNCTION

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University of Texas HSC - Houston

Background: Cardiac dysfunction is a key culprit in the morbidity and mortality of congenital diaphragmatic hernia (CDH). Despite the high prevalence of cardiac dysfunction in CDH, useful biomarkers of disease severity are limited. N-terminal pro b-type natriuretic peptide (pBNP) is a hormone that is released secondary to ventricular stretch. Although pBNP has been used as a prognosticator in other conditions such as heart failure and cardiomyopathy, little is known about its utility in patients with CDH associated cardiac dysfunction.

Objective: We hypothesized that pBNP levels would be associated with cardiac dysfunction and high-risk disease in CDH.

Methods: All patients in the CDH Study Group registry from 2015 to 2019 with at least one pBNP measurement were included. Mean pBNP values were used for patients with multiple values. Cardiac function data were collected from echocardiograms within the first 72 hours of life. Univariate analyses were performed to test for significant differences between groups. Statistical analyses were performed using Stata/IC 16.

Results: A total of 2,337 CDH patients were identified in the database. Of those patients, 212 (9%) had at least one pBNP value. Values ranged from 2.5 to 142,207.5 pg/mL. 115 patients had multiple pBNP values; for these patients, mean pBNP values were used for data analysis (SEM 14094.7 ± 21199.6). Of patients who had a pBNP measurement, 3 (1.5%) had Type A defects, 58 (29.6%) Type B, 111 (56.6%) Type C, and 24 (12.2%) Type D. Patients with high-risk defects (Stage C/D) had significantly higher pBNP levels than patients with low-risk defects (Stage A/B) (14281 vs. 5025, p=0.007). pBNP levels were significantly higher in patients who died (median 14100, IQR 4377 – 22900) compared to patients who survived (median 4911, IQR 1883 – 9810) (p<0.001). Patients with cardiac dysfunction had higher pBNP values than patients with normal cardiac function (8379 vs. 4778, p=0.005), but no pBNP cutoff value appeared to be both highly sensitive and specific for cardiac dysfunction (AOC=0.61) (Figure).

Conclusion: We conclude that, among patients with congenital diaphragmatic hernia, elevated proBNP was associated with high-risk defects, cardiac dysfunction, and mortality. Although additional study is needed to optimize measurement timing and frequency, proBNP shows significant promise as a prognostic factor and biomarker in congenital diaphragmatic hernia-associated cardiac dysfunction.

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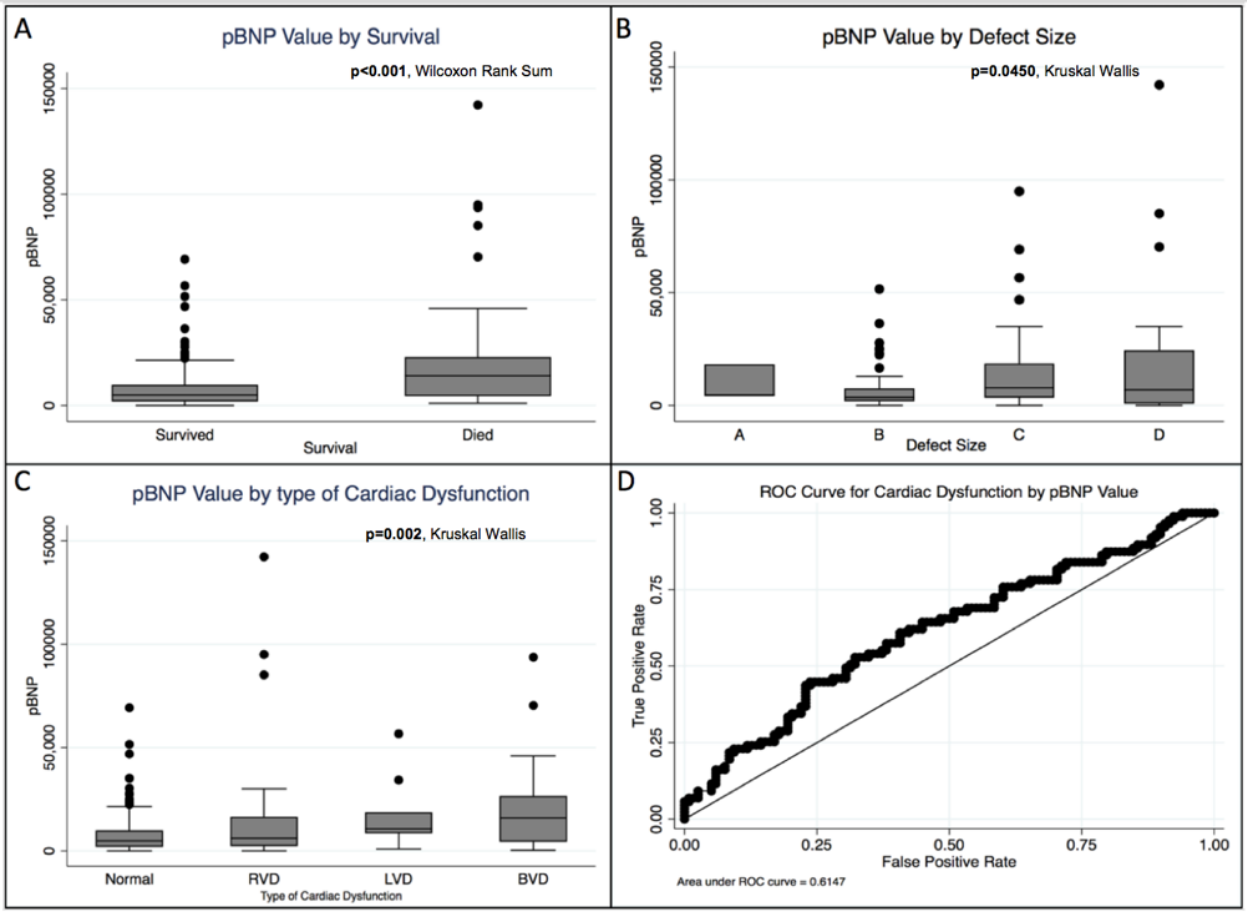

Figure 1: All boxplots are displayed as medians with IQR (grey boxes) with whiskers containing values ± 1.5*IQR; pBNPs are recorded as pg/mL A) pBNP values for CDH patients based on survival B) pBNP values for CDH patients based on CDHSG staging system C) pBNP values for CDH patients with cardiac dysfunction RVD = right ventricular dysfunction only, LVD = Left ventricular dysfunction only, BVD = Biventricular dysfunction D) ROC Curve for likelihood of cardiac dysfunction based on pBNP value

Mini-Talk II Session | Presentation 17

THE MORE YOU HAVE-THE MORE YOU LOSE: MUSCLE MASS CHANGES IN SEVERELY INJURED TRAUMA PATIENTS

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University of Texas at Austin Dell

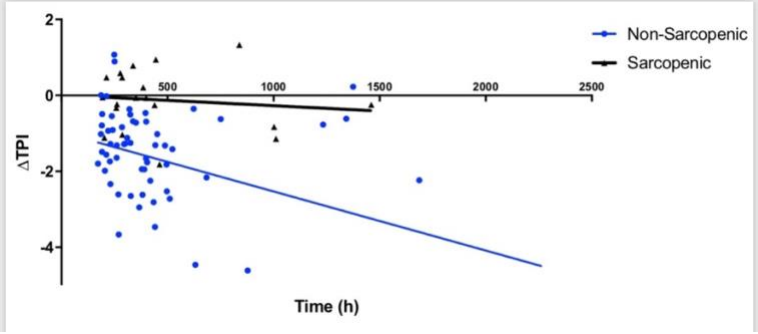
Background: Sarcopenia is a clinically relevant loss of muscle mass and function that can be objectively quantified through the use of CT imaging. It has implications of increased morbidity and mortality in adult trauma populations and poor surgical outcomes.

Objective: Our study aimed to evaluate loss of muscle mass change in adult trauma patients with prolonged hospital stays.

Methods: A retrospective analysis was performed using our trauma registry to identify all adult trauma patients admitted to our urban, academic Level 1 Trauma center between 2010 and 2017. Inclusion criteria were patients with a hospital length of stay greater than 14 days. All CT images were reviewed, and the cross-sectional area (cm2) of the left psoas muscle was measured for each patient at the level of the third lumbar vertebral body to determine total psoas area (TPA). The TPA was then normalized for patient stature by dividing by patient height^2 to determine the Total Psoas Index (TPI). Sarcopenia was defined as a TPI on admission below gender specific thresholds of 5.45(cm2/m2) in men and 3.85(cm2/m2) in women. The TPA, TPI, and rates of change in TPI were then evaluated and compared between sarcopenic and non-sarcopenic adult trauma patients.

Results: There were 81 adult trauma patients who met inclusion criteria. Patients were on average 43 years old, 70% male, 64% Caucasian, 90% sustained blunt trauma, and had an ISS=29. The average change in TPA was -3.8 cm2 and TPI was -1.3 cm2. On admission, 23% (n=19) of patients were sarcopenic while 77% (n=62) were not. The two groups were similar for demographics and injury severity, but sarcopenic patients were older (59 vs. 39, p<0.0001). Non-sarcopenic patients had a significantly greater change in TPA (-4.9 vs. -0.31, p<0.0001) and TPI (-1.7 vs. -0.13, p<0.0001). In addition, 37% of patients who were admitted with normal muscle mass subsequently developed sarcopenia during hospital admission. Older age was the only risk factor independently associated with developing sarcopenia while hospitalized (OR: 1.04, 95%CI 1.00-1.08, p=0.045). Furthermore, the rate of decrease in muscle mass was significantly greater (p=0.0002) for non-sarcopenic patients during their hospital stay (Figure1, non-sarcopenic patients shown as dotted line).

Conclusion: Adult trauma patients lose significant muscle mass during prolonged hospitalization. Over a third of patients with normal muscle mass at admission subsequently develop sarcopenia and older age is the primary risk factor to develop sarcopenia while hospitalized. Patients with normal muscle mass (non-sarcopenic) at admission have greater decreases in TPA and TPI and have a significantly accelerated rate of muscle mass loss when compared to sarcopenic patients.



Mini-Talk II Session | Presentation 18

DO OCCULT HERNIAS MATTER?

A Rondon, O Olavarria, K Bernardi, N Neela, N Dhanani, N Lyons, J Holihan, D Cherla, E Matta, J Hasapes, T Ko, L Kao, M Liang
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Background: Nearly half of all Americans have an occult hernia, which is a hernia seen on radiologic imaging but not felt on physical exam. Despite the high prevalence of occult hernias, little is known about the natural history of this disease.

Objective: We sought to study the clinical outcomes and AW-QOL of patients with occult hernias in order to better understand the natural progression of this disease.

Methods: This was a prospective cohort study that looked at patients with incidental occult hernias found during CT abdomen/pelvis from 2016-2018. Patients were enrolled at the time of their CT scans and had a standardized abdominal/groin exam performed by a blinded surgeon to confirm occult hernia diagnosis.

Our primary outcome was change in abdominal wall quality of life (AW-QOL) using a validated, hernia-specific modified Activities Assessment Scale survey that was administered at time of enrollment and at 1 year follow-up. Results of this survey fall within a range of 1 to 100, with 1 representing poor AW-QOL and 100 representing perfect AW-QOL. A "normal" AW-QOL has been previously determined to be 80, and the minimal clinically important difference is 7. Secondary outcomes included elective and emergent hernia repairs.

Results: Our study population was comprised of 199 patients with occult hernias, of which 131 (65.8%) completed follow-up, 12 (6.0%) passed away prior to follow-up, and 56 (28.1%) did not complete follow-up. Median follow-up time was 15.4 months (IQR 22.5). Among the 131 patients who completed follow-up, nearly half (56, 44.7%) experienced a decrease in their AW-QOL, 34 (30.0%) were unchanged, and 41 (31.3%) reported improvement. Overall, there was a slight mean decrease in AW-QOL (-0.5, ±36.2) in our patient population.

One-fourth of our patients (36, 27.5%) underwent abdominal surgery during the study period: 28 (21.4%) were elective procedures to address non-hernia diagnoses (e.g. cholecystectomy), 6 (4.6%) were elective hernia repairs, and 2 (1.5%) were emergent hernia repairs. An overall improvement in AW-QOL (+7.6, ±41.6) was observed among those who underwent abdominal surgery while those who did not undergo surgery experienced an overall worsening AW-QOL (-3.6, ±33.7).

Conclusion: When untreated, patients with occult hernias experienced a decrease in their AW-QOL over time. Additionally, patients with occult hernias had a small but real risk of incarceration and strangulation requiring emergent hernia repairs.

Further research is now needed to identify the optimal management strategy of patients with occult hernias.

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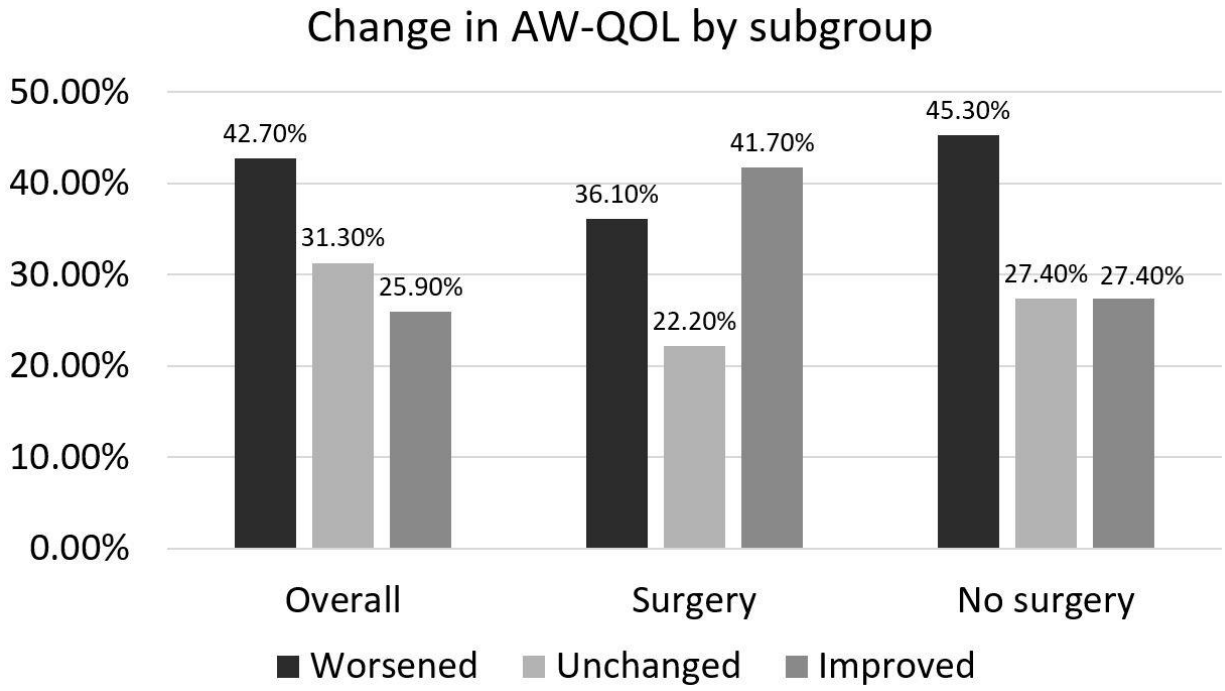

Trauma Session | Presentation 19

NOVEL DELIVERY SYSTEM OF TGF ?· -1 UTILIZING IMPLANTABLE BONE REGENERATION DEVICE FOR COMPROMISED WOUNDS IN A SWINE MODEL (SUS SCROFA)

J Sleeter, O Parry, J Yracheta, M Sippel, M Salas, V Gorantla, J Taboas, J Chen, T Swenson, A Almarza, E K Weitzel
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Background: High energy projectile and blast injuries are often seen in modern battlefield combat, resulting in complex soft tissue injuries and bony defects. Military personnel with traumatic bone injuries have no current ideal therapy to aid in the regeneration of the large amounts of bone lost in compromised wounds. Our device is a novel biologic delivery system, which aids in the acceleration of bone healing directly at the site of injury. This device is composed of a scaffold infused with a composite hydrogel, which carries mesenchymal stem cells and biofactors to regulate the regeneration process by minimizing inflammation. Here we demonstrate the translational potential using a swine model of the novel delivery device technology designed to regenerate bone for compromised extremity wounds.

Objective: The objective of this research is to regenerate bone using a novel regenerative bone device for compromised wounds.

Methods: An in vivo porcine model using adult female Yucatans (Sus scrofa) was developed to simulate two different injury patterns: (1) comminuted fractures and (2) 3 cm segmental defects of the fibula. These injuries were then treated using a hydrogel carrier for delivery of various doses of TGF $\boldsymbol{\beta}$ -1. The experimental group was compared to both no treatment and to the commercially available INFUSE® Bone Graft. Blood work, X-rays, flow cytometry, and animal assessments were performed. At study endpoint, which was designated at 30 days, the regeneration tissue was collected and evaluated.

Results: Histological evaluation of the treatment group with TGF $\boldsymbol{\beta}$ -1 showed significant woven bone regeneration when compared to no treatment. INFUSE also yielded regeneration, but with more cartilage and ectopic bone growth. Evaluation of flow cytometry of T-helper cell phenotypes in the inguinal lymph nodes of the treatment group portrayed a reduction in the pro-inflammatory molecules Th1 and Th17.

Conclusion: At one month, our implantable composite hydrogel resulted in significant woven bone and pockets of cartilage that were superior to that of INFUSE, with less inflammation and ectopic bone growth. Targeting the immune/inflammatory response in the injury site in complex wounds with large bone defects is a critical area where wound healing can be improved. By refining the regeneration of strong bone and increasing the speed of healing, patients with complex wounds can have an improved quality of life and a quicker return to duty.

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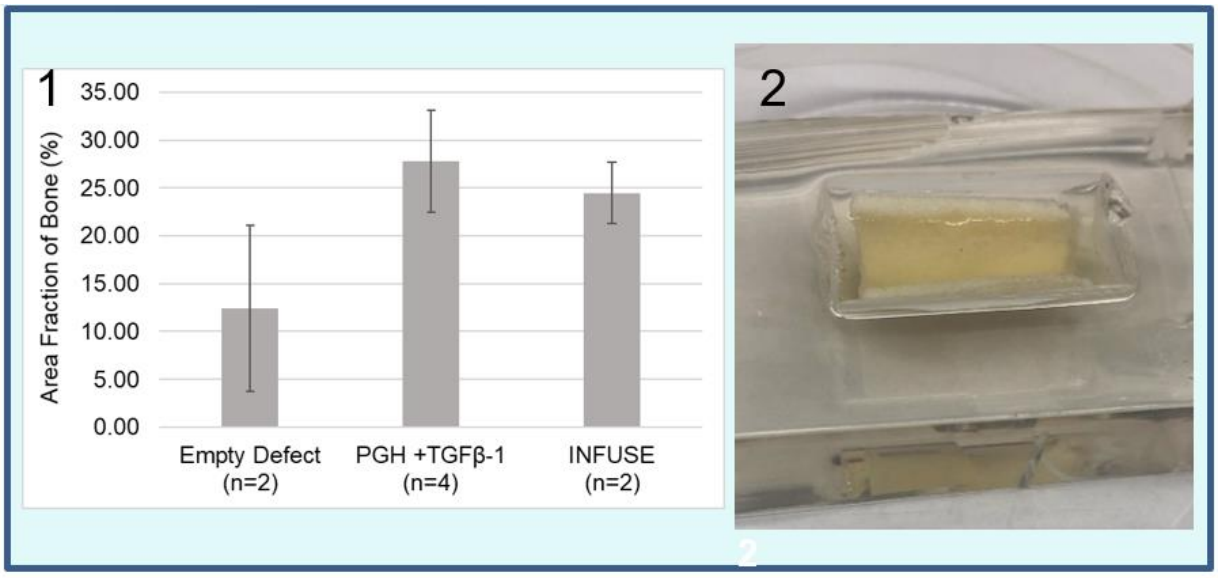

Figure 1. The hydrogel component of our device with TGFβ-1 at 100 µg/ml is superior to the commercial INFUSE (collagenous sponge with BMP-2) at 1/15th of the drug dose in INFUSE, yielding significant woven bone and pockets of cartilage at one month, with less inflammation and ectopic bone. **Figure 2**. Final device for segmental defects in mold (clear silicone) consisting of an external sponge and hydrogel interior (loaded with the TGFβ-1 and IL-10).

A NATIONAL TRAUMA DATA BANK REVIEW OF LARGE ANIMAL-RELATED INJURIES

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Background: Large animal-related injuries (LARIs) are relatively uncommon, but, nevertheless, a public hazard, with horseback riding injuries alone accounting for over 48,000 ER visits per year nationwide, according to the National Electronic Injury Surveillance System. LARIs involve both wild and domesticated animals, blunt and penetrating trauma, and occur in urban and rural settings. LARI research has mostly focused on specific subgroups: specific animals (e.g., horses), specific vocations (e.g., farmers), and specific injuries (e.g., blunt abdominal injuries). There is a relative paucity of studies with large sample sizes on the injury patterns for all traumatic LARIs.

Objective: To review LARIs in order to better understand injury patterns and outcomes.

Methods: We performed a retrospective study of the 2015 National Trauma Data Bank and used ICD-10 codes to identify patients injured by a large animal (defined as animals, marine and terrestrial, whose size is equal to or greater than the average American human adult per the CDC). Variables analyzed included patient demographics, admission physiology, injury pattern (AIS) and severity (ISS). The primary outcome was mortality, while secondary outcomes include days in the hospital, ICU, and on the ventilator. We subsequently divided the population into riders on large animals and non-riders who were injured by a large animal and compared the two groups.

Results: There were 6,662 LARIs included in our analysis. The most common LARIs were related to horses and cattle. The patients were on average 42 years old, 43% male, and 89% Caucasian. On admission, patients had an average heart rate of 84 beats per minute and systolic blood pressure of 132 mm Hg, with only 1% presenting hypotensive. The average ISS=10 and the most severe injuries (AIS >/= 3) were to the chest (19%), head (10%), lower extremities (10%), abdomen (6%), and spine (3%). The overall mortality was low (0.8%) and patients had short stays in the hospital (3 days), ICU (0.9 days), and on the ventilator (0.3 days). Overall 66% (n=4,409) of injuries occurred while riding a large animal, while 34% (2,253) of injuries were sustained by non-riders. When comparing riders to non-riders, there was no difference in age, race, admission physiology, or ISS. However, riders were more often than nonriders to be female (63% vs. 44%, $p<0.0001$) and sustain more severe injuries to the chest (21% vs. 16%, $p<0.0001$) and spine (4% vs. 2%, $p<0.0001$). Non-riders sustained more severe injuries to the face (0.8% vs. 0.1%, $p<0.0001$), abdomen (9% vs. 4%, $p<0.0001$), and upper extremities (0.5% vs. 0.2%, $p=0.02$). While there was no difference in mortality or hospital stay, the non-riders appeared to have a more complicated hospital stay with more days in the ICU (1 vs. 0.8, $p=0.006$) and on the ventilator (0.3 vs. 0.2, $p=0.03$).

Conclusion: Patients involved in a LARI are moderately injured with more complex injuries occurring in the chest, head, and lower extremities. Mortality is low and patients have a relative short and uncomplicated hospital course. Compared to non-riders, riders are more often female and more likely to sustain severe injuries to the chest and spine. On the other hand, non-riders sustain more severe injuries to the face, abdomen, and upper extremities, and have a relatively more complicated hospital course.

BLUNT CEREBROVASCULAR INJURY MANAGEMENT AND OUTCOMES IN THE ERA OF ENDOVASCULAR SURGERY. A REPORT FROM THE AAST PROSPECTIVE OBSERVATIONAL VASCULAR INJURY TRIAL (PROOVIT)

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Background: Blunt cerebrovascular injuries (BCVI) are uncommon and their optimal management, particularly the role of endovascular intervention, remains controversial.

Objective: The aim of this study is to identify trends in BCVI management for patients enrolled in the multicenter PROOVIT registry.

Methods: All patients with BCVI in the PROOVIT database from 2013-2018 were included in the study. Patient demographics, physiologic status at presentation, injury severity scores, injury grade, management strategy and outcomes were abstracted. Patients who underwent endovascular treatment were compared to those treated nonoperatively using logistic regression analysis to adjust for differences in baseline patient characteristics.

Results: Over the 6-year study period, 918 patients with BCVI were admitted to 22 participating trauma centers and enrolled in the PROOVIT registry. A single vessel was injured in 95% of the patients, with the vertebral artery being the most commonly injured at 48%, followed by the internal carotid (42%) and common carotid (5%) arteries. Multiple vessels were injured in 5% of the patients. CT angiogram was the diagnostic imaging modality in 85% of the cases. Anti-thrombotic therapy was not used in 24.8% of the patients overall and 22.5% of the patients selected for nonoperative treatment. The primary treatment modality was non-operative management in 885 (96.4%) cases and endovascular repair in 30 (3.3%) patients. Only 3 (0.3%) patients underwent an open operation. Fifteen patients (1.7%) failed nonoperative treatment and required endovascular intervention. After adjusting for differences in baseline characteristics, patients undergoing endovascular interventions had significantly higher rates of treatment failure (16.7% vs. 1.7%, Adjusted Odds Ratio[95% CI]: 11.5 [3.5-37.6], adjusted $p<0.001$) and stroke (6.1% vs. 33.3%, Adjusted Odds Ratio[95% CI]: 5.46 [2.2-13.8], adjusted $p<0.001$).

Conclusion: The overwhelming majorityof patients with BCVI are safely managed nonoperatively. Endovascular interventions are reserved for a select group of patients and are associated with significant rates of treatment failure and stroke. Despite evidence demonstrating the role of anti-thrombotic therapy for stroke prevention after BCVI, one in four of the patients with these injuries in the PROOVIT database did not receive any documented anti-thrombotic agent.

IS IT TIME TO IMPLEMENT LOW-TITER O WHOLE BLOOD IN TRAUMA RESUSCITATION BAYS?

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Background: Recent military experience demonstrates low-titer O whole blood (LTOWB) to be beneficial for trauma patients in hemorrhagic shock. However, few civilian centers have implemented LTOWB as a routine part of trauma resuscitation.

Objective: Here, we evaluate the early experience and safety of a LTOWB program at a Level 1 trauma center.

Methods: The prospectively maintained trauma database of a Level 1 trauma center was retrospectively queried for all patients admitted between January 2018-August 2019 with evidence of shock (heart rate [HR]> 120, systolic blood pressure [SBP]< 90mmHg, or shock index [SI; HR/SBP] >0.9) who received blood products prior to or within 24 hours (h) of arrival. Patients who received prehospital LTOWB were excluded. Patients were divided into 3 recipient groups: LTOWB only (Group 1), component therapy (CT) only (Group 2), and LTOWB+CT (Group 3). Demographics, injury severity score (ISS), trauma injury severity score (TRISS), abbreviated injury scale (AIS), amount and type of product received, safety, and outcomes (24h, 30-day [d], and overall mortality, ICU length of stay [LOS], and hospital LOS) were all evaluated. Statistical significance was set at $p<0.05$. Univariate analysis was used to evaluate variables affecting 24h, 30d, and overall mortality. Regression analysis was performed to identify variables predictive of mortality using ED HR, ED SBP, gender, study group, ISS, TRISS, and head, chest, and abdomen AIS.

Results: 147 trauma patients were included: 12 in Group 1, 99 in Group 2, and 36 in Group 3. Compared to Groups 1 and 2, Group 3 patients were more frequently male ($p=0.024$), had higher ISS (28 vs 20 and 17, respectively; $p=0.003$), and had lower TRISS (0.79 versus 0.96 and 0.95, respectively; $p=0.006$). Group 3 received the most LTOWB (median 4u), PRBCs (2u), and FFP (2u) at 24h compared to Groups 1 and 2 (overall $p<0.001$ for each product). There was no statistical difference in 24h mortality between Groups 1, 2, and 3 (16.7%, 19.2%, and 33.3%, respectively), though Group 3 had higher 30d mortality (44.4% vs 16.7% and 24.2%, respectively; $p=0.045$). There were no differences between groups in rates of pulmonary embolism, deep vein thrombosis, unplanned ICU transfer, unplanned intubation, and ICU or hospital LOS. On regression analysis, the only variable to meet significance was TRISS ($p<0.01$) for 24h, 30d, and overall mortality.

Conclusion: In our experience, the most severely injured trauma patients received combination LTOWB+CT and more overall product units. Despite being more severely injured, patients who received LTOWB+CT had similar 24h mortality as LTOWB or CT alone, suggesting a possible improved outcome for this cohort. No increase in transfusion-related complications was seen in any group receiving LTOWB. LTOWB is not inferior to CT and is a safe and feasible means of resuscitation of hemorrhaging trauma patients in civilian centers.

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Overall Outcomes

	WB alone (n=12)	Component alone (n=99)	WB + Component (n=36)	*p*-value
Days on Ventilator	1 (0, 4)	1 (0, 2)	1 (1, 3)	0.173
ICU LOS	2 (0, 5)	2 (1, 6)	4 (0, 7)	0.701
Hospital LOS	6 (2, 12)	6 (1, 15)	8 (1, 20)	0.859
24h Mortality, n (%)	2 (16.7)	19 (19.2)	12 (33.3)	0.194
30d Mortality, n (%)	2 (16.7)	24 (24.2)	16 (44.4)	0.045
Overall Mortality, n (%)	2 (16.7)	25 (25.3)	16 (44.4)	0.058
Pulmonary Embolism, n (%)	0 (0.0)	3 (3.0)	3 (8.3)	0.293
Deep Vein Thrombosis, n (%)	1 (8.3)	1 (1.0)	1 (2.8)	0.223
Unplanned ICU Transfer, n (%)	0 (0.0)	4 (4.0)	0 (0.0)	0.369
Unplanned Intubation, n (%)	0 (0.0)	3 (3.0)	1 (2.8)	0.83

WB: whole blood; LOS: length of stay

RIB FRACTURES AND FORCED VITAL CAPACITY

Alexander P. Nissen MD, Annelies T. Hickerson MD, Justin Sleeter MD, Tina Hall ACNP, James Aden PhD, Alexander Mills DO, Valerie G. Sams MD
SAMMC

Background: Complications after traumatic rib fractures are a common consequence of inadequate ventilation. Predicting appropriate level of care is critical to prevent morbidity and mortality. There is a dearth of literature evaluating the utility of bedside spirometry in this population.

Objective: We sought to examine the utility of bedside forced vital capacity (FVC) in predicting complications for patients suffering blunt traumatic ribs fractures, hypothesizing that admission FVC >50% predicted would be associated with reduced pulmonary complications.

Methods: We report the interim analysis of 79 consecutive adult patients with >3 rib fractures after blunt trauma, admitted to the hospital non-intubated, without cervical spinal cord injury (SCI), or severe traumatic brain injury (TBI) preventing participation in bedside spirometry. All measurements were taken on Wright Mark 8 spirometers (nSpire Health, Longmont, CO). FVC was recorded, and %predicted values calculated using conventional methods. Pulmonary complications represented a composite endpoint defined as any unplanned intubation, ICU readmission, pneumonia, and/or tracheostomy. Conventional statistics were used for comparisons including Wilcoxon's test for nonparametric continuous variables and Cochrane Armitage trend test for categorical variables.

Results: 79 consecutive patients were enrolled at the time of interim analysis; 23 with admission FVC of 0-29% predicted (low), 36 with admission FVC 30-49% predicted (moderate), and 20 with admission FVC >50% predicted (high). Groups showed similar baseline characteristics including age, smoking status, injury severity score (ISS) and chest abbreviated injury score (AIS), with the exception of pneumothorax being most frequent in the FVC 0-29% predicted group (47.8% vs. 13.9% and 20.0%, p=0.028). The low admission FVC group similarly required tube thoracostomy most frequently, (39.1% vs. 13.9% and 15.0%, p=0.046). Non-home discharge was more frequent in both the low and moderate FVC groups vs. the high admission FVC group (21.7% and 33.3% vs. 5.6%, p=0.031), but pulmonary complications were infrequent in all groups (8.7% vs. 5.6% vs. 0%, p=0.198), with only one death in the entire cohort due to non-pulmonary causes (Table 1). There were no occurrences of pneumonia, pulmonary embolism, empyema, or aspiration.

Conclusion: Patients with >3 rib fractures who are non-intubated on admission, and without cervical SCI, severe TBI, or pneumothorax requiring tube thoracostomy represent an apparently low risk group for subsequent pulmonary complications. Those with admission FVC >50% predicted are also at low risk of non-home discharge. Collectively, these factors may define a low risk rib fracture population amenable to further study to prevent over-triage of blunt trauma patients.

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Variable	FVC 0-29% Predicted (n=23)	FVC 30-49% Predicted (n=36)	FVC 50+% Predicted (n=20)	p-value
Demographics				
Age (yrs)	54.9 ± 14.9	60.9 ± 18.6	59.6 ± 15.2	0.694
Male Sex	17 (73.9%)	19 (52.8%)	15 (75.0%)	0.984
Height (cm)	170.6 ± 8.3	170.2 ± 9.8	171.5 ± 11.4	0.835
Weight (kg)	84.4 ± 14.9	83.7± 20.4	84.3 ± 25.2	1.000
Smoking Status				0.946
Active	5 (21.7)	8 (22.2)	4 (20.0)	
Former	1 (4.4)	2 (5.6)	2 (10.0)	
Pulmonary Comorbidities				0.213
Asthma	0 (0)	1 (2.8)	0 (0)	
COPD	1 (4.4)	1 (2.8)	3 (15)	
Pneumothorax	11 (47.8)	5 (13.9)	4 (20.0)	0.028
Hemothorax	5 (21.7)	5 (13.9)	4 (20.0)	0.851
Flail Segment	2 (8.7)	3 (8.3)	1 (5.0)	0.656
ISS	14.3 ± 9.6	13.1 ± 7.5	13.3 ± 7.0	1.000
Chest AIS	2.5 ± 0.67	2.7 ± 0.58	2.5 ± 0.76	1.000
Interventions				
PRBCs in first 24hrs (units)	0.39 ± 1.16 0 [0-0]	0.39 ± 1.13 0 [0-0]	0.20 ± 0.89 0 [0-0]	0.948
Epidural Catheter	1 (4.4)	1 (2.8)	0 (0)	0.369
Paravertebral Block	2 (8.7)	4 (11.1)	0 (0)	0.307
Chest Tube	9 (39.1)	5 (13.9)	3 (15.0)	0.046
VATS	0 (0)	1 (2.8)	0 (0)	0.959
Tracheostomy	0 (0)	0 (0)	0 (0)	-
Rib Plating	2 (8.7)	1 (2.8)	0 (0)	0.132
Outcomes				
Retained Hemothorax	1 (4.4)	0 (0)	0 (0)	0.188
Unplanned Intubation	1 (4.4)	2 (5.6)	0 (0)	0.479
ICU Readmission	2 (8.7)	2 (5.6)	0 (0)	0.198
Pulmonary Complications	2 (8.7)	2 (5.6)	0 (0)	0.198
Non-Home Discharge	5 (21.7)	12 (33.3)	1 (5.6)	0.031
Readmission	0 (0)	0 (0)	1 (5.0)	-
Death	0 (0)	1 (2.8)	0 (0)	-

TEMPORAL TRENDS IN PEDIATRIC FIREARM INJURIES USING THE NATIONAL TRAUMA DATA BANK

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Background: Firearm injuries in the United States remain a major cause of morbidity and mortality. Pediatric firearm injuries have gained national attention with increased efforts aimed at firearm injury prevention. We hypothesized that despite these efforts, prevalence of pediatric firearm injuries would be increasing over time.

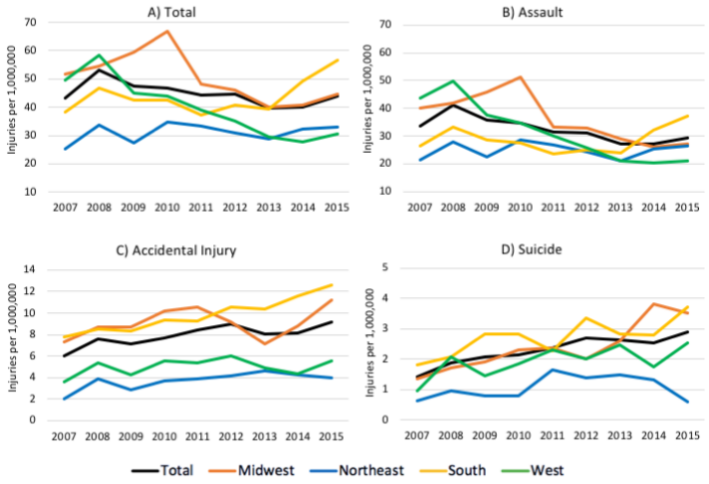
Objective: To define temporal trends in pediatric firearm injury and intent by U.S. region.

Methods: The National Trauma Data Bank was queried from 2007-2015 for firearm injuries in children <18 years old. Intent and U.S. regions were analyzed. Population was calculated based on annual U.S. census data.

Results: Of 29,795 pediatric firearm injuries, 10,953 (37%) occurred in the South, 7,244 (24%) in the Midwest, 6,403 (21%) in the West, 3,407 (11%) in the Northeast, and 1,788 (6%) unreported region. Males represented 86% of injuries and did not vary by region ($p=0.05$). Black youth incurred 59% of injuries, followed by white (19%), Hispanic (17%) and Asian/other (5%). 73% occurred in 15-17 year-olds. Assault represented the majority of injuries in 0-4 year-olds (49%), 12-14 year-olds (59%) and 15-17 year-olds (80%); accidental injury represented the majority in 5-11 year-olds (46%; $p<0.001$). The Northeast region had lowest rates of assault (25 per 1,000,000), suicide (1.1/1,000,000), and accidental (3.7/1,000,000) injuries. The South region had highest rates of suicide (2.7/1,000,000; $p<0.001$) and accidental (9.8/1,000,000; $p<0.001$) injuries. The Midwest region had highest assault rate (36.5/1,000,000; $p<0.001$). There is a significant trend in increasing suicide ($p=0.01$) and accidental ($p=0.02$) pediatric firearm injuries over time (Figure 1).

Conclusion: The majority of pediatric firearm injuries are due to assaults among teenagers. Despite increased national attention on pediatric firearm injury prevention, rates of accidental injuries and suicides are increasing.

Figure 1. Temporal trends in pediatric firearm injuries



Surgical Potpourri II Session | Presentation 25

PREDICTING OVER AND UNDER-TREATMENT OF ORGAN SPACE SURGICAL SITE INFECTION AFTER TRAUMA LAPAROTOMY: A PROSPECTIVE, OBSERVATIONAL STUDY

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University of Texas HSC - Houston

Background: Organ space surgical site infections (OS-SSIs) are common after trauma laparotomy and are associated with significant costs, additional procedures, and reduced quality of life. Accurate risk stratification of patients is essential to appropriately apply preventative treatments and to screen for OS-SSI postoperatively. A Bayesian risk calculator for OS-SSI was previously developed at our institution utilizing factors available upon abdominal closure and its accuracy has been corroborated by multicenter data. The relationship between the calculator-generated OS-SSI risks and surgeon-estimated risks is unknown.

Objective: We evaluated the hypothesis that there is a discrepancy between surgeon and calculator-generated OS-SSI risks, resulting in potential over- and under-treatment of patients.

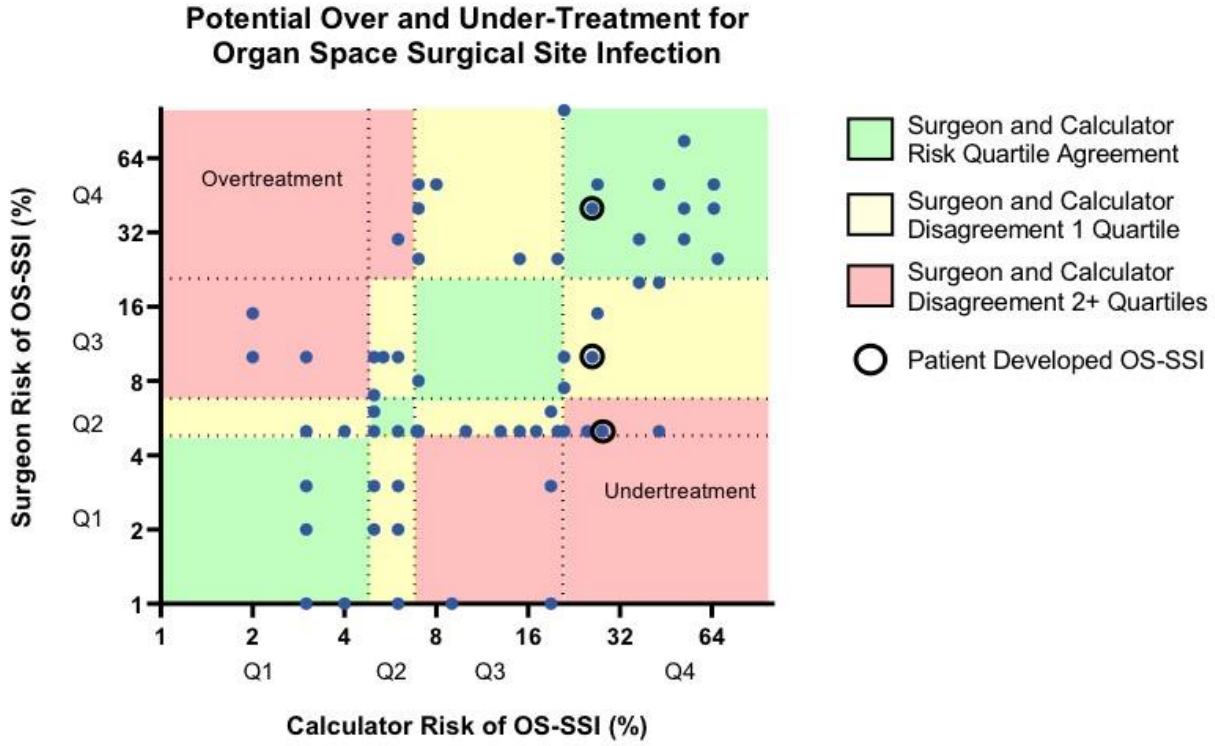
Methods: A prospective, observational study of surgeons performing trauma laparotomy on adult (≥16 years) patients was performed June-September 2019. Patients who died <48 hours from admission or had a delayed index laparotomy were excluded. Surgeons who scrubbed into an index trauma laparotomy were asked to estimate the patient's OS-SSI risk in percent within 24 hours. Clinical data were collected by chart review. Calculator risks were generated using operative factors and compared to surgeon estimated risks. Risk quartiles were assigned by the calculator-generated risk distribution. Univariate and one-way random effects reliability analyses were performed.

Results: For 47 index laparotomies, 75 estimations were obtained. Most patients were young (median age 28, IQR 20-39), male (71%), and suffered penetrating trauma (56%).

According to surgeon estimate, the median risk of OS-SSI, was 6% (IQR 5-25%). According to the calculator, the median OS-SSI risk was 7% (IQR 5-21%), p=0.82. After assigning risk quartiles, 28 (37%) of surgeon estimates agreed with the calculator quartile. (Figure) However, 26 (35%) of surgeon estimates were in a higher quartile than the calculator assigned risk quartile while 21 (28%) estimated a lower risk quartile. This correlates with a potential 35% over-treatment rate and a potential 28% under-treatment rate. One risk quartile discordance occurred in 35 cases and 2 risk quartile discordance occurred in 12 cases. Surgeon and calculator-generated risks had poor agreement, with an intraclass correlation coefficient of 0.13. Two patients (4%) developed an OS-SSI, both of which were in the highest, the 4th, calculator-generated risk quartile. (Figure, Circled Points) The surgeon estimated risks for the patients who developed an OS-SSI ranged from the 2nd to the 4th quartiles.

Conclusion: Despite similar group estimates, there was poor agreement between surgeon and calculator-generated OS-SSI risks. This may result in high rates of both over-and under treatment of and screening for OS-SSI. Routine calculation of the OS-SSI risk upon completion of a trauma laparotomy may improve surgeon decision making and patient outcomes.

Graph on following page



IMPROVED CLINICAL STAGING USING MULTIPLANAR MEASUREMENTS FOR LUNG CANCER

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Background: Despite the wealth of information available via routine diagnostic computed tomography (CT), tumors are conventionally measured and reported in the axial dimension only. The extent to which this practice may underestimate tumor burden and impair accurate clinical staging is unknown.

Objective: We sought to evaluate the impact of adding sagittal and coronal measurements to patient imaging review, as well as its role in determining candidates for potential neoadjuvant treatment in advance of surgical resection.

Methods: Consecutive patients were identified who underwent upfront surgery from 2010-2015 for clinical T2N0-1 non-small cell lung cancer (AJCC 7th Edition) at a single institution. Patients without available pre-operative CT, with pre-operative CT of poor quality (slice thickness >5mm), and patients who had multifocal disease or associated atelectasis precluding accurate tumor measurement were excluded. Imaging was reviewed by thoracic radiologists and longest tumor diameter in axial, sagittal, and coronal planes were reported.

Results: 152 patients were identified for detailed imaging review, including 106 (70%) who were initially reported as T2a and 46 (30%) T2b based upon axial images. Review of reformats revealed T stages ranging from T1b-T3 in the coronal plane, and T1a-T3 in the sagittal plane (Table). Axial-coronal and axial-sagittal T stage concordance were 76% (115/152) and 75% (114/152), respectively. Coronal-sagittal concordance was 70% (106/152). Importantly, 5% (8/152) were upstaged to T3 based upon three-dimensional measurements, suggesting a potential missed opportunity for induction chemotherapy. Spearman's correlation coefficient demonstrated the highest agreement between pathologic tumor size and axial diameter (ρ=0.70), as compared to coronal (ρ=0.68) and sagittal (ρ=0.64) measurements.

Conclusion: A modest but important proportion of patients are eligible for chemotherapy when three-dimensional tumor measurements are employed. Because prior investigations have demonstrated improved compliance with regards to completion of chemotherapy in the neoadjuvant (versus adjuvant) setting, routine measurement of tumors in three dimensions should be considered.

TABLE: T Stage of Non-Small Cell Lung Cancer in Axial and Reformatted Images

T Stage on Axial CT*,a	T Stage on Multiplanar Reformatted CT				
	T1a (%)	T1b (%)	T2a (%)	T2b (%)	T3 (%)
T2a (n=106)	0 (0)	7 (6.6)	92 (86.8)	7 (6.6)	0 (0)
T2b (n=46)	0 (0)	0 (0)	3 (6.5)	35 (76.1)	8 (17.4)

*According to the American Joint Committee on Cancer 7th Edition.

[a]CT: computed tomography

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DECREASED OPIOID USE AND LENGTH OF STAY WITH CRYOANALGESIA IN MINIMALLY INVASIVE PECTUS EXCAVATUM REPAIR

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Background: Pectus excavatum is an abnormal concavity of the chest seen in pediatric patients, which may affect heart and lung function. Treatment involves thoracoscopically placing a bar underneath the sternum to correct this abnormal concavity. Post-operative pain control has traditionally been challenging after pectus excavatum repair.

Objective: In 2016, we introduced cryoanalgesia as an adjunctive modality for post-operative pain management. We aimed to understand the impact of cryoanalgesia on opioid utilization, length of stay, and outcomes of pediatric patients undergoing minimally invasive pectus excavatum repair.

Methods: A single-center retrospective cohort study was conducted of all pediatric (<18 years) patients who underwent minimally invasive pectus excavatum repair (2011-2019). Patients who received cryoanalgesia were compared to those who did not (usual care). The primary outcome was total post-operative oral morphine equivalents per kilogram (OME/kg). Secondary outcomes included case length, length of stay (LOS), complications, and costs (adjusted for inflation). Univariate and multivariate analyses were performed, with $p < 0.05$ considered significant.

Results: Of 35 patients, 20 received cryoanalgesia (57%). Baseline characteristics, including Haller index, were similar between groups (Table). Patients who received cryoanalgesia had a lower post-operative opioid requirement compared to usual care (median 2.3 OME/kg, IQR 1.2-3.1, vs. 4.9 OME/kg, IQR 2.9-5.8, p<0.001). One third of cryoanalgesia patients did not require opioids at discharge, whereas all usual care patients did (p=0.01). In addition, as experience in cryoanalgesia increased, post-operative opioid utilization continued to decrease over time. Median LOS was shorter in cryoanalgesia patients: 3.1 days, IQR 2.3-3.4, vs. 5.1 days, IQR 4.3-5.4 (p<0.001). Although cryoanalgesia patients had longer surgical times, total operating room time was similar (Table). Median costs were similar between cryoanalgesia ($17,231, IQR $16,172-$19,569) and usual care patients ($16,869, IQR $15,754-$18,595, p=0.7).

Conclusion: Cryoanalgesia appears to be an effective adjunctive pain control modality in minimally invasive pectus excavatum repair. The use of cryoanalgesia is associated with lower post-operative opioid requirements and shorter lengths of stay, without increased

costs. Further multicenter studies are needed to fully evaluate the effectiveness and long-term outcomes of cryoanalgesia in pectus excavatum surgery.

Table: Patient Demographics and Clinical Outcomes: Cryoanalgesia versus Usual Care

	Usual Care n = 15	Cryoanalgesia n = 20	p-value
Age, years, median (IQR)	16.2 (13.7-16.9)	14.8 (13.5-16.2)	0.4
Any comorbidity, n (%)	10 (67%)	13 (65%)	0.9
Body mass index, median (IQR)	18.7 (16.0-20.1)	17.1 (15.5-19.6)	0.3
Haller index, median (IQR)	4.25 (3.6-5.4)	3.8 (3.3-4.3)	0.2
Patient-controlled analgesia utilized, n (%)	7 (47%)	17 (85%)	0.02
Epidural utilized, n (%)	9 (60%)	0 (0%)	<0.001
Surgical time, minutes, median (IQR)	118 (94-136)	144 (134-186)	<0.001
Total time in operating room, minutes, median (IQR)	217 (188-234)	212 (203-245)	0.5
Any complication, n (%)	6 (40%)	4 (20%)	0.27

PEDIATRIC SURGERY RESIDENT EDUCATION OVER THE LAST 15 YEARS

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Background: Surgical indications and techniques have changed over the last fifteen years. The number of Pediatric Surgery training programs has also increased.

Objective: We sought to examine the effect of these changes on resident education by examining case log data.

Methods: Accreditation Council for Graduate Medical Education (ACGME) case logs for graduating Pedatric Surgery residents were examined from 2004-2018. Using the summary statistics provided, linear regression analysis was conducted on each case log code and category.

Results: In 2004, there were 24 Pediatric Surgery training programs and 24 Pediatric Surgery residents graduating with an average of 979.8 total cases logged; in 2018, there were 36 programs with 38 residents graduating with an average of 1260.2 total cases logged. Total case volume of graduating residents significantly increased over the last 15 years ($p<0.001$). Significant increases were demonstrated in skin/soft tissue/musculoskeletal ($p<0.01$), abdominal ($p<0.001$), hernia repair ($p<0.001$), genitourinary ($p<0.01$), and endoscopy ($p<0.001$). No significant changes were seen in the head and neck, thoracic, cardiovascular, liver/biliary, and non-operative trauma categories. No categories significantly decreased over the time period. No significant changes were seen in the number of multiple index congenital cases, including tracheoesophageal fistula/esophageal atresia repair, omphalocele, gastroschisis, choledochal cyst excision, perineal procedure for imperforate anus, and major hepatic resections for tumors. Pertinent increases in specific procedures include diaphragmatic hernia repair ($p<0.01$), ECMO cannulation/decannulation($p<0.05$), thyroidectomy ($p<0.001$), parathyroidectomy ($p<0.001$), biliary atresia ($p<0.001$) circumcision ($p<0.001$) as well as most laparoscopic abdominal procedures. Specific procedure codes with significant decreases include tracheostomy ($p<0.05$), minimally invasive decortication/pleurectomy/blebectomy ($p<0.001$), laparoscopic splenectomy ($p<0.001$), as well as most open abdominal procedures.

Conclusion: Despite increasing numbers of Pediatric Surgery residents and training programs, the number of cases performed by each graduating resident has increased. This increase is primarily fueled by increase in abdominal, skin/soft tissue/musculoskeletal, hernia repair, genitourinary, and endoscopic cases.

TREATMENT VARIATION AND LONG-TERM OUTCOMES OF LOW GRADE APPENDICEAL NEOPLASMS

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Background: Appendiceal neoplasms are rare clinical entities, and as such our understanding of appropriate treatment of these tumors has evolved over time. In addition, the nomenclature used to describe Appendiceal neoplasms has been heterogeneous; this likely contributed uncertainty regarding appropriate treatments. After a recent consensus statement, the term Low-Grade Appendiceal Mucinous Neoplasm (LAMN) has been widely adopted. However, we hypothesize that there is still significant variation in how LAMNs are treated and that the natural history of these lesions is poorly understood.

Objective: To evaluate variation in treatment patterns of LAMNs, including receipt of guideline-concordant care, and to evaluate the long-term outcomes of patients after definitive treatment.

Methods: We conducted a single-institution retrospective review of a prospectively maintained appendiceal tumor database. Patients presenting with LAMNs from 2009-2019 were identified. We assessed variability in treatment patterns including whether patients underwent right colectomy. We also assessed spread of disease at time of presentation and long term outcomes.

Results: 136 patients met inclusion criteria. Median follow-up was 2.9 yrs (IQR 1.9-4.4). 88% of patients underwent surgery prior to referral to our institution. 65 patients underwent a colectomy; 46% of these were performed for perceived oncologic need/nodal evaluation. No nodal metastases were identified in the study population. In patients with resected LAMNS and no evidence of disseminated disease, 40% were offered second-look laparoscopy to evaluate for occult metastases. Laparoscopy did not identify peritoneal disease in any of these patients. 46 patients (34%) presented with disseminated disease and were treated with cytoreductive surgery and heated intraperitoneal chemotherapy (CRS/HIPEC). 50% of CRS/HIPEC patients were found to have peritoneal deposits of metastatic adenocarcinoma on final pathology. For patients undergoing CRS/HIPEC, 5 yr recurrence-free survival was 94% (95% CI 81-98%); there was one disease-related death in the cohort. For patients without disseminated disease, 5 yr RFS was 98% (85-99%).

Conclusion: There is significant variation in treatment patterns for LAMNs, particularly for patients treated prior to referral to a high-volume center. Patients frequently underwent colectomy without apparent oncologic benefit. In the current era of high-quality cross sectional imaging, routine use of second-look laparoscopy had low yield and is not recommended. Recurrence in this population is rare and low-intensity surveillance can be offered. Overall prognosis for patients with LAMNs is excellent, even when presenting with peritoneal disease.

CHARACTERIZATION OF PEDIATRIC HAND INFECTIONS AT A LARGE, SINGLE-CENTER INSTITUTION

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Background: Pediatric hand infections cause significant comorbidity in children. The hand holds vital importance in everyday function and normal development, and so optimal care in the short and long-term is necessary to prevent future physical and psychological comorbidity in children. Crucial aspects of the etiology, diagnosis, and management of pediatric hand infections are distinct from that of adult cases, though much of current treatment practice is generalized from the adult population.

Objective: With the purpose of better understanding the knowledge gap between care of children and adults, we aim to characterize patients with pediatric hand infections in terms of their demographics, etiology, treatment, and post-interventional course.

Methods: A retrospective chart review was conducted from April 2012 to May 2019 on all Texas Children's Hospital patients aged 0-18 years. Patients with diagnoses of hand infections were included in our study. Patient clinical and demographic information was collected and analyzed.

Results: A total of 57 patients were included in our study. Mean age of diagnosis was 7.3 years, and the majority were males (56%). Three patients (5%) had a prior history of upper extremity infection. Accidental trauma preceded the infection in 27 patients (47%), with cultures growing Staphylococcus aureus in 33 patients (58%). For 16 patients (28%), no causative organism could be definitively isolated. Abscess was the most common type of presenting infection, found in 24 patients (42%), although cases of cellulitis, felon, paronychia, flexor tenosynovitis, collar button abscess, and osteomyelitis were also identified. Pre-hospital oral antibiotics were given in 24 patients (42%). Twenty-nine patients (51%) had soft tissue swelling on radiological imaging before treatment and osteomyelitis-associated changes were seen in 11 patients (19%). All patients were admitted to the hospital and underwent at least one irrigation and debridement, with an average length-of-stay of 4.5 days. 17 patients were treated postoperatively with packing (30%), 12 patients (21%) with draining, and 7 patients (12%) with a combination of the two. Postoperative course was complicated by osteomyelitis in 8 patients (14%). Forty-six patients (81%) underwent complete remission and suffered no complications.

Conclusion: This study is the first in the literature to examine pediatric hand infections in a large cohort and highlights their demographics, types of infection and causative organisms, and treatment course. Pathogenesis of hand infection in the pediatric patient has more variety than adults, and so a thorough history-taking from both the patient and caregiver is required. Irrigation and debridement is the current foundation of treatment, though extent of the procedure and subsequent pharmacological care is case-dependent and largely depends on degree of infection.

Graphs on following page

Table 1: Characteristics of Study Population		
	n	%
Total Number of Patients	57	100
Average Age (years)	7.3	0.6-18.7
Gender		
Male	32	56%
Female	25	44%
Comorbidities		
Existing Comorbidities	5	9%
No Comorbidities	52	91%
Presentation		
Average Time From Injury Till Presentation (days)	9.3	1-120
History of Recent Upper Extremity Infection	3	5%

Table 2: Characteristics of Infection and Treatment		
Route of Infection		
Accidental Trauma	27	47%
Self-Inflicted Trauma	5	9%
Insect/Animal Bite	13	23%
Iatrogenic	2	4%
Spontaneous Infection	10	18%
Infectious Organism		
Methicillin-sensitive *Staphylococcus aureus*	19	33%
Methicillin-resistant *Staphylococcus aureus*	14	25%
Group A *Streptococcus*	2	4%
Pasteurella multocida	2	4%
Pseudomonas aeruginosa	1	2%
Kingella kingae	1	2%
Enterobacter aerogenes	1	2%
Haemophilus parainfluenza	1	2%
Staphylococcus epidermis	1	2%
Unknown	16	28%
Type of Infection		
Cellulitis	12	21%
Abscess	24	42%
Felon	6	11%
Paronychia	6	11%
Flexor tenosynovitis	4	7%
Deep hand space infection	0	0%
Collar button abscess	1	2%
Osteomyelitis	4	7%
Pre-Hospital Antibiotics		
None	28	49%
Topical	3	5%
Oral	24	42%
Both	2	4%
Radiological Findings Before Treatment		
None	10	18%
Gas in Soft Tissue	1	2%
Soft Tissue Swelling	29	51%
Osteomyelitis-associated Changes	11	19%

Table 3: Treatment and Postinterventional Course		
Average Length of Stay (days)	4.5	1-25
Average Time From Presentation until Final Follow-Up (months)	2.54	0.03-47.20
Irrigation and Drainage Procedures		
1	57	100%
2+	13	23%
Antibiotic Used		

Average Duration of Antibiotics Course (days)	14.3	3-60
Postoperative Management		
Packing	17	30%
Drain	12	21%
Soak	7	12%
Splinting	2	4%
Combination of Above	7	12%
Unknown	12	21%
Postoperative Complications		
No Complications	46	81%
Osteomyelitis	8	14%
Other	3	5%

THE MODIFIED ACTIVITY ASSESSMENT SCALE: THE MINIMUM CLINICALLY IMPORTANT DIFFERENCE

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Background: The minimal clinically important difference (MCID) is the smallest change in patient derived scores that represents a clinically important change to the patient and not just variation due to repeat testing. The MCID is a better indicator for change in health status than statistical significance. Hernias are known to impact abdominal wall quality of life (AW-QOL). We previously reported the MCID for a validated, hernia-specific AW-QOL survey, the modified activity assessment scale (mAAS), ranged from 7-14 based upon statistical distribution of a one-time measurement of 150 patients.

Objective: Our aim was to validate the MCID of the mAAS, using both a patient centered and statistical approach.

Methods: This is a prospective observational study. On this survey, 1 = poor and 100 = perfect QOL. Patients were surveyed prior to undergoing computed tomography abdomen/pelvis scans and resurveyed one year later. Both anchor (patient-centered) and distribution (statistical) based approaches were used to estimate the MCID. Prior to re-survey a year later, patients were asked if they had a worsening or improvement in their AW-QOL, which established the basis of the anchor-based approach. Patients who reported no change were the control (no clinical difference) and the patients who reported a change (improved or worsened) were considered in the study groups (clinically important difference). The MCID was calculated by taking a weighted average of the difference between the control and study groups. Distribution-based approach was also performed using a widely accepted method of calculating one-half of the standard deviation in the change of quality of life of the entire cohort.

Results: Overall, 181 patients were followed at 1 year: 95 (52.8%) self-reported no change (control), 71 (39.2%) reported improvement, and 15 (8.3%) reported worsening of their AW-QOL. The control group's mean (standard deviation) change was -1.3 (31.4) while those who self-reported improvement changed by +2.4 (32.9), and those who worsened declined by -6.3 (23.3). The weighted average difference in AW-QOL between control and study groups was 4 for the anchor-based approach. Utilizing the distribution-based approach, the overall change in AW-QOL was -0.3 (31.4) and the MCID was 16.

Conclusion: Our study results refine and validate prior work demonstrating similar ranges of the mAAS MCID. Understanding the MCID is important when comparing the effectiveness of treatments on patient-centered outcomes. Utilizing weighted averages of current and published MCIDs, we recommend standardizing and adopting MCID of 5 and 15 for minor and major changes when assessing AW-QOL using the mAAS.

GENDER BIAS IN INTEGRATED PLASTIC SURGERY RESIDENT SELECTION PROCESS: AN ANALYSIS OF CURRENT TRENDS IN THE UNITED STATES

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Background: According to the American Society of Plastic Surgeons, the male to female ratio of practicing plastic surgeons is approximately 5:1. As more surgical specialties are recruiting female residents, there has been an increase in the amount of females entering plastic surgery training. While gender bias has been extensively studied, there is a paucity of data in the literature regarding gender bias in plastic surgery resident recruitment.

Objective: We set out to examine the current trends in residency recruitment and whether a quantifiable gender bias exists in the resident selection process.

Methods: A review of all the integrated plastic surgery programs within the United States with publicly available information through their websites was conducted. Data were collected regarding department or division status, the gender of the chairman and the program directors, the number of residents per year and gender of residents per year. In order to assess only the current trend, only post-graduate years 1–3 were examined. The ratio of male to female residents was calculated and an independent sample t test was used to assess whether program directors were more likely to hire residents of their own gender.

Results: A total of 62 residency programs were identified with requisite data. The vast majority had a male program director with only 8 female program directors identified. Each residency program had a mode of 2 residents per year (range: 1 – 4). The mean ratio of female/male (F/M) residents overall was 1/1.2. Female program directors selected residents in the same ratio as their male counterparts [F/M ratio: 1/1.26 versus 1/1.18, p: 0.813]. A linear logistic regression failed to identify the geographic location, department status, gender of the department Chairman or the number of residents selected per year as predictors of higher F/M ratio. An increased number of female faculty was associated with an increased number of female residents, p: 0.031.

Conclusion: There are still fewer female program directors, faculty and residents in plastic surgery overall. While there may be an implicit bias toward selecting male residents by both male and female program directors, neither was more likely to select a resident of their own gender. However, this analysis does not rule out the possible self-selection factor in choosing plastic surgery as a specialty. Further investigation into the factors contributing to the gender disparity in plastic surgery is warranted.

HANDOVER PRACTICES AMONG TRAUMA AND ACUTE CARE SURGEONS: A MULTICENTER SURVEY STUDY

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Background: The handover period has been identified as particularly vulnerable period for communication breakdown leading to patient safety events. Clear and concise handover is especially critical in high acuity care settings such as trauma, acute care surgery (ACS), and surgical critical care (SCC). There is no census for the most effective and efficient means of evaluating or performing handover.

Objective: We aimed to characterize the current handover practices and perceptions of trauma and acute care surgeons in the USA.

Methods: A survey was sent to 2265 members of EAST via email regarding handoff practices at their institution. Respondents were queried regarding their practice setting, average census, level of trauma center, and patients (trauma, emergency general surgery and/or intensive care). Data regarding handover practices were gathered including frequency of handover, attendees, duration, timing, and formality. Finally, perceptions of handover including provider satisfaction, desire for improvement, and effectiveness were collected.

Results: Three hundred eighty surveys (17.1%) were completed. The majority (73.4%) of respondents practiced at level 1 trauma centers (N = 279) and were trauma/acute care surgeons (86.5%). Thirty five percent of respondents reported a formalized handover and 52% utilized a standardized tool for handover. Only 18% of respondents had ever received formal training, but most (51.6%) thought this training would be helpful. Eighty one percent of all providers felt handoff was essential for patient care and 77% felt it prevented harm. Seventy two percent thought their handoff practice needed improvement and this was more common as the average census increased. The most common suggestions for improvement were shorter and more concise handoff (41.6%), different handoff medium (24.5%), and adding verbal communication (13.9%).

Conclusion: Trauma and acute care surgeons perceive handover as essential for patient care and the majority desire improvement of their current handover practices. Methods identified to improve the handover process include standardization, simplification, and verbal interaction which allows for shared understanding. Formal education and best practice guidelines should be developed.

CURRENT PATIENT RESOURCES ON THE WEB FOR VARICOSE VEINS

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Background: Patients are increasingly seeking information on their conditions from the Internet.

Objective: This study aims to evaluate quality and readability of freely available online patient resources for varicose vein.

Methods: An internet search for "varicose veins" were conducted on meta-search engines Yippy and Dogpile with a cleared-cache web browser in July 2019. Two separate raters scored websites on the dimensions: accountability, interactivity, structure, and content. Discrepancies were discussed and consensus was reached. Readability was calculated with Flesch Grade Level and SMOG formula. Statistical analysis was performed with SPSS using ANOVA.

Results: A total of 103 website met inclusion criteria. Reason for exclusion included: duplications 64, lack lower extremity varicose vein related educational content 23, website not accessible 8, physician oriented 2. Website type included: open access 54 (52.4%), hospital/healthcare organization 38 (36.8%), Governmental 7 (6.8%), professional organization 3 (2.9%), industry sponsored 1 (1%). Format of content included: webpages 60 (58.3%), articles 40 (38.8%), webpages and articles 2 (1.9%), personal blog 1 (1%). Total quality score was 22.5±5.9 (total 42). Subcategory website quality score were: accountability 5.7±4.5 (n=16), interactivity 2.4±0.9 (n=6), structure 3.6±0.8 (n=5), content 11.6±3.8 (n=15). Overall accountability of websites was poor: 32% disclosed authorship, 39% used citations and 49% neither had a date of creation or modification. Most websites (80%) did described conservative management. Sclerotherapy (66%) was the most common described procedure followed by endovenous laser ablation (63.1%), radiofrequency ablation (51.5%), ambulatory phlebectomy (39.8%), ligation and stripping (35.9%), and surface laser (21.4%). Government- (28.6±4.5) and industry-sponsored (29.2) websites performed better on accountability, interactivity, structure, and content than hospital/healthcare organization (20.6±4.6), professional organization (21.3±5), and open access site (23.1±6.4) (P=0.008). Importantly, open access websites had significantly lower accuracy (2.9 ±1.4) compared to government (4.6±0.2), hospital/healthcare organization (4.1±0.5), professional organization (4.5±0.5), industry sponsored 5 (P≤0.001). Overall readability was low with average FK grade level 10±2, SMOG grade level 10±1. Government sponsored sites while having the highest total score also were most readable (FK grade 8±1, SMOG grade 8±1) compared to open access (FK grade 10±2, SMOG grade 9±1), professional organization (FK grade 9±2, SMOG 9±2), Hospital/healthcare organizations(FK 11±2, SMOG 10±1), and industry sponsored (FK 11, SMOG 10) (P≤0.001).

Conclusion: Quality of online patient resources on varicose vein is highly variable and readability for a patient is poor. Government sponsored websites have the highest quality while remaining most readable. Providers are advised to provide a list of appropriate websites to their patients to avoid confusion and ensure appropriate delivery of accurate and readable information.

THE EFFECTS OF DECREASED OPEN ABDOMINAL AORTIC ANEURYSM EXPERIENCE ON VASCULAR SURGERY TRAINING

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Background: A paradigm shift regarding open versus endovascular procedures has taken place in vascular surgery. The reasons regarding this shift include a short-term mortality benefit, shorter post-procedural recovery and length of stay, and lower rates of common complications after open surgery such as pneumonia. This trend focuses on patient outcomes, but a perspective overlooked is the effect that decreased open cases have on vascular training.

Objective: Open repair of abdominal aortic aneurysms (AAA) is gradually being replaced by endovascular aneurysm repair (EVAR). This study reviews our observations of declining open AAA repair, increasing EVAR, and the implications for vascular surgery trainees (VSTs).

Methods: The Medicare claims database was used to obtain data regarding AAA repair from 1995 to 2016. Excluded from this cohort are individuals with Medicare advantage plans, which comprise an ever-increasing percentage of Medicare beneficiaries, up to 34% in this time period. AAA was defined as infrarenal aneurysms. Data regarding vascular training were from the Accreditation Council for Graduate Medical Education's required operation log aggregated into an annual summary report. The datasets utilized for fellows include the 1999-2000 through 2017-2018 cohort, and the 2012-2013 through 2017-2018 cohort for integrated fellows.

Results: AAA repairs from all modalities have decreased from 1995 (n=32741) to 2016 (n=21220) by 35.2%. The number of AAAs that were repaired in an open fashion decreased by 93.4% (n=26910, 1995; n=1785, 2016). However, EVARs increased from 2001 (n=8501) to 2016 (n=17905) by 110.6%. These trends are mirrored by the decrease in open elective repair and increase in endovascular repair that VSTs complete during their residency or fellowship.

Conclusion: The number of AAA repairs from all modalities have decreased since 1995. With the advent of EVAR, the number of open AAA repairs has further decreased. This shift is also reflected in vascular surgery training. Given this decline and the inverse association of case volume and mortality, supplemental training may soon become required in order to ensure competence in open AAA repair for VSTs.

DETERMINING THE BEST OPERATIVE APPROACH FOR NONPARASITIC SPLENIC CYSTS IN CHILDREN

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Background: Nonparasitic splenic cysts (NPSC) are rare in the pediatric population. Partial splenectomy has been proposed to be superior to laparoscopic cystectomy to limit recurrence. We hypothesized that laparoscopic cystectomy is a feasible approach.

Objective: The purpose of this study was to evaluate laparoscopic cystectomy and longterm outcomes.

Methods: IRB-approved, retrospective review of children age <18 presenting with a NPSC from 2013-2018. Patient demographics, presenting symptoms, imaging, cyst characteristics, and management were evaluated. Data were analyzed using descriptive statistics and chi square tests.

Results: Thirty patients were identified over a 5 year period. 57% (17/30) were male (p = 0.5). Median age was 12.7 years (IQR: 8.8-14.6 years)) and median cyst diameter at presentation was 6.3 cm (IQR: 1.7 – 9.6 cm). 57% (17/30) were observed and 43% (13/30) had an intervention. Patients who underwent intervention were older (12.7 years vs 11.3, p = 0.14) and had larger cyst size (median diameter 9.0 vs 2.2 cm, p = 0.001) than those who were observed. Laparoscopic cystectomy was the most commonly performed operation in 47% (7/15). Partial splenectomy was performed in 27% (4/15), total splenectomy in 13% (2/15), open cystectomy in 7% (1/15) and percutaneous aspiration in 7% (1/15). Recurrence was noted in 40% (6/15) of intervention patients: 4 who had laparoscopic cystectomy (57%), 1 who had open cystectomy (7%), and 1 who had aspiration (7%); however, none required re-operation. Median time to recurrence was 3.9 months (IQR: 2.2 – 12 months). All patients in the cohort were reviewed for long-term outcomes. Six patients were lost of follow-up and 24 patients had documented follow-up with the pediatric surgery clinic. Thirty-three percent (8/24) of patients had follow-up visits at least 12 months from initial presentation. Ninety-two percent of patients were asymptomatic at follow up.

Conclusion: Observation is an appropriate management strategy for small, asymptomatic splenic cysts, but a large, symptomatic splenic cysts may require operative intervention. There is a high recurrence rate for laparoscopic cystectomy, however, patients did not require re-operation and on long-term follow up, remained asymptomatic. Therefore, laparoscopic cystectomy remains a valid surgical option.

COMPARATIVE OUTCOMES OF PATIENTS WITH SINGLE 2-3 CM HEPATOCELLULAR CARCINOMA LESIONS TRANSPLANTED BEFORE AND AFTER 18 MONTHS OF LOCO-REGIONAL THERAPY

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Background: Loco-regional therapy (LRT) is a standard of care to bridge patients with localized hepatocellular carcinoma (HCC) to liver transplantation (LT).

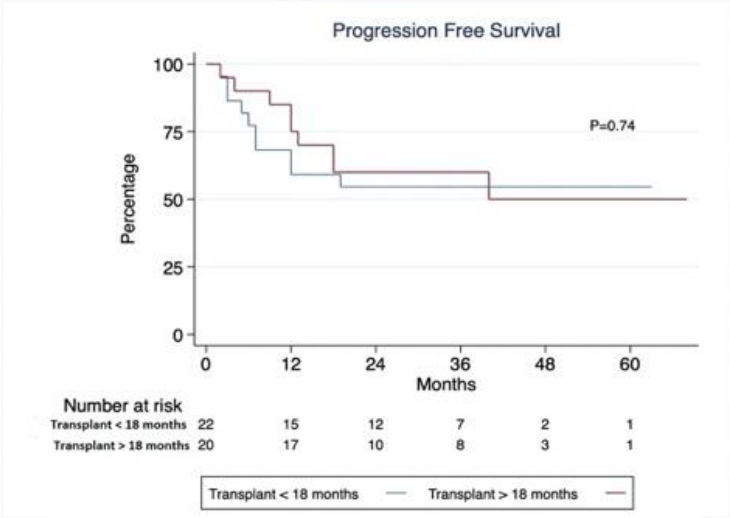
Objective: Our objective was to evaluate if timing of LT from LRT has an impact on the outcomes of patients with single small HCC.

Methods: We performed a retrospective analysis of patients diagnosed with unifocal 2-3 cm HCC underwent radiofrequency ablation (RFA) or trans-arterial chemo-embolization (TACE) as a bridging therapy before transplantation at a single institution, between 2013 and 2017. Patient's characteristics and oncologic outcomes were analyzed.

Results: Of 208 patients, 42 (20.1%) had single 2-3 cm HCC lesions, and were followed for a median of 35.4 months (25.5-45.7). Twenty-four patients underwent TACE and 18 patients underwent RFA as the initial LRT. Median (IQR) time from LRT to LT was 17.4 months (13.5, 20.3). ROC analysis yielded the cutoff mark of 18 months based on recurrence rates (sensitivity: 56.3%, specificity: 46.2%,). From the initial LRT, 22/42 patients (52.4%) had LT within 18 months, while 20/42 (47.6%) had LT >18 months after initial LRT. One and 5-years progression free survival for patient who were transplanted within 18 months vs > 18 months after LRT were 62%, and 54 % vs 75%, and 60 %, p=0.74, respectively. Overall survival was comparable with one patient dying from each group with cirrhosis related complications.

Conclusion: Bridging LRT for a single HCC 2-3 cm provides comparable long-term survival in patient transplanted before and after 18 months of initial therapy.

Figure 2. KM curve of progression free survival



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HEPATIC METASTASECTOMY IN STAGE IV BREAST CANCER PATIENTS WITH ISOLATED LIVER METASTASES

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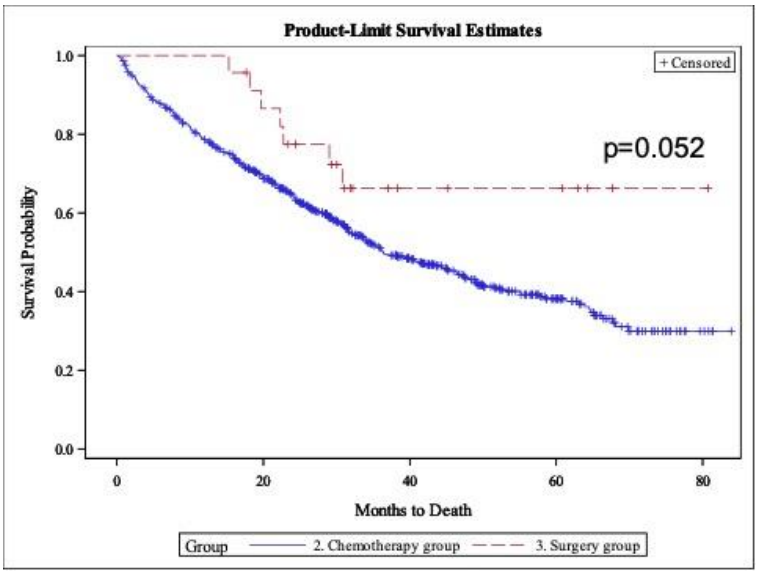
OBJECTIVES: The purpose of this study was to determine whether hepatic metastasectomy improves long-term outcomes among patients with isolated metastases to the liver.

METHODS: The 2004-2015 National Cancer Database was queried for all patients diagnosed with stage IV breast cancer with metastases isolated to the liver. Patient demographics, disease, treatment and outcome-related data were analyzed.

RESULTS: Of 2,895 patients, only 90 (3.1%) underwent hepatic resection. Compared to patients receiving systemic therapy alone, patients treated with metastasectomy tended to be younger (52±12.7 vs 59.2±14.6; p<0.001) and have private insurance (74.4% vs 45.3%; p<0.001). Predictors of metastasectomy were younger age (OR .98; CI 0.96-0.99; p=0.01), lobular carcinoma (OR 2.3; CI 1.06-4.82; p=0.03), breast conservation therapy (OR 6.96; CI 3.47-13.95; p=0) and mastectomy (OR 5.74; CI 3.06-10.76; p=0). Compared to systemic therapy alone, hepatic metastasectomy was independently associated with a 39% increase in overall survival (p=0.01) (Figure 1).

CONCLUSION: Stage IV breast cancer with isolated liver metastases is a rare presentation and few patients undergo hepatic resection. However, in this highly selected patient population, hepatic metastasectomy appears to confer a significant survival advantage over systemic therapy alone.



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PREOPERATIVE EVALUATION, CLINICOPATHOLOGIC FACTORS, MANAGEMENT STRATEGIES AND OUTCOMES OF HEPATOCELLULAR CARCINOMA IN A SAFETY-NET HOSPITAL

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Background: Safety-net hospitals are institutions that care for the largest number of patients who are uninsured or covered by Medicaid, and, as a consequence, have historically cared for a disproportionate number of patients of low socioeconomic status and racial/ethnic minorities. Additionally, despite comprising a minority of overall hospitals, they have been shown to account for a disproportionate number of cancer patients. These innate challenges make these hospitals important in understanding the unique situations and needs of vulnerable patients and in improving access to and the delivery of cancer care in order to ultimately improve patient outcomes.

Objective: The purpose of this this study is to characterize the treatment of hepatocellular carcinoma (HCC) at Ben Taub Hospital, a safety-net hospital in the Texas Medical Center.

Methods: Three-hundred-four patients with hepatocellular carcinoma treated at Ben Taub Hospital or its affiliated clinics between January 1, 2009 and December 31, 2014 were identified. A retrospective chart review was performed to assess the relationship between demographic characteristics, clinicopathologic data, treatment strategies, and outcomes of these patients.

Results: Two-hundred twenty-six men and 78 women with a mean age of 58 years underwent evaluation. Two-hundred sixty-two (86%) were either uninsured or Medicaid patients. Two-hundred seventeen patients (71%) had either hepatitis B or C infection. The majority (58%) of patients presented with multiple lesions and 67 patients (22%) presented with metastases. Of the 122 patients (40%) that presented with a solitary lesion, the average size was 4.97 cm. Trans-arterial chemoembolization was used in 113 (37%) patients, sorafenib was given to 80 (26%) patients. Five patients underwent

successful transplant. Additional treatments included ablation, Y90, radiation and resection. One-hundred twenty-six (42%) patients died of their disease and 17 patients (6%) are alive with no evidence of disease, however, 145 (48%) patients have been lost to follow up.

Conclusion: Most patients with HCC present to this safety-net hospital with advanced disease but are able to be offered standard of care treatment. Screening programs to detect HCC at an earlier stage are paramount to successful long term outcomes. Our ongoing studies will determine whether disparities in stage at initial presentation, clinicopathologic variables, and outcomes exist in patients presenting to our safety-net hospital compared to those presenting to our tertiary/quaternary referral center.

DEVELOPMENT OF A VETERAN-CENTERED BLADDER CANCER SURVIVORSHIP CARE PLAN

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Background: Bladder Cancer (BC) is the third most commonly diagnosed cancer in U.S. Veterans and comprised 6% of all new Veteran cancer cases in 2010. Veteran cancer survivors in the Veterans Health Affairs system (VHAS) tend to be older and have high comorbidity burden, relative to patients not in the VHAS. A Survivorship Care Plan (SCP) is a navigation tool intended to help a cancer patient transition to survivor and includes a comprehensive cancer care summary and follow-up plan. Although professional organizations recommend their use, research demonstrating efficacy of SCPs for improving patient outcomes is mixed. Delivery of an SCP to survivors was part of an accreditation Standard from the American College of Surgeons Commission on Cancer (ACS CoC), which certifies our cancer program.

Objective: This project aimed to transform a generic SCP template from the American Society of Clinical Oncology (ASCO) into an SCP that is patient-centered and veteran-centric, via a mixed-methods approach.

Methods: We used maximum variation sampling to screen and recruit participants across stage, grade and treatment experiences: 1) patients with intact bladder, stratified by guidelines-based risk groups; 2) patients who underwent eadical cystectomy; 3) patients who underwent bladder-sparing chemoradiation. We conducted individual qualitative interviews with 20 Veteran BC survivors about their experiences and unmet needs. Interviews were recorded, transcribed, and analyzed using rapid qualitative analysis. Identified themes were used to adapt the ASCO SCP to fit veterans' reported needs and preferences. Focus groups were then conducted (FG1 n=5; FG2 n=7) with Veteran BC survivors to seek feedback on the adapted SCP. The draft SCP was adjusted after each FG to incorporate feedback and suggestions.

Results: Our sample largely identified as older (median age 71), White (84%), and male (100%). Individial interview participants (n = 20) expressed a wide range of needs for additional information and support, and 90% of interview participants reported experiencing side effects related to treatment, short-term and/or long-term. The most requested elements of an SCP included information on nutrition (n = 8), physical activity (n = 6), support groups (n = 8), managing side effects (n = 6), and surveillance (n = 4). Several participants explicitly expressed interest in peer support and BC-specific support groups earlier in their cancer experience. The SCP was adapted to incorporate this information following interviews and further amended after FGs to include: veteran specific risk factors for BC, a glossary of terms, and bold statements of the importance of treatment adherence for BC and importance of smoking cessation.

Conclusion: Veteran BC survivors have a diverse and unique set of needs that differ from those of the general population, and aging survivors often have multiple comorbidities that require continued care coordination. We developed an SCP for Veteran BC Survivors that is rooted in veteran survivors' voices. The 2020 ACS CoC Standard for survivorship has shifted from delivery of an SCP to development of a Survivorship Program. Future research should: 1) investigate the efficacy of using this SCP to improve veteran outcomes, and 2)

study the needs, barriers, and benefits of implementing a broader Survivorship Program to bolster support for a population with complex needs.

Source of Funding: Michael E. DeBakey VAMC HSR&D FY19 Seed Award.

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OUTCOME OF VASCULAR TUMOR IN SEER REGISTRY

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Background: Hemangiosarcoma and epithelioid hemangioendothelioma (EHE) are rare malignant vascular tumors.

Objective: We aim to describe patient demographics, tumor characteristics, treatments, and outcomes based on national data.

Methods: Data on patients with hemangiosarcoma and EHE were obtained from Surveillance, Epidemiology, and End Results (SEER) database. Statistical analysis was performed with SPSS.

Results: Between the years 1975-2006, 5070 patients with hemangiosarcoma and 427 patients with EHE were identified. Forty-six percent were male. Median age at diagnosis was 68 (IQR, 54-78). Patient were mostly white (84%), followed by African American (8%), Asian or Pacific Islander (7%), American Indian/Alaska (0.4%), and unknown (0.6%). Median tumor size was 46 (IQR, 24-80) mm. Tumor grades was high at presentation (Grade I -11.2%; Grade II – 17.3%; Grade III 34%; Grade IV-37%). Tumor extension was localized tumor in 47%, considered regional in 29%, and 25% had distant metastasis. The majority of patient underwent surgery (64%) and a third underwent radiation or chemotherapy. Patients with EHE were significantly younger (51 vs 61, $P<0.001$) and had significant better 5 year survival (55% vs 27%, $P<0.001$). Increasing age at diagnosis ($P<0.001$), female sex ($P=0.005$), left sided tumor ($P=0.013$), larger tumor size ($P<0.001$), higher tumor Grade ($P<0.001$), greater tumor extension ($P<0.001$), single malignancy ($P<0.001$), not undergoing surgery ($P<0.001$), regardless of undergoing radiation therapy or chemotherapy, were associated with worse survival in patients with hemangiosarcoma while older age ($P<0.001$), larger tumor size ($P=0.001$), distant tumor extension ($P=0.001$), earlier year of diagnosis ($p=0.028$), not undergoing surgery (0.039) or chemotherapy (0.049) were associated with lower survival in EHE.

Conclusion: Hemangiosarcoma and EHE are rare malignant tumor more common in the fourth and fifth decade of life. EHE has improved survival compared to hemangiosarcoma. Surgery improve survival in both hemangiosarcoma and EHE.

THE IMPACT OF SURVEILLANCE INTERVAL FOLLOWING RESECTION OF PRIMARY WELL DIFFERENTIATED LIPOSARCOMA OF THE RETROPERITONEUM

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Background: Resection of recurrent retroperitoneal well differentiated liposarcoma (RP WDLPS) is unlikely to result in surgical "cure." Thus many clinicians will delay surgery after diagnosis of recurrence until the time of symptom intolerance or if there is an increase/rapid rate of disease progression. The current consensus of the multidisciplinary sarcoma group at MD Anderson Cancer Center (MDACC) is to examine and image patients following primary sarcoma resection every 3 months for the first 2 years postoperatively, although level 1 data supporting this practice are lacking.

Objective: The aim of this study to determine whether longer interval follow-up (q4-6 months) might be feasible in this patient population without impacting outcomes or delaying treatment in those who recur.

Methods: A retrospective review of all patients (n=90) with primary RP WDLPS who underwent surgical resection at MDACC Aril 1996-April 2017 and who received follow-up care and surveillance at MDACC was performed. Dates of postoperative follow-up, surveillance visits, diagnosis of recurrence, and surgery for recurrence were collected. For patients who recurred, time to recurrence and time to second surgery for recurrence were determined in order to assess the potential impact of surveillance interval on timing of surgery or initiation of systemic therapy for recurrence.

Results: Median age at diagnosis was 62 years (range 32-82). 52.2% of patients were male (47/90). Median tumor size was 29cm (range 6-70) with 18.9% (17/90) of patients having multifocal primary tumors. R0/R1 resection was achieved in 84 patients (93.3%) [R2 in 3 (3.3%), unknown in 3 (3.3%)]. 55 patients (61.1%) developed local recurrence with median time to recurrence of 24.6 months (range 2.5-123.6). Of the patients who recurred, 39 (70.9%) underwent resection of recurrent disease at a median 6.3 months (range 0.9-58.0) from diagnosis of recurrence and 31.0 months (range 7.2-118.5) from primary WDLPS resection. As most recurrences occurred at or beyond 1 year (38/55 [69.1%] patients w/RFS ≥12 months, 28/55 [50.9%] w/RFS ≥24 months), surveillance intervals of 3 vs 4 vs 6 months are unlikely to significantly impact management of recurrence. In this cohort, surveillance follow-up/imaging at 4 month intervals (compared to 3 months) would not have impacted management of WDLPS recurrence in the great majority of patients (89, 98.9%) except in 1 patient (1.1%) would have delayed initiation of treatment (chemotherapy). Likewise, surveillance follow-up/imaging at 6 month intervals (compared to 3 months) would not have impacted management of WDLPS recurrence in the majority of patients (87, 96.7%) but would have delayed initiation of treatment (chemotherapy) in 1 patient (1.1%) and might impact/delay timing of operation in the 2 patients (2.2%) who underwent surgery for recurrence within 1 year of primary tumor resection. Median overall survival was 66.8 months (range 11.2-283.5).

Conclusion: Surgical resection is the treatment of choice for primary RP WDLPS. In this cohort of 90 patients who underwent resection of primary RP WDLPS, recurrence was common and frequently occurred beyond the early postoperative period. Surveillance follow-up/imaging at 3 vs 4 or 6 month intervals in the first 2 years following primary WDLPS resection may not significantly impact timing of surgery or systemic therapy for recurrent disease. If longer interval follow-up/imaging were shown to be safe with equivalent patient outcomes in prospective studies, the resulting change in practice patterns might result in decreased anxiety and cost for patients and the healthcare system overall.

THE INTERPLAY OF CIRRHOSIS AND RACE ON STAGE AT DIAGNOSIS OF HEPATOCELLULAR CARCINOMA

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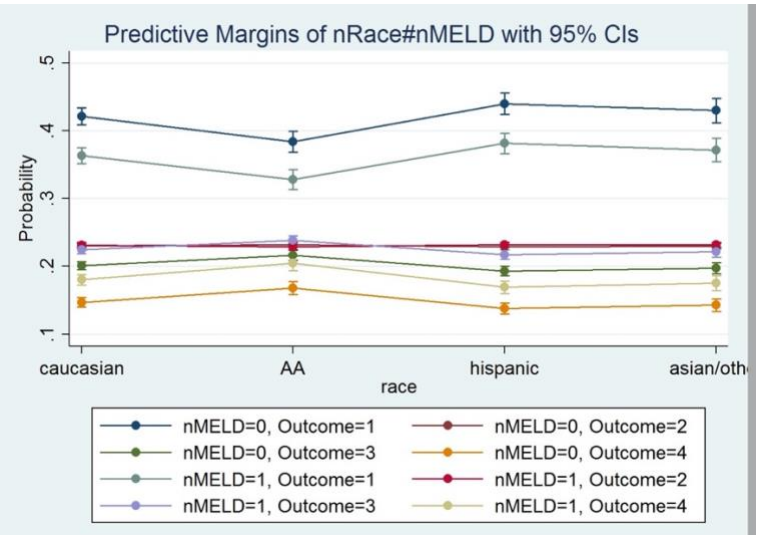
Background: Cancer-related racial disparities are partially attributed to stage at diagnosis. Incidence rates of hepatocellular carcinoma (HCC) may be disproportionate amongst minorities and contribute to prognosis disparities. We compared the degree of cirrhosis at HCC diagnosis to examine the impact of race upon cancer stage.

Objective: We compared the degree of cirrhosis at HCC diagnosis to examine the impact of race upon cancer stage.

Methods: National Cancer Data Base queried for HCC cases. Unknown stage patients were excluded. Site-specific variables were used to calculate Model for End-Stage Liver Disease (MELD) score. A multilevel mixed-effect ordered logistic regression estimated factors associated with stage at diagnosis. An interaction term for MELD was tested to determine the effect between racial groups.

Results: A total of 48,492 patients (male=76%) with mean age 63.1 years (SD10.5) were included. At diagnosis, a higher proportion were stage 1=18,706(38%), 2=11,111(23%), 3=10,432(22%) and 4=8,183(17%). MELD score was highest for AA, 16.5 (SD10.1) and lowest for Asian patients, 14.2 (SD9.2) (p=0.01). After adjusting for MELD, income and insurance status in the ordered logistic regression model, AA race was associated with higher stage (OR1.10,95%CI:1.00-1.20). Across the range of MELD scores, the predicted probability of advanced stage was significantly higher for AA patients (Figure1).

Conclusion: After adjusting for socioeconomic factors (income and insurance), African American race maintains association with advanced HCC stage at diagnosis thereby excluding a disproportionate number from potentially-curative treatment. An understanding of cirrhosis development and progression may mitigate the racial inequity of HCC prognosis.



ARE MUTATIONAL PROFILES OF COLORECTAL CANCER AND PULMONARY METASTASES CONCORDANT?

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Background: The advent of molecular targeting strategies has altered the treatment strategies for metastatic colorectal cancer (CRC). It has been well demonstrated that specific genetic mutations impact the extent of response to such therapeutic interventions. Concordance of mutational findings between primary CRC tumors and metastatic lesions has been thoroughly reported for nodal and hepatic disease; however, the relationship between mutational abnormalities in primary CRC tumors and associated pulmonary metastatic lesions is poorly understood.

Objective: The aim of our study was to determine concordance of genetic profiles through the use of next generation sequencing (NGS) between primary CRC and pulmonary metastases.

Methods: Patients who underwent pulmonary metastasectomy for CRC at a single institution from 2002 to 2018 were identified. Individuals who did not have available NGS data for primary CRC and PM were excluded. Genes were selected for analysis if they were known to be therapeutically targetable or actionable, or if they were reported in both CRC primary and pulmonary metastasectomy in at least 80% of cases. Concordance was defined by either both wildtype or both mutant alleles in lung and colorectal lesion; genes with opposing mutational profiles between primary and lung were reported as discordant.

Results: 38 patients met inclusion criteria, in whom KRAS, BRAF, NRAS, and PIK3CA were examined for mutational concordance (Table). High levels of concordance (greater than 95%) were observed between primary CRC and lung metastases for the majority of the genes evaluated. A slightly higher frequency of discordance was noted for KRAS and PI3KCA with 5/35 (14%) and 3/31 (10%) samples displaying discordant mutational profiles, respectively. Of all discordant samples, 78% (7/9) reflect de novo mutations in metastatic tissue. NRAS displayed 100% concordance between CRC and pulmonary metastases. The presence of KRAS-mutant CRC was 95% sensitive for KRAS-mutant pulmonary metastatic disease. Of the patients with KRAS discordant tumors, 4/5 (80%) had de novo mutations and 1/5 (20%) patient converted to wildtype. Anti-EGFR therapy was used in 75% (3/4) of cases demonstrating wildtype-to-mutant conversion. In comparison, de novo PIK3KCA mutations were observed in 2/3 (67%), while 1/3 (33%) converted to wildtype.

Conclusion: High intertumoral genetic homogeneity exists, with greater than 85% CRC-lung concordance in several targetable genes. In the absence of pulmonary metastasis sequencing, it may be reasonable to use primary CRC NGS to guide prognostication and molecular targeted therapy. However, the occurrence of de novo KRAS-mutant pulmonary metastases is not insignificant, and should be considered, particularly in an inoperable patient previously treated with anti-EGFR therapy for KRAS wildtype disease.

Table: Mutational Concordance Between Primary Colorectal Cancer and Lung Metastasis

Gene	BRAF	KRAS	NRAS	PI3KCA
NGS Pairs Examined	35	35	33	31
WT_C-WT_L Concordant, n (%)	32 (91)	12 (34)	30 (91)	24 (77)
Mt_C-Mt_L Concordant, n (%)	2 (6)	18 (51)	3 (9)	4 (13)
Total Concordant, n (%)	34 (97)	30 (86)	33 (100)	28 (90)
WT_C-Mt_L Discordant, n (%)	1 (3)	4 (11)	0 (0)	2 (7)
Mt_C-WT_L Discordant, n (%)	0 (0)	1 (3)	0 (0)	1 (3)
Total Discordant, n (%)	1 (3)	5 (14)	0 (0)	3 (10)

NGS: next generation sequencing; WT: wild-type; C: colorectal cancer; L: lung metastasis; Mt: mutant

EVALUATION OF ASCENDING THORACIC AORTIC ANEURYSM AND DISSECTION IN MICE WITH STREPTOZOCIN-INDUCED DIABETES MELLITUS

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Background: Although diabetes, a common disease in the United States, has devastating effects on human health, evidence suggests a negative association between diabetes and the incidence of ascending thoracic aortic aneurysm and dissection (ATAAD). The mechanism behind the presumed protective effect of diabetes on ATAAD is poorly understood.

Objective: In this study, we examined the effect of diabetes on ATAAD development in mice. We hypothesized that in a mouse model that promotes ATAAD, mice with streptozocin (STZ)-induced diabetes would have a lower incidence of ATAAD compared to non-diabetic mice.

Methods: Male and female wild-type (WT; C57BL/6) mice received intraperitoneal injections of STZ (n=35) or vehicle (n=36). Blood glucose levels were measured to confirm diabetes. Some diabetic (n=25) and non-diabetic (n=26) mice were challenged with angiotensin II infusion (2,000 ng/min/kg) for 4 weeks through an osmotic minipump. Diabetic (n=10) and non-diabetic (n=10) mice received vehicle alone and were used as unchallenged controls. We measured blood pressure, measured ascending aortic diameters directly after sacrifice, and evaluated aortic pathology.

Results: Median blood glucose values were significantly elevated in diabetic vs non-diabetic mice (418 vs. 145 mg/dl, p=0.0001). Mean systolic blood pressure measurements were similar between the challenged diabetic and non-diabetic groups, and between the unchallenged diabetic and non-diabetic groups. Furthermore, mean ascending aortic diameters were similar in unchallenged diabetic and unchallenged non-diabetic mice (1.36±0.1 vs. 1.23±0.14 mm, p=0.8) and in challenged diabetic and challenged non-diabetic mice (1.64±0.25 vs. 1.58±0.27, p=0.8). Although the challenged groups had similar incidences of aortic dilatation (64% vs. 69%, p=0.7), the incidence of severe ATAAD (dissections and ruptures) was significantly lower in the challenged diabetic mice compared to the challenged non-diabetic mice (24% vs. 62%, p=0.007). No differences were seen between males and females.

Conclusion: Our results suggest that STZ-induced diabetes may have a protective effect against severe ATAAD. Further studies are needed to determine the effects of diabetes on various aspects of ATAAD progression, including aortic inflammation, protease activation, extracellular matrix remodeling, and smooth muscle cell dysfunction.

FACTORS ASSOCIATED WITH USE OF PRESCRIPTION OPIOD MEDICATIONS AT HOME AFTER THORACIC SURGERY

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Background: Enhanced recovery after surgery with pre-emptive pain management program has been shown to decrease opioid prescriptions after thoracic surgery. However, it is unclear which factors are associated with being able to manage without opioid at home after thoracic surgery.

Objective: We sought to determine which factors were associated with the need for prescription opioid medications after thoracic surgical procedures.

Methods: We performed a retrospective analysis of postoperative pain survey, which assessed patient usage of pain medications following surgery, usage of pain medications prior to surgery, as well as pain level (1-10 scale) at the time of follow-up (3-8 weeks after surgery). We used patient response to the pain survey in combination with procedural and patient characteristic data and performed univariate and multivariate logistic regression to determine factors influencing the need for managing pain without prescription opioids. We also determined the median pain level at follow-up for all patients who had thoracic surgical procedures.

Results: 229 patients completed questionnaires at a median of 37 days after surgery. Most patients received minimally invasive surgery (n=213, 93%) with the three most common types of operations being foregut (n=93, 41%), pulmonary resection (n=80, 35%) and esophagus (n=17, 7%%). Thirty-nine percent of patients (n=89) were taking chronic pain medications preoperatively with 14% on chronic opioids (14%). 166 patients (72%) did not take opioids after surgery. Univariate analysis showed chest wall operation, open surgery, transthoracic approach, any pain medication prior to surgery, opioids prior to surgery, and multiple numbers of preoperative pain medications, were significantly associated with a discharge opioid requirement. Multivariate analysis showed chronic pain medication (OR 4.94, 95% CI 1.35, 18.07, p=0.02) and chronic opioid use (OR 18.39, 95% CI 5.22, 92.01, p<0.001) were associated with opioid use postoperatively. The median pain level was 0 (0-10 scale) at follow-up for all patients.

Conclusion: A majority of thoracic surgical patients were able to have their pain managed without opioid prescription. The opioid sparing pain management regimen was successful in patients who were not on chronic pain medication(s) prior to surgery. This factor should be considered when tailor the patient's pain management after thoracic surgical procedures.

Graph on following page

Table 1. Characteristics associated with narcotics after surgery, univariate logistic regression

	Total (N=229)	Opioids after surgery		Unadjusted OR (95% CI)	p-value
		No (*n*=166)	Yes (*n*=63)		
Time between surgery and survey (days), median (IQR)	37.0 (34.0, 40.0)	38.5 (34.0, 40.0)	36.0 (33.0, 40.0)	0.96 (0.92, 1.01)	0.13
Surgery type					
Lungs	80 (34.9)	56 (33.7)	24 (38.1)	(reference)	
Esophagus	17 (7.4)	14 (8.4)	3 (4.8)	0.50 (0.13, 1.90)	0.31
Chest wall	8 (3.5)	2 (1.2)	6 (9.5)	7.00 (1.32, 37.19)	0.02
Pleura	12 (5.2)	7 (4.2)	5 (7.9)	1.67 (0.48, 5.78)	0.42
Mediastinum	15 (6.6)	9 (5.4)	6 (9.5)	1.56 (0.50, 4.86)	0.45
Diaphragm	4 (1.7)	1 (0.6)	3 (4.8)	7.00 (0.69, 70.74)	0.10
Foregut	93 (40.6)	77 (46.4)	16 (25.4)	0.48 (0.24, 1.00)	0.049
Open					
Minimally invasive	213 (93.0)	158 (95.2)	55 (87.3)	(reference)	
Open	16 (7.0)	8 (4.8)	8 (12.7)	2.87 (1.03, 8.02)	0.04
Thoracic versus abdominal cavity					
Abdominal cavity	98 (42.8)	81 (48.8)	17 (27.0)	(reference)	
Thoracic cavity	131 (57.2)	85 (51.2)	46 (73.0)	2.58 (1.37, 4.86)	0.003
No pain medication prior to surgery	140 (61.1)	120 (72.3)	20 (31.7)	0.17 (0.10, 0.34)	<0.001
Narcotics prior to surgery	34 (14.8)	5 (3.0)	29 (46.0)	27.46 (9.92, 76.06)	<0.001
Number of different pain medication prior to surgery, median (IQR)	0.0 (0.0, 1.0)	0.0 (0.0, 1.0)	1.0 (0.0, 2.0)	2.35 (1.69, 3.29)	<0.001

Table 2. Characteristics associated with Opioid at discharge, multiple logistic regression

	Adjusted OR (95% CI)	p-value
Time between surgery and survey (days)	0.97 (0.91, 1.03)	0.31
Surgery type		
Lungs	(reference)	
Esophagus	0.69 (0.12, 3.95)	0.68
Chest wall	2.52 (0.23, 27.38)	0.45
Pleura	1.26 (0.27, 5.83)	0.76
Mediastinum	1.36 (0.34, 5.42)	0.67
Diaphragm	14.00 (0.88, 222.22)	0.06
Foregut	0.78 (0.04, 16.52)	0.87
Open vs minimally invasive	1.91 (0.33, 11.16)	0.47
Thoracic cavity vs abdominal cavity	2.29 (0.12, 42.75)	0.58
Opioid prior to surgery	18.39 (5.25, 64.34)	<0.001
Number of different pain medication before surgery	1.42 (0.89, 2.28)	0.14

AUC = 0.81

PREDICTORS OF UNPLANNED READMISSION AFTER AORTIC ROOT REPLACEMENT

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Background: Reducing the incidence of unplanned readmission after aortic root replacement (ARR) represents an opportunity to improve outcomes, however predictors of readmissions are unknown.

Objective: We sought to identify factors associated with unplanned readmission after ARR. Hypothesized predictors of readmission included increased comorbidities, increased difficulty of operation (non-elective, redo operation, concomitant arch), and post-operative life alerting complications. We also evaluated whether there were differences in predictors of readmission between women and men.

Methods: Using prospective phone contact and retrospective record review, we determined the frequency and characteristics of unplanned readmissions within 30 days of discharge in 286 consecutive patients who survived to discharge after ARR. We used univariate and multivariable logistic regression to identify factors associated with readmission.

Results: We identified 60 unplanned readmissions among 54 of the 286 patients (19%). After readmission, 7 patients had operations (wound debridement [n=5] was most common) and 24 had non-surgical procedures: pericardiocentesis (n=11) and thoracentesis (n=10) were the most common. Out of the 286 patients, 55 (19%) were women; there was no significant difference in readmission rates between men (n=42 [18%]) and women (n=12 [22%], p=0.4). There were no significant differences in preoperative or intraoperative factors in those who were readmitted vs. those who were not. Post-operatively, readmitted patients had more pericardial effusion (n=11 [20%] vs n=12 [5%], p=0.0002) and pleural effusion (n=8 [15%] vs n=13 [6%], p=0.02) than did those without readmission. Multivariable logistic regression analysis identified pericardial effusion (odds ratio [OR]=4.13; p=0.005) and pleural effusion (OR=4.44, p=0.02) as significant predictors of readmission overall. Within women, postoperative pleural effusion (OR=14.51, p=0.03) was the only significant predictor of readmission, whereas, within men, pericardial effusion (OR=7.79, p=0.0007) was the only significant predictor. At 24 months, survival was similar between readmitted patients (93% ± 5%) and those who were not readmitted (96% ± 2%).

Conclusion: Preoperative and intraoperative factors were not associated with readmission after ARR. Patients with postoperative pericardial and pleural effusion were more likely to be readmitted; optimizing management of effusions before discharge may reduce readmission after ARR. Additionally, factors associated with readmission may vary between men and women and may indicate potential for more targeted optimization prior to discharge in the future.

Graph on following page

Table. Characteristics of Patients Who Underwent Aortic Root Repair Stratified by Readmission Status

Variable	All (n=286)	With Unplanned Readmission (n=54)	Without Unplanned Readmission (n=232)	P value
Coronary artery disease	53 (19%)	10 (19%)	43 (19%)	1
Pulmonary disease	42 (15%)	10 (19%)	32 (14%)	0.4
Redo operation	66 (23%)	8 (14%)	58 (24%)	0.1
Urgent or emergency root operation	46 (16%)	10 (19%)	36 (16%)	0.6
Concomitant hemiarch, full arch, or elephant trunk	237 (83%)	41 (76%)	196 (84%)	0.1
Postoperative life-altering complication	4 (1%)	1 (2%)	3 (1%)	0.6

* Life-altering complication defined as discharge with persistent stroke, neurologic deficit, or renal failure necessitating dialysis.

ROBOTIC ASSISTED THORACOSCOPIC PULMONARY RESECTION IS ASSOCIATED WITH IMPROVED OUTCOMES COMPARED TO VIDEO ASSISTED THORACOSCOPIC PULMONARY RESECTION

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Background: Minimally invasive lung resection has shown to improve post-operative outcomes compared to open thoracotomy.

Objective: Objective of this study is to compare the outcome of Da Vinci Xi robot assisted surgery (Xi robot) and video assisted thoracoscopic surgery (VATS) for pulmonary resection.

Methods: We performed a retrospective analysis of prospectively collected STS database at a single institution of patients who underwent elective lung resection from 2012 to 2019. We compared patient outcomes at different time periods, before adoption of the robot technology, initial robot experience, and mature robot experience. We then performed propensity match analysis of patients who underwent VATS vs Xi robot anatomic pulmonary resection. We then performed univariate and multivariate logistic regression modeling to determine the factors associated with postoperative outcomes.

Results: Five hundred four (504) patients underwent pulmonary resection between three time periods, 220 patients (43.7%, predominately VATS) prior to the first use of the Da Vinci Xi robot, 126 patients (25%, initial robot) from initial experience with robot, and 158 patients (31.1%, mature robot) during mature robot experience. There were significantly less post-operative complications (15.2% vs 34.9% vs 39.1%, $p<0.001$), shorter median length of stay (2 days vs 3 days vs 4 days, $p<0.001$) and lower readmission rate (1.9% vs 4% vs 11.8%, $p<0.001$) in the mature robot period compared to initial robot period and predominately VATS period, respectively. We then performed propensity matched analysis of VATS (n=124) vs Xi robot (n=124) for patients who underwent anatomic pulmonary resection. Multivariate analysis shows Xi robot (OR 0.51; 95% CI, 0.29-0.91, p=0.02) is associated with decrease in post-operative events while age (OR 1.03; 95% CI, 1.00-1.06, p=0.03) and smoking (OR 2.8; 95% CI, 1.29-6.09, p=0.01) were associated with increase in post-operative event.

Conclusion: Adoption of Da Vinci Xi robot was associated with significant decrease in post-operative complication, length of stay and re-admission rate. Moreover, use of Xi robot in anatomic pulmonary resection was associated with significant decrease in post-operative complication compared to VATS pulmonary resection. Xi Robot may improve outcomes in pulmonary resection.

Table 1. Multiple logistic regression for post-operative event for propensity matched group.

Characteristics	Adjusted OR (95% CI)	p-value
Xi robot case (versus VATS case)	0.51 (0.29, 0.91)	0.02
Age (years)	1.03 (1.00, 1.06)	0.03
Body mass index	1.00 (0.99, 1.02)	0.57
Smoking	2.80 (1.29, 6.09)	0.01
Procedure time (per 10mn)	1.03 (1.00, 1.06)	0.09
Conversion to open surgery	1.89 (0.68, 5.27)	0.22