Poster #29

PROSPECTIVE, MULTICENTER EVALUATION OF GUNSHOT DETECTION TECHNOLOGY ON EMS DISPATCH AND TRANSPORT TIMES

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Introduction: Previous single-center research demonstrated that the use of a commercially available, acoustic gunfire detection, location, and notification system (gunshot detection technology=GDT) was associated with more rapid response and shorter prehospital transport times for gunshot wound (GSW) victims transported by both police and emergency medical systems (EMS). Our goal was to determine if these findings could be validated in a broader study of heterogeneous trauma systems.
Methods: We performed a 7-site, prospective, observational cohort study of adult patients who sustained a GSW in cities using GDT from June 2019 through July 2021. Demographics, dispatch time, response time, transport time, and clinical data were collected for patients transported by EMS. We compared shootings where GDT was utilized (GDT) versus those where it was not (nGDT). Exclusion criteria included incidents that did not occur in the confines of the city, non-EMS transport, and patients with incomplete data. Descriptive statistical analysis, t-test, Mann-Whitney U, $\chi 2$ test, as well as linear and logistic regressions were performed.
Results: A total of 1,348 GSW victims were included, GDT=371 (27.5%), nGDT= 977 (72.5%). Patients located by GDT were more likely to be black than white or Hispanic (89.2%/2.2%/6.7% vs. 67%/19.5%/11.3%, p<0.001). [Table 1] Physiologic parameters were similar between cohorts. Patients located by GDT were less likely to have suffered a severe head injury than patients in the nGDT cohort (5.1% vs. 10.0%, p=0.003). Median time for EMS dispatch to scene was not different between cohorts (GDT = 6 min [IQR, 4-8], nGDT = 6 min [IQR 4-8]. We also found no difference in transport time from scene to hospital between groups (GDT=10min [IQR 6-14], nGDT=10min [IQR 7-10]. Mortality was not significantly different between cohorts (15.9% vs. 17.2%, p=0.36).
Conclusions: This large, multicenter study was unable to demonstrate transport time or survival benefits for gunshot detection technology in trauma systems using EMS transport. Given previous work demonstrating improved prehospital transport times in a system that also utilized police transport, it is possible that there still may be a role of GDT in trauma systems, but this will require ongoing and individualized assessment.

Figure 1: Gunshot Detection Technology impact on EMS dispatch and transport times

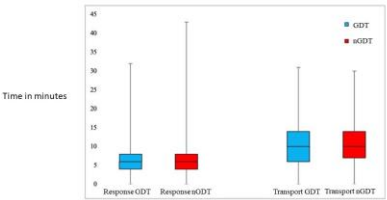

Table 1: Gunshot Detection Technology: demographics, clinical data, & outcomes

	Gunshot Detection Technology (GDT)	No Gunshot Detection Technology (nGDT)	p-value
Age	30.73 (11.04)	31.33 (12.03)	0.40
Male Gender	322 (86.8%)	844 (86.4%)	0.85
Race			<0.001
White	8 (2.2%)	190 (19.5%)	
Black	331(89.2%)	653 (67.0%)	
Hispanic	25 (6.7%)	110 (11.3%)	
Arrival SBP	133 ± 48	117 ± 47	0.17
Arrival HR	83 ± 26	87 ± 34	0.07
ISS	9 [IQR 1-16]	9 [IQR 1-18]	0.11
Severely injured body regions			
Head AIS >4	19 (5.1%)	98 (10.0%)	0.003
Chest AIS >4	31 (8.4%)	107 (11.0%)	0.34
Abdomen AIS >4	33 (8.9%)	88 (9.0%)	0.44
Extremity AIS >4	11 (3.0%)	16 (1.6%)	0.09
EMS dispatch to scene time (minutes)	6 [IQR 4-8]	6 [IQR 4-8]	0.11
EMS transport time to trauma center (minutes)	10 [IQR 6-14]	10 [IQR 7-10]	0.29
Prehospital interventions	19 (5.1%)	79 (8.1%)	0.06
Intubation	29 (7.8%)	60 (6.1%)	0.27
Needle decompression	64 (17.2%)	137 (14.0%)	0.14
Tourniquet	87 (23.5%)	100 (10.2%)	<0.001
Wound packing			
Mortality	59 (15.9%)	168 (17.2%)	0.36

* SBP = systolic blood pressure (mm Hg), HR = heart rate, ISS = injury severity score (scale 1-75, >15 = severe trauma, 75 = fatal), AIS = Abbreviated injury score (scale 1-6, 6 = lethal), EMS = emergency medical services, IQR = interquartile range

Poster #30

A DECADE OF FIREARM INJURIES: HAVE WE IMPROVED?

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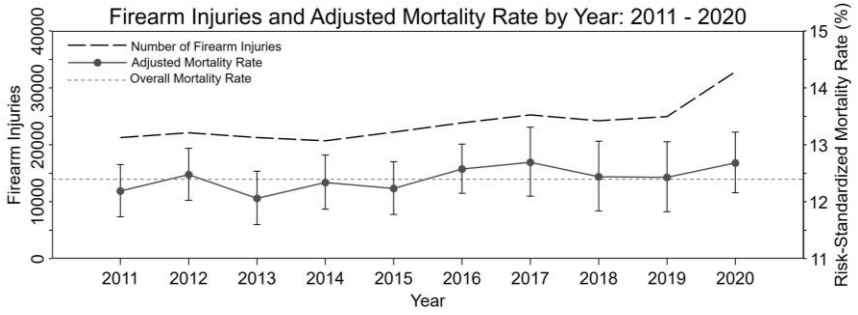
Introduction: Firearms injuries are a growing public health issue, with marked increases coinciding with the onset of the COVID-19 pandemic. This study sought to evaluate temporal trends, hypothesizing that despite a growing number of injuries, mortality would improve over the past decade.
Methods: Patients aged 18 years and older with firearm injuries from 2011-2020 were identified using the National Trauma Data Bank (NTDB). Trauma centers not present the entirety of the study period were excluded to allow for temporal comparison. Joinpoint regression and risk-standardized mortality rates were used to evaluate injury counts and adjusted mortality over time. A subgroup analysis was performed to describe centers with the largest increase in firearm injuries in 2020.
Results: A total of 238,674 patients met inclusion criteria. Firearm injuries increased by 31.1% in 2020, compared to an annual percent change of 2.4% from 2011-2019 (p=0.01). Unadjusted mortality declined by 0.9% from 2011-2020, but after controlling for demographics, injury characteristics and physiology, adjusted mortality increased from 12.2% to 12.7% for the same period. Subset analysis of centers with the largest change in firearm injuries in 2020 found that they were more often level I centers, with higher historical trauma volumes and percentage of firearm injuries ($p < 0.001$).
Conclusions: Firearm injuries pose an increasing burden to our trauma systems, with level I and high-volume centers seeing the largest growth in 2020. Despite centers seeing an increase in firearm injuries, mortality has remained unchanged over the past decade.



Poster #31

BENCHMARKING OF TRAUMA CENTER PERFORMANCE IN BLUNT MULTISYSTEM VERSUS PENETRATING TRUNCAL INJURY

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Introduction: Trauma center (TC) benchmarking seeks to identify and disseminate best practices used at high performing centers. However, the resources and care processes required to achieve optimal outcomes can varies between different mechanisms of injury. We hypothesized that there is poor agreement in TC risk-adjusted performance in the care of patients with blunt multisystem (BMS) and penetrating truncal (PT) injuries.

Methods: This was a retrospective cohort study using data derived from the National Trauma Databank (2017-2018). BMS (blunt trauma with AIS ≥ 3 in two or more body regions) and PT (penetrating trauma with AIS ≥ 3 in neck, chest, or abdomen) groups were defined. Patients with prehospital cardiac arrest or dead-on-arrival (HR=0, SBP=0, GCSmotor=1) were excluded. The cohort was further limited to hospitals treating at least 10 of each patient types over the study period. Mixed-effects multivariable logistic regression was used to calculate the observed-to-expected mortality ratio for each TC in both patient groups, adjusting for patient baseline and injury characteristics. TCs were identified as high, average, or low performers in both BMS and PT patient cohorts based on hospital outlier status derived from the regression models. The concordance between the performance of centers for BMS and PT patients was evaluated using the Kappa statistic.

Results: 93,890 cases were identified across 370 trauma centers, with 73,115 (75%) patients having blunt multisystem injuries and 25,774 (26.39%) having penetrating torso injuries were included. After adjustment, 46 centers were identified to be high performers for penetrating torso injuries, and 150 centers were found to be above performers for blunt multisystem trauma. The concordance between the performance of trauma centers for both injury types was found to be low (Kappa =0.118, p-value = 0.00053).

Conclusion: This study highlights the importance of considering injury type in benchmarking and quality improvement efforts in trauma care. The low concordance between performance for both injury types highlights the need for a more thoughtful approach to initiatives aimed at improving individual center level care.

Performance	Penetrating Truncal		
Multi-system Blunt	High n=46	Average n= 296	Low n=28
High, n=150	29	114	7
Average, n=193	11	165	17
Low, n=27	6	17	4

Poster #32

EPIDEMIOLOGY OF TRAUMATIC INJURY BASED ON TRAUMA QUALITY IMPROVEMENT PROGRAM DATA 2011-2020

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Introduction: Trauma remains a leading cause of morbidity and mortality across all age groups. The objective of this study was to assess inpatient trauma epidemiology, trends, injury mechanisms, severity, and outcomes in the United States over the last decade.
Methods: We merged annual data from the Trauma Quality Improvement Program (TQIP) database from 2011-2020. Analyses consisted of descriptive statistics for overall and yearly frequencies, proportions and means stratified by race/ethnicity, mechanism, and injury severity score (ISS). The statistical significance of trends was assessed with a linear regression term for year.
Results: There were 2,441,780 observations from 2011 to 2020. The mean age of injured patients increased from 44.4 in 2011 to 55.0 in 2020 ($p < 0.001$). The most common injury mechanism was falls (47.9%), followed by motor-vehicle collisions (21.72%), and firearms (8.16%). Throughout the decade, there were increases in falls (49.8% to 53.5%; $p < 0.001$), firearms (8.0% to 11.0%; $p <0.001$), and bicycle collisions (1% to 2.9%; $p <0.001$). The percentage of motor vehicle, motorcycle, and pedestrian-related injuries all decreased ($p <0.001$). Over the study period, 25.5% of patients were classified as severely injured (ISS 16-24), while 15.8% were critically injured (ISS>/=25); the number of patients who were severely or critically injured decreased over time from 47.8% in 2011 to 35.9% in 2020 ($p<0.001$). The number of patients treated at Level 1 trauma centers increased from 55.7% in 2011 to 62.2% in 2020 ($p < 0.001$). The number of patients who died from their injuries decreased from 5.6% in 2011 to 5.1% in 2020 ($p < 0.001$). Pedestrian collisions (9.9%) and firearms (9.1%) had the highest case fatality rates.
Conclusion: TQIP-participating hospitals have seen a dramatic increase in the mean age of the patients they treat, primarily driven by falls in an aging population. Gun violence hospitalizations saw a steady increase over the last decade.

Poster #33

RELEASED INTRACELLULAR CONTENTS MAY CONTRIBUTE TO PRESENTING HYPOCALCEMIA IN TRAUMA

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Introduction: Multiple studies have reported severely injured trauma patients presenting with low pre-transfusion ionized calcium (iCa, normal range 1.2-1.4mM) levels. iCa is necessary for coagulation, cardiac contractility, and vascular tone. The mechanisms by which iCa levels decrease remain unclear. We hypothesized that intracellular contents such as negatively charged phosphate ions and proteins released from damaged tissue bind calcium and contribute to low presenting iCa levels.
Methods: Blood was collected from 5 healthy donors into heparin vacutainer tubes. Liver, lung, kidney, and skeletal muscle from male C57BL/6 mice who had undergone laparotomy were flash frozen and ground with a mortar and pestle. The homogenized tissue was added to heparinized blood in amounts to simulate relative physiologic differences in mass. iStat CG8+ cartridges were used for measurement.
Results: Mean baseline iCa was 1.24mM±0.05. All tissue demonstrated a dose-dependent relationship with iCa. iCa in blood with liver tissue ranged from 1.09mM±0.06 (liver 15mg/mL, $p=0.01$) to 0.91mM±0.04 (60mg/mL, $p<0.001$). Blood with skeletal muscle iCa ranged from 0.94mM±0.03 (62.5mg/mL, $p=0.002$) to 0.62mM±0.07 (250mg/mL, $p<0.001$). Kidney ranged from 1.18mM±0.04 (2mg/mL, p=ns) to 1.13±0.02 (8mg/mL, $p=0.03$). Lung ranged from 1.16mM±0.03 (3mg/mL, p=ns) to 1.11mM±0.02 (12mg/mL, $p=0.03$). K demonstrated dose-dependent increase with all tissue types, with skeletal muscle and liver having the largest impact.
Conclusion: Damaged tissue contributes to presenting hypocalcemia by releasing intracellular contents. Elevated K represents release of intracellular contents. Calcium regulation in trauma is complex and involves renal losses, intracellular movement following cellular activation, and binding by circulating contents released by damaged tissue. Further work is needed to determine relative quantitative contribution of these mechanisms and how they evolve in order to guide optimal calcium management therapy.

Poster #34

TIME TO SURGERY STABILIZATION OF RIB FRACTURES: DOES IT IMPACT OUTCOMES?

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Introduction: Rib fractures are common, morbid and potentially lethal. Intuitively, if interventions to mitigate downstream effects of rib fractures can be implemented early, likelihood of developing these complications should be reduced. Surgical stabilization of rib fractures (SSRF) is one therapeutic intervention shown to be useful for mitigating complications of these common fractures. Our aim was to investigate the association between time to SSRF and complications among patients with isolated rib fractures undergoing SSRF.

Methods: The 2013-2019 ACS TQIP database was queried to identify those >18 with isolated thoracic injury undergoing SSRF. Patients were divided into three groups: SSRF≤2d, SSRF>2d but ≤3d, and SSRF >3d. Poisson regression, adjusting for demographic and clinical covariates, was used to evaluate the association between time to SSRF and the primary endpoint, in-hospital complications. Quantile regression was used to evaluate the effects of time to SSRF on the secondary endpoints, hospital and ICU length of stay (LOS).

Results: Out of 2,185 patients, 918(42%) underwent SSRF ≤2d, 432(20%) underwent SSRF>2d but ≤3d, and 835(38%) underwent SSRF >3d. Hemothorax was more common among patient undergoing SSRF >3d, otherwise all demographic and clinical variables were similar between groups. After adjusting for potential confounding, SSRF >3d was associated a with three-fold risk of composite in-hospital complications [adjusted incidence rate ratio (IRR): 3.15, 95% confidence interval (CI): (1.76-5.62); p<0.001], a 4-day increase in total hospital LOS [change in median LOS (95%CI):4.09(3.69-4.49), p<0.001], and a nearly 2-day increase in median ICU LOS [change in median LOS (95%CI): 1.70 (1.32-2.08), p<0.001] compared to SSRF≤2d.

Conclusion: Among patients undergoing SSRF in TQIP, earlier SSRF is associated with less in-hospital complications and shorter hospital stays. Standardization of time to SSRF as a trauma quality metric should be considered.

Poster #35

SEVERE ISOLATED CHEST TRAUMA AND PULMONARY CONTUSION: A CONTROVERSIAL CONTRAINDICATION TO RIB FIXATION

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Introduction: Pulmonary contusion (PC) is currently considered a relative contraindication to surgical stabilization of rib fractures (SSRF), but the data underlying this practice is scant. This study aimed to compare outcomes in patients undergoing SSRF vs. non-operative management (NOM) in PC.

Methods: The ACS-TQIP 2017-2020 was queried to identify patients with PC, three or more rib fractures, and with or without flail chest. Patients with severe extra-thoracic injuries were excluded. The outcomes evaluated were in-hospital mortality, ventilator-associated pneumonia (VAP), hospital and intensive care unit (ICU) length of stay (LOS), unplanned ICU admission, ventilator days, and tracheostomy rate. Propensity score matching (PSM) was performed to account for patient demographics, injury- and hospital-related characteristics. After matching, patients undergoing SSRF vs. NOM were compared. A subgroup analysis stratifying patients into major and minor PC was performed.

Results: Of the 48,757 patients included in the analysis, 3,271 (6.7%) underwent SSRF. Following PSM, 2,448 matched pairs of patients with PC were analyzed. SSRF was associated with lower in-hospital mortality (1.9% vs. 5.1%, p<.001), higher rates of unplanned ICU admission (6.7% vs. 4.2%, p<.001), and tracheostomy (10.7% vs. 8.4%, p=.006) compared to NOM. In the subgroup analyses, SSRF was associated with reduced mortality compared to NOM. Regardless of PC severity, SSRF was associated with longer hospital LOS, ICU LOS, and prolonged ventilator days compared to the NOM cohort (Table 1).

Conclusion: In patients with severe chest wall injury and PC, SSRF is associated with lower mortality despite PC severity, but at the expense of longer ICU and hospital stays. These findings indicate that SSRF may benefit patients with PC.

Table 1. Outcomes following propensity score matching of the non-operative versus SSRF treatment group according to pulmonary contusion severity.

Outcomes	All-severity pulmonary contusion (n=2,448 pairs)			Minor pulmonary contusion (n=673 pairs)			Major pulmonary contusion (n=590 pairs)		
In-hospital outcomes	Non-operative	SSRF	p-value	Non-operative	SSRF	p-value	Non-operative	SSRF	p-value
Mortality	126 (5.1%)	47 (1.9%)	**<0.001**	29 (4.3%)	11 (1.6%)	**0.004**	38 (6.4%)	15 (2.5%)	**0.001**
Ventilator Associated Pneumonia	72 (2.9%)	91 (3.7%)	0.13	14 (2.1%)	17 (2.5%)	0.59	25 (4.2%)	26 (4.4%)	0.89
Tracheostomy	205 (8.4%)	262 (10.7%)	**0.006**	33 (4.9%)	49 (7.3%)	0.068	59 (10.0%)	80 (13.6%)	0.058
Hospital length of stay	6 (2-12)	11 (6-17)	**<0.001**	6 (2-11)	10 (6-16)	**<0.001**	7 (3-14)	12 (7-19)	**<0.001**
Unplanned ICU admission	104 (4.2%)	165 (6.7%)	**<0.001**	34 (5.1%)	48 (7.1%)	0.11	26 (4.4%)	38 (6.4%)	0.12
ICU length of stay	3 (0-8)	6 (3-11)	**<0.001**	2 (0-6)	5 (2-9)	**<0.001**	3 (0-8)	7 (3-13)	**<0.001**
Ventilator Days	0 (0-3)	0 (0-6)	**<0.001**	0 (0-0)	0 (0-4)	**<0.001**	0 (0-4)	2 (0-8)	**<0.001**

Patients matched by age, sex, Body Mass Index (BMI), Injury Severity Score (ISS), Glasgow Coma Scale (GCS), flail chest, lung laceration, pneumothorax, hemothorax, and American College of Surgeons (ACS) designated level. Data are presented as median (IQR) for continuous measures, and n (%) for categorical measures. SSRF, Surgical stabilization of rib fractures; ICU, Intensive Care Unit.

Poster #36

PLANNED AND UNPLANNED REOPERATIONS AFTER THORACOTOMY FOR PENETRATING TRAUMA. LESSONS LEARNED AFTER 15 YEARS.

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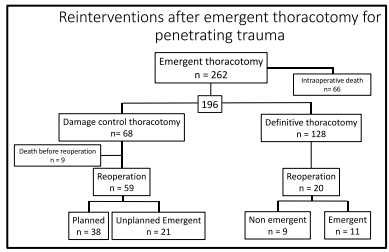
Introduction: Specific information regarding reoperation after trauma thoracotomies (TT) is scarce. We analyzed the causes, treatment, and outcomes in patients managed in a high-complexity hospital in an upper-middle-income country, searching for strategies to reduce **unplanned reoperations** (UR) after penetrating chest trauma (PTT).
Methods: Patients ≥15 years treated with a TT for PTT between 2006 and 2020 were retrospectively reviewed. Trauma characteristics, surgical treatment, causes of reoperation, and outcomes were registered.
Results: Two-hundred-sixty-two TTs were performed. Intraoperative deaths occurred in 66 patients leaving 196 cases for analysis. Median (IQR) age was 26 (20 - 35) years; 95.9% were male. Gunshot wounds occurred in 59.6%. Resuscitative thoracotomy was required in 40 cases (20.1%), aortic occlusion in 55 (28.1%), and damage control thoracotomy (DCT) in 68 (34.7%), A "definitive" thoracotomy (DT) was performed in 128 (65.3%).
Nine DCT patients died before a reoperation. Seventy-nine subjects (40.3%) were reoperated. Twenty after a DT and 59 after a DCT. Thirty-two emergent UR were performed. Eleven after DT and 21 after a DCT. Nine DTs and 38 DCTs had non-emergent reoperations.
The most frequent causes of emergent UR were bleeding due to coagulopathy in 9 patients, surgical bleeding in 7, and missed injuries in 6 patients.
Planned reoperations for definitive repair included closure of the thoracic incision in 51 cases, unpacking (thoracic wall in 51, lung in 34, perivascular in 17), deferred major lung resections (four lobectomies, three pneumonectomies), and three vascular reconstructions.
DCT patients who survived until a scheduled reoperation had a similar mortality to non-DCT (8.5%). Mortality after an emergent (UR) was higher, (50%).
Conclusion: Technical errors leading to post-op bleeding were the most common cause of UR. Timely bleeding control, an a more systematic/selective post-op completion diagnostic work-up (CT angio, endoscopy, and/or angio-embolization) may reduce the need for emergent reoperations and their negative impact.



Poster #37

IMPACT OF LOW-PRESSURE NEGATIVE SUCTION WITH INTERCOSTAL TUBE DRAINAGE IN PATIENTS WITH THORACIC TRAUMA: A RANDOMISED CONTROLLED TRIAL

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Introduction: Thoracic trauma frequently includes a pneumothorax, haemothorax, or mixed hemopneumothorax, which may necessitate an intercostal drainage (ICD) for evacuation of air and fluid to improve breathing and circulatory functions. However, thoracic trauma-related problems such persistent /constant air leak, retained haemothorax, and empyema still happen in some patients even with ICDs. This study was designed to evaluate the benefits of using negative pleural suction with ICD tube in patients with thoracic trauma in terms of the duration of ICD, length of hospital stays, incidence of complications of thoracic trauma and need for additional interventions.

Methods: Patients with thoracic trauma who underwent tube thoracostomy for pneumothorax, haemothorax, or hemopneumothorax were randomised into two groups: Group I in which under water seal drainage system was connected to a low-pressure negative suction (-20 cm H_2O) and Group II where no suction was applied. Patients who required mechanical ventilation or emergency surgery at the time of admission to the emergency department (ED), patients with a past history of chronic pulmonary diseases and patients with severe traumatic brain injury were excluded from the study. Duration of ICD, length of hospital stays, the incidence of complications like recurrent pneumothorax, retained haemothorax, persistent air leak, etc and secondary interventions such as reinsertion of ICD, intrapleural streptokinase instillation (IPSI), video assisted thoracoscopic surgery (VATS) and thoracotomy were compared. This study was registered with Clinical Trial Registry of India (CTRI) (REF/2020/11/038403).

Results: A total of 654 patients with thoracic trauma who required ICD were assessed for their eligibility and 584 were excluded. Finally, 70 patients were randomised into two groups (35 in each group). Both the groups were comparable in terms of demographics, mechanism of injuries, primary survey findings etc. There were no statistically significant differences between both the groups in terms of duration of ICD (median of 4 days in each group; $p = 0.82$), hospital stay ($p = 0.47$) and ICD or injury related complications.

Conclusions: The use of negative pleural suction with under-water seal drainage system did not show any advantage in patients with traumatic pneumothorax, haemothorax, or hemopneumothorax in terms of duration of ICD, hospital stays, and other complications. A multicentre study with large sample size is required to reach a consensus.

Poster #38

A TALE OF SIZE IN TRAUMA: A MULTICENTER ANALYSIS OF SUREON PLACED SMALL-BORE THORACOSTOMY TUBES

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Introduction: Surgical dogma that larger chest tubes are better for thoracic drainage has been challenged in recent years with the introduction of surgeon-placed percutaneous catheters. The purpose of the study is to evaluate outcomes between small-bore (SB) and large-bore (LB) chest tubes with the hypothesis that SB catheters will have comparable complication rates including retained HTX and need for VATS.
Methods: A retrospective review was performed on all patients with a thoracostomy tube for traumatic PTX or HTX between 7/1/21-6/30/22 at 3 level-1 trauma centers. Exclusion criteria included ISS 75, tube placement at an outside hospital, in the operating room, or by a radiologist. SB catheters were defined as ≤14 Fr and LB tubes were ≥24 Fr. All other sizes were excluded. SB and LB chest tubes were compared.
Results: A total of 621 patients were included over the 24-month study period with 264 (42.5%) in the SB group and 357 (57.5%) in the LB group. Patients in the SB group were older (50.7 vs 43.6 years, $p<0.001$), had a higher rate of blunt injury (91.3% vs 73.1%, $p<0.001$), and a lower ISS (19.0 vs 26.5, $p<0.001$). The SB group had higher rates of COPD (8.7% vs 4.2%, $p=0.020$) and tobacco use (34.5% vs 21.0%, $p<0.001$). The SB group were more likely to have PTX (71.6% vs 43.1%, $p<0.001$) and less likely to have HTX (11.4% vs 17.4%, $p=0.011$) and HPTX (12.9% vs 37.8%, $p<0.001$) as an indication. The rates of retained HTX (3.8% vs 13.2%, $p<0.001$) and VATS (0.4% vs 6.7%, $p<0.001$) were lower in the SB group. No differences were seen in rates of ARDS, VAP, empyema, and unplanned intubation between the groups. Hospital LOS (6 vs 8 days, $p=0.005$) was shorter and mortality was lower in the SB group (8.0% vs 19.1%, $p<0.001$). Adjusted analysis identified that SB tubes were protective from retained HTX and mortality. A subgroup analysis was performed on HTX/HPTX, significant difference persisted in this higher risk group and adjusted analysis showed that SB chest tubes did not predict mortality.
Conclusion: SB catheters for traumatic PTX and HTX are safe and effective without increasing the rate of VATS for retained HTX. These catheters are an effective alternative to large bore drains.