

John MacArthur Trauma Competition

Moderator: Kevin Schuster, MD, FACS, Professor of Surgery, Yale School of Medicine
Chair, CT Committee on Trauma

Judges: Connecticut Committee on Trauma

Jeremy Fridling, MD	University of Connecticut School of Medicine	Bilateral versus Unilateral Arterial Embolization in Pelvic Trauma: A Multicenter Retrospective Cohort Study
Austin McIntosh, MD, PGY1	Saint Mary's Hospital	Comparison of Mortality Rates Between EMS and Private ED Drop-Offs: A Single Study at a Level 2 Trauma Center
Pawan Mathew, MD	Yale School of Medicine	Cell Phone Measured Population Mobility and Interactions as a Predictor of Trauma Volume and Trauma Center Need
Nicole Taylor, MD	Saint Mary's Hospital	Drunk, High, or Die: The Effect of Alcohol and Delta-9-tetrahydrocannabinol Intoxication on Trauma Patient Outcomes
Nicholas Estes, MD	Saint Mary's Hospital	Social Vulnerability and Injury Severity of Geriatric Patients Presenting to the ED as a Trauma Following a Ground-Level Fall at a Single Community Hospital
Meagan Kozhimala, MD, ScM	Waterbury Hospital	"Head Injury Alerts: A Retrospective Study on the Risk of Intracranial Bleed among Elderly Patients Presenting after Falls while on Anticoagulation vs Antiplatelet Therapy"
York Lin Chew, MD	Saint Mary's Hospital	Incidences of Delayed Intracranial Bleed in 30-days in Patients Who Are on Anticoagulation or Antiplatelet After Sustaining a Fall. - 3-Year Data
Subigya Parajuli, MD	Saint Mary's Hospital	Outcomes of Emergent Thoracotomy in a Single US Level II Trauma Center

Bilateral versus Unilateral Arterial Embolization in Pelvic Trauma: A Multicenter Retrospective Cohort Study

Jeremy Fridling, MD

University of Connecticut / Hartford Hospital

Introduction: Traumatic hemorrhage from pelvic injury presents a significant challenge and pelvic artery embolization (PAE) is often utilized for bleeding control. However, the optimal approach remains unclear whether unilateral or bilateral embolization is preferred. We hypothesized that there would be no difference in 7-day mortality in patients undergoing unilateral vs. bilateral PAE for pelvic trauma.

Methods: A multicenter retrospective review was conducted on adult patients who underwent PAE for pelvic trauma at six New England trauma centers between 2018 and 2022. Patients were included if they were found to have unilateral hemorrhage or no hemorrhage on the initial pelvic angiogram. Patients were excluded due to bilateral hemorrhage or pre-hospital cardiac arrest. Next, patients were categorized into those who received Unilateral PAE vs. Bilateral PAE. The primary outcome measured was 7-day mortality. Secondary outcomes included complications and re-interventions after the index PAE. A multivariate analysis was conducted to identify predictors of 7-day mortality.

Results: Of the 117 patients included in the study (62% male, 75% White, 90% with blunt injuries, and a median age of 60 years [IQR: 50-75]), 63 (54%) had unilateral arterial hemorrhage, and 54 (46%) had no arterial hemorrhage on angiography. 68 patients underwent Unilateral PAE and 49 patients underwent Bilateral PAE. There were no significant differences in age, sex, race, or shock index between the Unilateral and Bilateral PAE groups. However, the median injury severity score (ISS) was significantly higher in the Bilateral PAE group (29 [19-44] vs. 21 [11-30]; $p = 0.002$). There were no significant differences between the two groups in terms of gluteal muscle necrosis or venous thromboembolism, but the incidence of acute kidney injury was higher in the Bilateral PAE group (29% vs. 13%, $p = 0.039$). The groups were also similar regarding the need for repeat embolization, pelvic packing, and the number of packed red blood cells transfused. There was no significant difference in 7-day mortality between the groups (10% vs. 15%, $p = 0.454$). Logistic regression analysis identified ISS (OR = 1.21, 95% CI: 1.06–1.37, $p = 0.004$) and age (OR = 1.17, 95% CI: 1.07–1.29, $p = 0.001$) as significant predictors of 7-day mortality; however, no significant association was found between Bilateral versus Unilateral PAE and 7-day mortality.

Conclusion: Although bilateral PAE may be associated with a higher incidence of acute kidney injury, unilateral and bilateral pelvic embolization for trauma has similar efficacy and 7-day mortality in this multicenter retrospective review. Our results suggest that unilateral as opposed to bilateral PAE may be the most appropriate management.

Post-Procedural Outcomes of Patients Undergoing Unilateral vs. Bilateral PAE				
	Total (n=117)	Unilateral PAE (n=68)	Bilateral PAE (n=49)	p-value
No additional procedures for pelvic hemorrhage required	95 (81.2)	58 (85.3)	37 (75.5)	0.181
Repeat embolization for control of hemorrhage	2 (1.7)	1 (1.5)	1 (2.0)	1.000
Pelvic packing for control of hemorrhage	8 (6.8)	3 (4.4)	5 (10.2)	0.277
Additional exploratory laparotomy for control of hemorrhage	17 (14.5)	7 (10.3)	10 (20.4)	0.126
Gluteal muscle necrosis	2 (1.7)	1 (1.5)	1 (2.0)	1.000
Extremity ischemia requiring intervention	1 (0.9)	1 (1.5)	0 (0.0)	1.000
DVT or PE	11 (9.4)	3 (4.4)	8 (16.3)	0.050
Acute kidney injury	23 (19.7)	9 (13.2)	14 (28.6)	0.039
Packed red blood cells transfused in first 24 hours (mL)	1000 [500-2375]	725 [350-2183]	1503 [615-2750]	0.112
7-day mortality from admission	15 (12.9)	10 (14.9)	5 (10.2)	0.454

PAE, pelvic arterial embolization; DVT, deep vein thrombosis; PE, pulmonary embolism.
Values are presented as median [25th-75th percentiles] or number (percentage), where applicable.

Comparison of Mortality Rates Between EMS and Private ED Drop-Offs: A Single Study at a Level 2 Trauma Center

McIntosh, A., MD¹; Tapley, R., MSN, RN¹; & Biggs, C., MD, FACS¹

1 - Stanley Dudrick Department of Surgery; Saint Mary's Hospital, Waterbury, Connecticut

Background: Saint Mary's Hospital, a community-based, ACS-verified Level 2 trauma center in Connecticut, has identified a significant disparity in mortality rates between trauma patients transported by Emergency Medical Services (EMS) and those arriving via private emergency department (ED) drop-offs. This disparity may be attributed to differences in pre-hospital care quality, transport efficiency, and initial management. Understanding these differences is crucial for informing targeted improvements in trauma care protocols to enhance patient outcomes and ensure equitable care.

Methods: We performed a retrospective cohort study at Saint Mary's Hospital from June 2014 to June 2024, analyzing 942 patients—781 transported by EMS and 161 via private ED drop-off. Excluded from the study were 79 patients under 17 years old or deceased upon arrival. Data on demographic characteristics, injury severity score (ISS), treatment, and outcomes were examined. Mortality rates were compared using Chi-square and t-tests, while multivariate logistic regression adjusted for confounders.

Results: The mortality rate for patients transported by EMS was 22.4% (175/781), significantly higher than the 5.6% (9/161) observed for private ED drop-offs ($p < 0.01$). EMS patients had a higher average ISS (21.2 vs. 18.5, $p < 0.01$). After adjusting for ISS, age, and gender, patients arriving via private ED drop-off had a significantly lower risk of mortality (adjusted OR 1.52, 95% CI 1.10-2.09).

Conclusion: The elevated mortality rate among EMS-transported trauma patients underscores the need for targeted interventions such as enhanced paramedic training and improved triage processes. Long-term efforts should include public education on the risks of self-transportation and enhancements to pre-hospital care systems. To address these disparities, further research is needed, particularly focusing on standardizing EMS protocols and integrating telemedicine. These measures will not only impact local practices but also inform broader regional and national trauma care policies.

Cell Phone Measured Population Mobility and Interactions as a Predictor of Trauma Volume and Trauma Center

Pawan Mathew, MD
Yale School of Medicine

We sought to understand whether cellular telephone activity in commercial spaces as a marker for population mobility would be associated with trauma admission volumes. We took advantage of cellular telephone data made available during the COVID pandemic along with the large swings in population activity to investigate this possibility.

Study Design: Trauma registry data from six level I trauma centers (TC) in New England were used to identify the number and nature of daily trauma admissions (TA) from January 20th 2020 to August 24th 2021. Center setting ranged from rural to urban. The Device Exposure Index (DEX) is a standardized measure of daily cellular telephone interactions with other cellular telephones within a county. Median, standard deviation and range for daily values of the DEX and number of TA were calculated. Spearman's rank correlation was calculated for the first wave of Covid-19 from March 2020 to May 2020 and for June 2020 to December 2020. Center-specific Poisson models were created to control for seasonality.

Results: During the study period, daily TA ranged from 13 to 77 (median 42) across all participating TC and substantial between center differences in daily TA volumes were observed (TC 1 median 4 vs. TC 2 median 10, p<0.001). After declaration of a public health emergency (PHE) on March 10, 2020, both the county DEX and overall number of TA's declined sharply (80.5% and 70.5% respectively), both reaching their lowest levels at the end of March. Daily TA recovered to PHE levels by July 2020, whereas the DEX recovered more slowly, reaching pre-PHE levels in Spring of 2021. The daily DEX index was moderately correlated with TA from March to May of 2020 for five centers serving unique catchment areas, Spearman's rho: ranging from 0.22 to 0.47 (p<0.05) (Table 1). The sixth center where the catchment area overlaps with those of multiple level I centers had much lower correlation $\rho = 0.06$ (p=0.59) (Table 1). After controlling for seasonality, DEX vs. TA relationships remained significant across the same five centers (Table 2).

Conclusion: County-level daily DEX scores correlated significantly with TC-specific numbers of daily TA at 5 of 6 TC during the first three months after the PHE declaration. From June 2020 onward, TA quickly recovered to pre-PHE levels while DEX scores recovered more slowly. Similarity in these larger and longer-term trends may allow for trauma system planning. Additional research is needed; however, use of cellular telephone activity and interactions may be a valuable adjunct for trauma system planning.

Table 1. Spearman's rho correlation coefficient

Center	3/1/20-5/31/20		6/1-12/31/20		1/1/21-8/24/21	
	Spearman's rho	p-value	Spearman's rho	p-value	Spearman's rho	p-value
1	0.22	0.041	-0.01	0.843	0.29	<0.001
2	0.44	<0.001	0.02	0.782	0.23	<0.001
3	0.06	0.594	0.16	0.016	0.14	0.035
4	0.36	<0.001	0.19	0.004	0.27	<0.001
5	0.27	0.001	0.11	0.119	0.29	<0.001
6	0.47	<0.001	0.12	0.072	0.24	<0.001

Table 2. Center specific Poisson regression adjusted for season, high DEX as reference level

Center	Incidence Rate Ratio (IRR)	95 % Confidence Interval IRR		p-value
1				
Dex				
low	0.80	0.70	0.90	<0.001
medium	0.82	0.72	0.93	0.003
2				
Dex				
low	0.88	0.80	0.96	0.004
medium	0.94	0.87	1.03	0.177
3				
Dex				
low	0.94	0.86	1.03	0.172
medium	1.01	0.92	1.11	0.774
4				
Dex				
low	0.82	0.75	0.88	<0.001
medium	0.89	0.83	0.97	0.006
5				
Dex				
low	0.79	0.71	0.89	<0.001
medium	0.95	0.85	1.06	0.384
6				
Dex				
low	0.84	0.78	0.90	<0.001
medium	0.90	0.84	0.97	0.005

Drunk, High, or Die: The Effect of Alcohol and Delta-9-tetrahydrocannabinol Intoxication on Trauma Patient Outcomes

Nicole Taylor MD, Tian Sheng Ng MD, Carina Biggs MD FACS

The Stanley J Dudrick Department of Surgery, Saint Mary's Hospital, Waterbury, Connecticut

Introduction: Toxicology screening in trauma patients has become a requirement in many institutions due to the vast number of intoxicated patients that sustain traumatic injuries each year. Most commonly, these patients test positive for alcohol, marijuana or both. Previous studies have investigated the mortality of traumatic brain injury patients that test positive for alcohol and marijuana however there is little research within the United States that analyzes general trauma patient outcomes. We sought to investigate the impact of alcohol (ETOH), Delta-9-tetrahydrocannabinol (THC) and co-intoxication on trauma patient characteristics and outcomes in a single-institution Level II Trauma Center over a five-year period.

Methods: The authors performed a retrospective single-institution chart review of 4309 trauma patients from 2018-2023. Only patients with a recorded urine drug toxicology and alcohol screening were included (n=1902). The patients were divided into four groups: ETOH-/THC-, ETOH+/THC-, ETOH-/THC+, ETOH+/THC+. Patient outcomes such as injury severity score, age, mortality, ICU admission, total length of stay, GCS and injury mechanism were investigated. Data was analyzed using ANOVA and Chi-Square analysis.

Results: There were 1902 trauma patients with completed urine and alcohol toxicology screening from 2018-2023, 40.0% ETOH-/THC-, 29.7% ETOH+/THC-, 15.2% ETOH-/THC+ and 15.1% ETOH+/THC+. Patients testing positive for ETOH, THC or both were significantly younger than patients with negative urine toxicology. Additionally, patients testing positive for THC (ETOH-/THC+ and ETOH+/THC+) were significantly younger than those who tested solely positive for alcohol. Patients in the ETOH+/THC- and ETOH+/THC+ groups presented with a lower GCS than the other groups. In regards to injury mechanism, ETOH-/THC- patients were more likely to present after a fall, and ETOH-/THC+ patients were less likely to present after an assault. There was no significant difference in injury severity, length of stay, ICU admission or mortality between the groups.

Conclusions: As alcohol and marijuana remain legal for use in Connecticut we have found that the number of positive toxicology trauma patients is substantial. Although there were significant differences in the age and injury mechanisms of trauma patients with positive toxicology, there were no significant differences in survival or hospital-based outcomes. This begs the question, should toxicology testing continue to be a requirement for our trauma patients? Limitations of our study include the number of patients removed from the study as they did not undergo urine toxicology testing due to death or disposition from the emergency department prior to sampling.

Social Vulnerability and Injury Severity of Geriatric Patients Presenting to the ED as a Trauma Following a Ground-Level Fall at a Single Community Hospital

Nicholas Estes MD, Faith Adekunle BS, Carina Biggs MD

Introduction: There is a longstanding history of falls affecting the geriatric population in our country. Our study is unique in that we used the Social Vulnerability Index (SVI) to understand the influence of social factors on falls in the geriatric community. This index, which uses US Census data to determine the vulnerability of communities based on four variables, allowed us to examine the social components surrounding these falls. We focused on housing type and transportation, household characteristics, race and minority status, and socioeconomic status. Our goal was to understand how SVI accounts for differences in length of stay and injury severity, which we measured via their disposition from the ED.

Methods: We conducted a retrospective chart review of geriatric patients presenting as trauma following a ground-level fall at a single community hospital during the last five years. We utilized patient charts to identify their address and found their census tract, which was then matched with SVI. We then compared the SVI for patients who presented during this period and their length of stay and degree of injury. Data were analyzed using logistic regression, linear regression, and an ANOVA.

Results: We identified 1674 geriatric patients who presented as traumas following a groundlevel fall, with a breakdown of 61.4% female and 38.6% male. Additionally, the following was a breakdown by race of the patients: 92.9% white, 4.4% African American, 0.4% Asian, 0.1 Native American, and 2.2% of unknown/unspecified race. When evaluating the severity of injuries, we had the following findings: no significant difference between races and their length of stay following the fall; no significant difference between race and the severity of injury following presentation to the ED. We also tested the SVI between races that presented to the ED, and we found a significant difference between the Asian demographic presenting after ground-level fall. The data showed that, on average, the Asian population had a significantly lower SVI score than other races presenting after a ground-level fall ($p < 0.001$). Otherwise, there was no significant difference in the SVI score among other races that presented to the ED.

Conclusions: Our study reveals a significant difference in geriatric patients of the Asian race presenting to the ED following a ground-level fall. These patients had a lower SVI compared to patients of other races, indicating a lower degree of social vulnerability. This finding underscores the need for further research to understand the outcomes for these patients, particularly given the small population of Asian patients included in the study.

Head Injury Alerts: A Retrospective Study on the risk of intracranial bleed among elderly patients presenting after falls while on anticoagulation vs antiplatelet therapy”

Meagan Kozhimala MD, Jacob Silverman MD, Pei Kwok MD, Paul Fata MD, Austin Thompson MD, Yousuf Uddin MD, Dayna Failla, Peter Zdankiewicz MD
Waterbury Hospital

Introduction: Trauma is the fifth leading cause of death amongst the elderly population, those > 65 years old. It has been shown that having a tiered system for trauma activation improves efficiency and patient outcomes. Our institution implemented a 3-tier trauma activation system in 2017, for which the third tier involved “head injury alerts” for patients > 65 y.o., on anticoagulation or antiplatelet therapy who had a head strike. The number of these alerts have steadily increased over the years due to the aging population. The activation requires an Emergency Department attending and surgical resident at the bedside within 5 minutes and CT scan of head within 15 minutes of arrival unless deemed unsafe or unnecessary by the provider. This study sought to evaluate the relative rate of head bleeds for patients > 65 y.o on antiplatelet therapy relative to those on anticoagulation following headstrike.

Method(s): A retrospective chart review was performed on all patients from 2017 to 2023 who presented as a head injury alert in the emergency department and were evaluated by the surgery team. Patients were between 65 to 110 years old, on anticoagulation or antiplatelet therapy and had a head strike after a fall. Information on demographics, medication, presenting signs and symptoms, imaging results, mechanism of injury, and patient outcome were collected. All patient information was collected in a single, one-time chart review and de-identified.

Results: A total of 1,190 patients presented to the Emergency Department for a head injury alert between 2017 and 2023. Of these 46.3% (n=551) were Male and 53.7% (n=639) were Female (p=0.72). Of all patients who presented, only 5.7% (n=67) were found to have head bleeds. This composed 5.3% (n=29) of the Male cohort and 5.9% (n=38) of the female cohort. When comparing anticoagulation versus antiplatelet therapy for all ages, there was a significant difference with antiplatelet therapy more likely to result in a head bleed compared to anticoagulation therapy (OR 2.09 (95% CI 1.19-3.67, p=0.01).

Conclusion(s): Overall, there were more female patients who fell as well as developed head bleeds which matched prior studies data on falls in the elderly population, though this did not reach significance in this study . Patients were significantly more likely to develop head bleeds after a fall when on antiplatelet medication compared to those on anticoagulation medication. Limitations include this being a retrospective study which excluded patient on multiple antiplatelet/anticoagulant or a combination of antiplatelet and anticoagulation.

	Total				Total
	M	M	F	F	
	1	0	1	0	2
Aggrenox	0	1	0	1	2
Brilinta	0	5	3	3	11
Coumadin	3	65	3	52	123
Effient	1	4	0	0	5
Eliquis	9	194	7	188	398
Heparin	0	1	0	0	1
Lovenox	0	1	1	1	3
Plavix	6	74	8	112	200
Pradaxa	1	4	0	11	16
unknown	1	15	0	11	27
Warfarin	0	2	0	2	4
Xarelto	8	156	16	220	400
Total	29	522	38	601	1190

Incidences of Delayed Intracranial Bleed in 30-days in Patients Who Are on Anticoagulation or Antiplatelet After Sustaining a Fall. - 3-Year Data

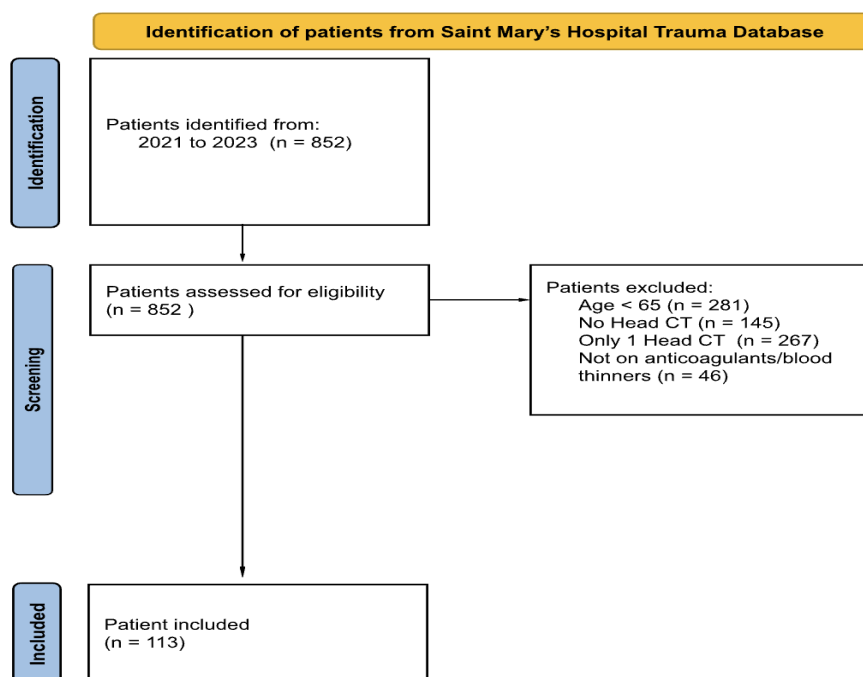
York Lin, Chew MD, Crimsun Rose Kessler MS, Christian Leonard Vitug MS, Eunice Grace Villegas MS, Orlando Perdomo Perez MS, Stanley Seville Chan MS, Amanda Jane Loya PA-S, Roxanne Tapley, RN BSN, Nicholas Druar MD, MPH, Carina Biggs MD, FACS
Saint Mary's Hospital

Introduction: Delayed intracranial hemorrhage (dICH) after an initial CT scan is a rare but recognized complication in elderly patients on anticoagulants or antiplatelets who sustained head trauma from a fall incident. However, the exact risk is yet to be determined due to the limited data available on the incidence of dICH. Therefore, there is a lack of consensus in current major guidelines on the role of repeat head CT in this specific group of patients, with mostly institutional-based protocol as the guide for repeating head CT. We aim to provide data on the incidence of dICH in this group of patients and we hypothesize that most patients will not have new dICH that would require further surgical intervention.

Method(s): We retrospectively reviewed patients receiving anticoagulant and antiplatelet therapy who sustained a fall and presented to a level II trauma center over three years, from November 1st, 2020, to October 31st, 2023. Patients were evaluated for the mechanism of injury, heights of fall, alcohol and drug involvement, Glasgow Coma Score (GCS), Injury Severity Score (ISS), age, gender, types of anticoagulation or antiplatelet, and initial and subsequent (within 30 days) Head CT scans. Our inclusion criteria include patients with documented use of anticoagulant and antiplatelet (e.g. Warfarin, Eliquis, Xarelto, Aspirin, Plavix) for any medical conditions at the time of their fall, age ≥ 65 . Exclusion criteria include severe trauma or mechanism of injuries that is non-fall-related such as assault. Severe coagulopathy or bleeding disorders. Known intracranial abnormalities such as aneurysm and tumor. Documented missed anticoagulation use during the time of the injury.

Results: 852 patients sustained a fall in a total of 3 years; 113 patients fulfilled the study criteria. The overall mean age is 80.3, 95% Confidence Interval (CI) (78.1-81.8) with a female predominance of 61 individuals (54.5%) vs male 51 (45.5%). Mean GCS was 14.5, 95% CI (12.3-14.8). 4.5% of the patients tested positive for alcohol, 67.9% of the patients tested negative, and 17.6% were not tested. 2 out of 113 patients were found to have delayed head bleed confirmed on subsequent head CT with the odds ratio 0.028 with 95% CI (0.008-0.09), $P < 0.01$.

Conclusions: Our data indicates a low incidence of delayed intracranial hemorrhage after an initial negative head CT scan in patients who sustained a fall in our community setting. This finding does not justify the routine use of repeat head CT after a negative initial result. The use of repeating head CT in this setting is becoming controversial, highlighting the need for more extensive national data.



Outcomes of Emergent Thoracotomy in a Single US Level II Trauma Center

Subigya Parajuli, MD
Saint Mary's Hospital

Background: Resuscitative thoracotomy (RT) is performed as a salvage manoeuvre for selected patients with trauma. However, there is some debate about its outcomes and the concomitant risks of blood borne pathogen exposure to the providers. We aim to present a single centre experience of RT at a US level II trauma centre.

Methods: This was a retrospective analysis of the trauma registry at our centre. All the trauma patients who underwent resuscitative thoracotomy in the emergency department between 2013 and 2023 at St. Mary's Hospital were included. Frequency and percentages were used to describe the categorical variables. Mean was used to describe continuous variables.

Results: During the study interval, 15 RT were performed. Although an overall decrease in the rate of RT was observed in the last five years (34% between 2019-2023) compared to the previous five (46% between 2013-2018). Most of the patients were males (n=12), with penetrating injury being the most common mechanism (67%). The mean ISS was 43, with 53% of patients with some signs of life on arrival. 53% of patients had only intrathoracic injury. 87% of the patients got intubated in the trauma bay and 67% received MTP. 53% of patients had some cardiac repair with 27% having bilateral thoracostomy in the trauma bay. Our overall survival was 20%. The mean ISS among survivors was 27 and 67% had cardiac repair done in the ED among survivors. We did not have any needlestick injury in any of these procedures.

Conclusion: Safely performed RT is a great armamentarium in the trauma bay that saves lives.