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Original Article

Patterns and outcomes of chest injury among adult patients treated at Hawassa university comprehensive specialized hospital, Hawassa Sidama, Ethiopia: Retrospective record review

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Abstract

Introduction: Trauma is a major global health concern, causing 4.4 million deaths annually, with thoracic injuries accounting for 25% of deaths. Developing countries disproportionately bear these deaths due to inadequate post-trauma measures.

Methods: Retrospective chart review study was conducted at Hawassa University Comprehensive Specialized Hospital among 111 chest injury patients from August 01/2021 to August 31/2023. Data were collected using structured questionnaires from the trauma registry, 24-hour reports, and patient charts and collected by trained nurses. The collected data were entered, cleaned, edited, and analyzed using SPSS version 25.0 statistical software.

Results: A total of 111 chest injury patients' charts were included in the analysis. About three-fourths (74.77%) were males, and 28 (25.23%) were females. Blunt trauma (77.5%, n = 86) was the most common type of injury, with road traffic crashes (59.5%, n = 66) being the most common mechanism. Rib fracture (n = 39, 35.14%) was the most common injury, followed by hemothorax (n = 37, 33.33%), hemopneumothorax (n = 32, 28.83%), and flail chest (n = 18, 16.22%). On univariate analysis, comorbidity (P <0.001), blunt mechanism (P = 0.039), hemopneumothorax (P = 0.006), flail chest (P = 0.021), pulmonary contusion (P = 0.014), development of complication (P <0.001), and extra thoracic injuries (P = 0.013) were associated with mortality.

Conclusion: This study found that one in ten chest injury patients died in a hospital, with road traffic

accidents being the main cause. Most patients sustained blunt chest injuries and death was associated with chronic diseases, hemopneumothorax, multiple injuries, and complications.

Key words: Blunt trauma, Road traffic accident, Thoracic trauma

Introduction

Trauma is a major global health concern, causing 4.4 million deaths annually and being the leading cause of death for individuals aged 5-29 years (1). It is a major public health problem in every country across the world and causes approximately 5.8 million deaths per year; about 16,000 deaths per day. Trauma is affecting and putting a significant health burden on all populations, regardless of age, sex, income, or geographical region (2,3). Thoracic trauma accounts for up to 25% of trauma-related deaths (3). Isolated blunt trauma to the chest is fatal in 10% of cases; rising to 30% if associated with other injuries (4). Majority of chest injuries occur in the thoracic cage, the commonest being rib fractures with underlying pulmonary contusion. The Advanced Trauma Life Support protocol prioritizes patients for life-threatening injuries, requiring rapid diagnosis and treatment (5). Thoracic trauma patients typically require basic treatment methods like management of airway, oxygen support, volume support and tube thoracostomy, with 10% requiring definitive operative intervention, commonly in penetrating thoracic injuries (5-8).

Rib fractures are common thoracic injuries. Clinical diagnosis of rib fracture includes pain during breathing, tenderness, and bony crepitus, supplemented by chest x ray. Elderly individuals with blunt chest trauma are at risk for pulmonary deterioration post-injury and should be closely monitored (9, 10). Injury is reported to be the leading cause of death, hospitalization, and long-term disabilities in economically productive age groups worldwide (11). Patients aged 24 - 44 years are more likely to experience accidents such as road traffic accidents, falls, and fights than other age groups (12). Trauma is responsible for 11% of all disability-adjusted life years in middle and low-income countries (13).

Chest trauma is also a significant cause of morbidity and mortality in Africa, accounting for 27.4% of trauma-related deaths in South Africa and 88.8% of chest injury-related deaths due to penetrating trauma thoracic trauma (14). According to a study conducted at Tikur Anbessa Specialized Teaching Hospital (TASTH), trauma is a significant public health issue in Ethiopia, with traumatic injuries accounting for 30.1% of emergency department deaths (15). A study at TASTH found chest trauma accounted for 13.9% of road traffic-related injuries among 230 surveyed individuals (16), while Zewditu Memorial Hospital found the chest trauma ranked fourth (9.5%) among the total cases of trauma following Road transport accident (RTA) (17).

Factors such as age, time between injury occurrence and hospital admission, hospital stay, injury mechanism, pattern, severity, comorbidity, associated injury, and complications are linked to death in traumatic chest injury patients (18-21). This study aims to examine patterns and outcomes of chest trauma at Hawassa University Comprehensive specialized hospital, Hawassa, Ethiopia partially following recent establishment of thoracic surgical service in the institution. Data were gained from the hospital's registry and analyzed to find the predictors for patients' outcomes following chest injuries. The findings of this study will help to understand the causes, patterns, and outcomes of chest trauma patients in the study area which will be essential for the establishment of prevention strategies as well as treatment protocols.

Methods and materials

Study area and period

The study was conducted at Hawassa University Comprehensive Specialized Hospital (HUCSH), from August 2021 to August 2023. Hawassa City is found 273 km south of Addis Ababa, Ethiopia. HUCSH was established in 2005. The hospital provides medical, surgical, intensive care unit (ICU), and emergency care, out and in-patient service for about 20 million populations from South regions, and other neighboring regions within 38 different departments. The hospital has 400 inpatient beds and eight intensive care beds, with five functional ventilators. It serves 102,033 patients annually, including an average of 1800 injured patients (29).

Study design

Retrospective Cross-sectional study design was used to assess patterns and outcomes of chest injury at HUCSH.

Source population

The source population includes all adult trauma patients presented to HUCSH from August 1/2021 to August 31/2023 and fulfilled the inclusion criteria.

Study population

The study population includes entire adult chest trauma patients evaluated and managed at HUCSH from August 1/2021 to August 31/2023.

Inclusion and exclusion criteria:

Inclusion criteria

All chest injury records of adult patients, who visited HUCSH during the study period, aged 18 years and above were included in this study.

Exclusion criteria

Patients with chest injury and incomplete data, and those who died on arrival were excluded from the study.

Sample size determination and sampling technique

The study included all patients with a diagnosis of chest trauma who met inclusion criteria during the study period. Since the entire patients during the study period were included, sample size determination was not applied.

Study variables

Type of chest injury (blunt /penetrative) was dependent Variable in this study. Independent variables include age, gender, and mechanism of injury, time of presentation and presence of comorbid disease

Data collection instrument

Patients admitted with a diagnosis of chest trauma were initially identified from the logbooks of the triage, intake, and procedure rooms of the emergency department. The English language checklist was developed by reviewing similar studies. The data were collected by two trained nurses using ODK Collect.

Data quality control

To ensure the data quality, training was given to the data collectors and the supervisor on ways of extracting the data based on the study objectives. The tool was also tested at 5% of the sample at HUCSH's surgical morning hall. Data were checked for consistency and completeness daily by the supervisor and principal investigator.

Data processing and analysis

Data were collected by using ODK collect version 1.25.2 and then exported to SPSS version 25 for analysis. Descriptive statistics like frequency, parentage were used to present categorical date, and measures of central tendency were used to show continuous data. A Chi-square test is used to determine the association between the type of injury and the entire independent variables. Association between variables was taken as statistically significant at a p-value of <0.05

Operational definition

Death: any patient admitted and started treatment at HUCSH as a result of chest injury regardless of its cause but lost his/her life in the hospital during treatment before being discharged from the hospital.

Alive: Any patient admitted and started treatment at HUCSH as a result of chest injury regardless of its cause and discharged either cured with or without disability or referred to other hospitals for further treatment but not died.

Results

Sociodemographic and injury-related characteristics

A total of 111 chest injury patients' charts were included in the analysis. About three-fourths (74.77%) were males, and 28 (25.23%) were females. Fifty (45.05%) of patients were aged 18 to 30 years, with a median age of 32 (IQR = 25–45) years. Ninety (81.08%) presented to the hospital within 24 hours of the injury, and 21 (18.92%) presented beyond 24 hours. Road traffic accident was the leading mechanism of injury in 66 (59.46%) patients, followed by falls 20 (18.02) patients. Ten (9.01%) patients have comorbidity, and of them, six (60%) had diabetes and 2 (20%) had cardiovascular disorders and 2(20%) had asthma. Mechanism of injury and comorbidity were significantly associated with mortality following chest injury (p< 0.001) (Table 1).

Pattern of chest injury and associated injury

More than three-fourths (77.48%) of patients had blunt chest injuries and 96 (86.49%) had isolated chest injuries. Extra-thoracic injuries included 16 (14.41%) head injuries, 12 (10.81%) arm injuries, six (5.41%) abdominal injuries, five (11%) leg injuries, and two (1.80) pelvic injuries. Ninety-eight cases (88.2%) were admitted, while 13 (11.8%) were discharged from the ED. More than half (56.2%) of the admitted patients stayed for more than seven days, and of those, eight cases were hospitalized for more than 20 days. Extra-thoracic injuries were statistically significantly associated with mortality following chest injury (p= 0.013). Twenty-one (60%) patients with extra-thoracic injuries were hospitalized for more than seven days. There was no statistically significant difference in length of stay among patients who had associated injuries vs. isolated chest injuries (44.74% vs. 60%, p = 0.135) (Table 2). Among 111 chest injury patients, 39, (35.14%) patients had rib fracture, 37 (33.33%) had hemothorax, 32, (28.83%) had hemopneumothorax and 18, (16.22%) had flail chest (Figure 1).

There is a statistically significant association between the pattern of chest injury and mortality (p<0.05). Hemopneumothorax (P = 0.006), flail chest (P = 0.021), and pulmonary contusion (P = 0.014) were significantly associated with mortality of chest injury patients

Intervention and Treatment Outcomes

The majority of patients (79.28%) underwent chest tube drainage, with 36.36% developing complications during hospitalization. These included 12 cases of atelectasis, 12 cases of pneumonia, 10 cases of retained hemothorax, and 3 empyema cases. Only two penetrating chest injury patients underwent thoracotomies.

Table 1: Sociodemographic and injury-related characteristics of chest injury patient admitted at HUCSH, August 01/2021-August 31/2023

Variables	Category	Frequency	Percentage	$\chi 2(p-value)$
Sex	Male	83	74.77	0.23(0.624)
	Female	28	25.23	
Age in years	18-30	50	45.05	0.97(0.613)
	31-44	31	27.93	
	≥45	30	27.03	
Presentation time	<24 hrs.	90	81.08	
	>24 hrs.	21	18.92	
Mechanism of injury	RTA	66	59.46	3.865(0.049)
	Fall down	20	18.02	
	Assaults	25	22.52	
Comorbidity (Diabetes, CVS, and Asthma)	Yes	10	9.01	15.5(<0.001)
	No	101	90.99	

Ninety-three (83.78%) recovered and were discharged home; three were referred to another facility; and 13 died. Of those who died, 8 (61.54%) died in the ICU, and 5 (38.46%) died in the emergency department. Complications during hospitalization were significantly related to an increased risk of death in chest injury patients (<0.001) (Table 3).

Table 2 Pattern of chest injury and associated injury of chest injury patient admitted at HUCSH, August 01/2021-August 31/2023

Variables	Category	Frequency	Percentage (%)	$\chi 2 (p-value)$
Type chest injury	Blunt	86	77.48	
	Penetrating	25	22.52	
Involved part	Isolated chest injury	96	86.49	
	Thoraco-abdominal injury	15	13.51	
Associated injury	Upper extremity	12	10.81	6.14(0.013)
	Abdomen	6	5.41	
	Head	16	14.41	
	Lower extremity	5	4.50	
	Pelvic	2	1.80	
LOS(n=98)	≤7	43	43.8	
	≥7	55	56.2	

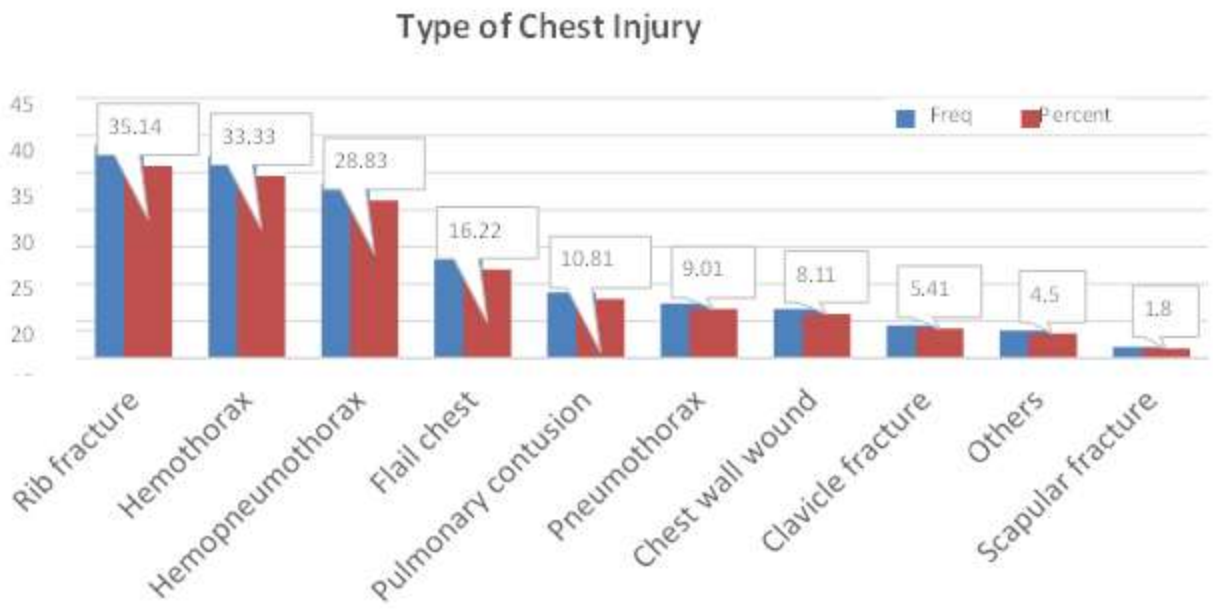

Figure 1 Pattern of Chest injury among chest injury patients admitted at HUCSH, August 1/2021-August 31/2023

Table 3 Intervention and treatment outcomes of chest injury patient admitted at HUCSH,2023

Variables	**Category**	**Frequency**	**Percentage (%)**	$\chi 2(p-value)$
Intervention given	Non-operative	21	18.92	
	chest tube drainage	88	79.28	
	Thoracotomy	2	1.80	
Complication	Yes	37	33.33	12.6(<0.001)
	No	74	66.67	
Type of complications (n=37)	Wound sepsis	5	13.51	
	Pneumonia	13	35.14	
	Atelectasis	14	37.84	
	Retained hemothorax	10	27.03	
	Chest empyema	4	10.81	
	Other	1	2.70	
Outcome	Improved	93	83.78	
	Died	13	11.71	
	Referred	3	2.70	
	Left against advice	2	1.80	
Death	Emergency department	5	38.46	
	ICU	8	61.54	

Discussion

Our study revealed that chest injuries primarily affect young adult males, with road traffic accidents being the leading cause, accounting for up to 60% of cases. This is the same as the global trend of injuries, primarily affecting young adult males, which accounts for almost 50% of injury-related mortality, affecting a significant proportion of a country's economically productive workforce (11). The high incidence of chest trauma in younger male can be explained by greater exposure to risk factors such as driving vehicles, sports that involve physical contact, active social life, and drug use, including alcohol (12).

A study in Sudan from found that 54.7% of chest injuries were male and 45.3% female, with a mean age of 27.41 years. Road traffic accidents were the most common cause, followed by attacks, stab wounds, falls, and gunshots. The commonest abnormal findings were rib fractures 56.7%, hemothorax 14.7%, pneumo-hemothorax 14% and simple pneumothorax in 11.3% (13).

A study in India found that thoracic injuries account for 18.2% of all trauma admissions, with blunt mechanisms in 89.1% of cases. Traffic accidents and assault were the most common modes of injury, with rib fractures (68%) being the most common chest injury. Associated extra thoracic injuries caused higher mortality rates (14). In our study Road traffic accidents are the leading cause of injuries, accounting for up to 60% of cases, followed by falls and interpersonal violence (13). The mechanism of injury was found that statically significantly related to the treatment outcome of the patients (p= 0.049). This finding was consistent with the result of similar studies (12-15).

A study by Adel Hamed Elbaih at Egypt Suez Canal University Hospital found that blunt thoracic trauma caused 72% of injuries, with only 28% of penetrating injuries. The majority of patients were male (87.5%) and female (12.5%). Rib fractures were common in blunt chest trauma, while hemothorax was common in penetrating chest trauma (16). On the other hand, a study in northwest England found a male predominance (88.4%), with penetrating injuries (54.1%) more common than blunt injuries. The most commonly encountered thoracic injuries were rib fractures (36.3%) and major hemothorax (36.3%), followed by simple pneumothorax (32.9%) and pulmonary lacerations (21.2%). Cardiac injuries were present in 38 patients (26%), with 11.6% of patients sustaining pericardial laceration, 6.1% having a laceration to a coronary artery, 3.4% suffering cardiac tamponade, and 1.4% sustaining simple hemopericardium without tamponade (17).

In our study, rib fractures are the most common type of chest injury, followed by hemothorax and hemopneumothorax. This aligns with a previous study in Addis Ababa and Nigeria, where rib fractures were the most common, followed by hemopneumothorax and pulmonary contusion in 18.2% and 14.6% of cases respectively (18,19). Our study also found that extra-thoracic injuries were statistically significantly associated with the mortality of chest injury patients, the finding supported by other studies (20-23). Out of the total cases, 14.41% of patients had associated head injuries and 10.8% had upper extremity injuries. Duration between injury and hospital admission, presence of multiple extra-thoracic injuries, and complications are associated with death in traumatic chest injury patients (13-18).

We found that the presence of underlying chronic comorbid illness predicts the outcome of traumatic chest injury. The finding was

similar to a study done in Tanzania (24). Predominant comorbidities include asthma, COPD and diabetes, which directly contribute to pulmonary insufficiency or immunosuppression and hence delay recovery (25-27).

The most common admission complication in this study was atelectasis and pneumonia. The presence of complications was one of the strongest determinants of mortality in chest injury patients. Those patients who had developed complications were more likely to die as compared to those without complications (p= 0.001), the finding similar to other studies (28-30). The severity of injury determines patient survival, with hemopneumothorax causing eight (25%) deaths, the finding similar to study done at Tikur Anbesa Specialized Hospital (TASH) which reported that hemopneumothorax is the leading cause of death among chest injury patients (20).

In our study we found intercostal drainage tube insertion was the most common modality of treatment in 88 (79.28%) of the patients, similar to other studies (31-35). Thoracotomy is indicated for patients who suffer penetrating cardiac trauma, who have cardiac tamponade (31,32). In this study, only two penetrating chest injury patients required thoracotomy for massive hemothorax, and one patient died of irreversible shock.

Conclusion

This study found that one in ten chest injury patients died in a hospital, with road traffic accidents being the main cause. Most patients sustained blunt chest injuries and death was associated with chronic diseases, hemopneumothorax, multiple injuries, and complications.

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Ethical considerations

To adhere to ethical issues formal ethical approval letter was taken from Hawassa University College of Health Sciences, Department of General Surgery. We ensured that individual information was undisclosed and kept confidential. Personal unique identifiers such as the names of study participants were not taken.

Data availability statement

Readers who wish to gain access to the data can write to the main author at siyasebew@gmail.com.

Conflicts of interest

The authors declared that they have no competing interest.

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Authors' contributions

SM involved in editing the research proposal, monitoring data collection process, analysis, editing, and manuscript write up. AA involved in planning, writing proposal, monitoring data collection process, analysis and manuscript write-up. CD involved in editing the proposal, and manuscript write-up.

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