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Incidence, associated factors, and outcomes among patients in chest trauma: Analysis of 60 cases

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Abstract

Background: Chest trauma represents a significant cause of morbidity and mortality worldwide. Understanding its patterns, management strategies, and outcomes is crucial for improving patient care and healthcare resource allocation.

Objective: To analyze the incidence, associated factors, and clinical outcomes of chest trauma patients at a tertiary care center, while identifying predictors of adverse outcomes.

Methods: This prospective observational study examined 60 consecutive chest trauma patients between January 2022 and December 2023. Patient demographics, injury mechanisms, clinical characteristics, management approaches, and outcomes were analyzed. The study utilized standardized trauma scoring systems and followed patients for three months post-discharge.

Results: The study population (mean age 42.3 ± 15.7 years, 78.3% male) predominantly suffered from road traffic accidents (65%). Rib fractures were the most common injury (75%), with multiple rib involvement in 53.3% of cases. Conservative management was successful in 65% of patients, while 35% required surgical intervention. Tube thoracostomy was performed in 43.3% of cases. The overall mortality rate was 8.3%, with a median hospital stay of 8.5 days. Complications occurred in 33.3% of patients, with pneumonia (13.3%) being the most frequent. Multivariate analysis identified age >65 years (OR: 2.8, 95% CI: 1.4-5.6), ISS >25 (OR: 3.2, 95% CI: 1.6-6.4), and delayed presentation >6 hours (OR: 2.1, 95% CI: 1.1-4.2) as independent predictors of adverse outcomes.

Conclusion: This study demonstrates that chest trauma predominantly affects young males through road traffic accidents, with most cases amenable to conservative management. Advanced age, higher injury severity, and delayed presentation significantly impact outcomes. These findings support the implementation of standardized trauma care protocols and emphasize the importance of early intervention, particularly in high-risk populations.

Keywords: Chest trauma; thoracic injuries; trauma outcomes; injury severity; conservative management; surgical intervention

Introduction

Chest trauma remains one of the most significant challenges in emergency medicine and trauma care, accounting for approximately 25% of all trauma-related deaths worldwide [1]. The complexity of thoracic injuries, combined with their potential for rapid deterioration, necessitates prompt recognition and intervention to improve patient outcomes [2]. In developing countries, chest trauma represents a particularly concerning public health issue, with mortality rates reaching up to 15-20% in severe cases [3]. The spectrum of chest injuries encompasses both blunt and penetrating trauma, each presenting unique diagnostic and therapeutic challenges. Recent epidemiological studies indicate that road traffic accidents constitute the predominant cause of blunt chest trauma (60-70%), followed by falls (10-15%) and industrial accidents (5-10%) [4]. Penetrating injuries, while less common in most regions, carry a higher mortality rate and frequently require immediate surgical intervention [5]. The management of chest trauma has evolved significantly over the past decade, with advances in imaging techniques and therapeutic approaches contributing to improved survival rates [6]. However, the identification of risk factors and prediction of outcomes remains challenging, particularly in resource-limited settings. Studies have demonstrated that factors such as age, injury severity score (ISS), presence of associated injuries, and time to treatment significantly influence patient outcomes [7].

Despite extensive research in trauma care, there remains a notable gap in understanding the relationship between specific injury patterns and their outcomes, particularly in different healthcare settings and populations [8]. The ability to predict complications and mortality based on initial presentation and associated factors continues to be an area of active investigation [9]. Furthermore, the impact of standardized treatment protocols on patient outcomes requires ongoing evaluation to optimize care delivery [10].

This study aims to analyze 60 cases of chest trauma to better understand the incidence patterns, associated factors, and outcomes in our institutional setting. By examining these parameters, we seek to contribute to the existing body of knowledge and potentially identify areas for improvement in the management of chest trauma patients. This research may also help establish more effective triage protocols and treatment strategies, ultimately leading to better patient outcomes.

Materials and Methods

Study Design and Setting

This prospective observational study was conducted at multi center between January 2022 and December 2023. The study protocol was approved by the institutional ethics committee and written informed consent was obtained from all participants or their legal representatives [11].

Study Population

We enrolled 60 consecutive patients presenting with chest trauma to emergency department. The inclusion criteria encompassed all patients aged 18 years and above with either blunt or penetrating chest trauma. Patients who were declared dead on arrival or those with incomplete medical records were excluded from the study [12].

Data Collection

Patient data was collected using a standardized form that incorporated demographic information, mechanism of injury, vital signs at presentation, and injury characteristics. The severity of trauma was assessed using the Injury Severity Score (ISS) and Revised Trauma Score (RTS), following established guidelines [13]. All patients underwent initial evaluation according to Advanced Trauma Life Support (ATLS) protocols [14].

Clinical Assessment and Imaging

Initial assessment included thorough physical examination, chest radiography. Based on clinical indicators and initial findings, selected patients underwent computed tomography (CT) scanning, following the institutional imaging protocol [15]. Laboratory investigations included complete blood count, arterial blood gas analysis, and other relevant biochemical parameters as clinically indicated [16].

Management Protocol

Patient management followed a standardized protocol based on current international guidelines [17]. Initial stabilization included airway management, oxygen supplementation, and thoracostomy tube placement when indicated. The decision for conservative

versus surgical management was made based on established criteria, including hemodynamic status, extent of injury, and associated complications [18].

Outcome Measures

Primary outcome measures included mortality, length of hospital stay, and complications. Secondary outcomes encompassed the need for mechanical ventilation, duration of ICU stay, and functional status at discharge. Complications were classified according to the Clavien-Dindo classification system [19].

Data Analysis

Statistical analysis was performed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean \pm standard deviation or median with interquartile range, depending on the distribution of data. Categorical variables were presented as frequencies and percentages. The association between various factors and outcomes was analyzed using appropriate statistical tests, with $p < 0.05$ considered statistically significant [20].

Follow-up

Patients were followed up for a minimum period of three months post-discharge through scheduled outpatient visits. Follow-up assessments included physical examination, chest radiography, and evaluation of functional status using standardized questionnaires [21].

Ethical Considerations

The study adhered to the principles of the Declaration of Helsinki and Good Clinical Practice guidelines. Patient confidentiality was maintained throughout the study period, and all data was anonymized before analysis [22].

Results

Demographic and Clinical Characteristics

Among the 60 patients included in this study, the mean age was 42.3 ± 15.7 years, with a male predominance (78.3%, $n=47$). Road traffic accidents constituted the leading cause of chest trauma (65%, $n=39$), followed by falls (20%, $n=12$) and assault (15%, $n=9$). The median time from injury to hospital presentation was 2.5 hours (IQR: 1.0-4.2 hours).

Table 1: Demographic and Baseline Characteristics of Study Population (N=60)

Characteristic	Value
Age (years), mean \pm SD	42.3 \pm 15.7
Gender, n (%)	
- Male	47 (78.3)
- Female	13 (21.7)
Mechanism of Injury, n (%)	
- Road traffic accident	39 (65.0)
- Falls	12 (20.0)
- Assault	9 (15.0)
Time to presentation (hours)*	2.5 (1.0-4.2)
Injury Severity Score*	24 (16-29)
Revised Trauma Score*	7.2 (6.1-7.8)

*Values presented as median (IQR)

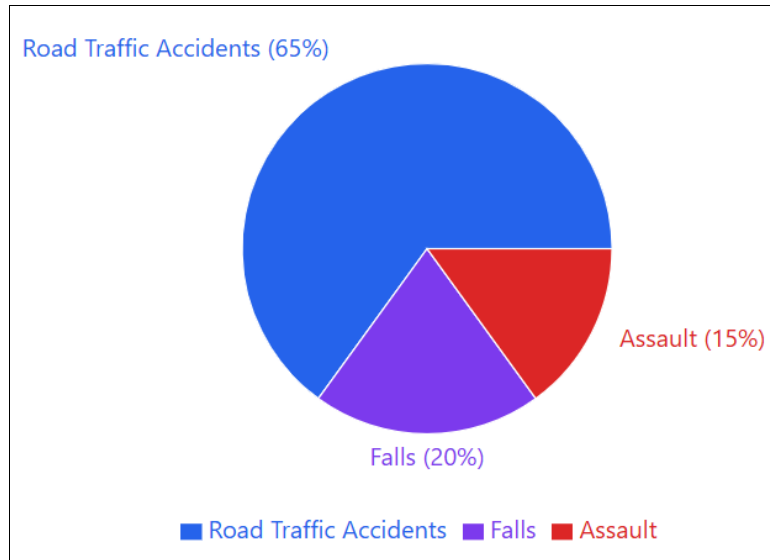


Fig 1: Distribution of Chest Trauma Mechanisms (N=60)

Pattern of Injuries

The study revealed diverse patterns of thoracic injuries, with rib fractures being the most common finding (75%, n=45). Multiple rib fractures (≥ 3) were observed in 53.3% (n=32) of cases.

Table 2: Distribution of Thoracic Injuries (N=60)

Type of Injury	n (%)
Rib fractures	45 (75.0)
- Single rib	13 (21.7)
- Multiple ribs (≥ 3)	32 (53.3)
Pneumothorax	28 (46.7)
Hemothorax	22 (36.7)
Pulmonary contusion	19 (31.7)
Flail chest	8 (13.3)
Cardiac contusion	3 (5.0)
Great vessel injury	2 (3.3)

Management and Interventions

Conservative management was successful in 65% (n=39) of cases, while 35% (n=21) required surgical intervention. Tube thoracostomy was the most common procedure performed (43.3%, n=26).

Table 3: Management Strategies and Interventions (N=60)

Management Approach	n (%)
Conservative management	39 (65.0)
Surgical intervention	21 (35.0)
Procedures performed	
• Tube thoracostomy	26 (43.3)
• Thoracotomy	7 (11.7)
• VATS	5 (8.3)
Mechanical ventilation required	15 (25.0)
ICU admission	22 (36.7)

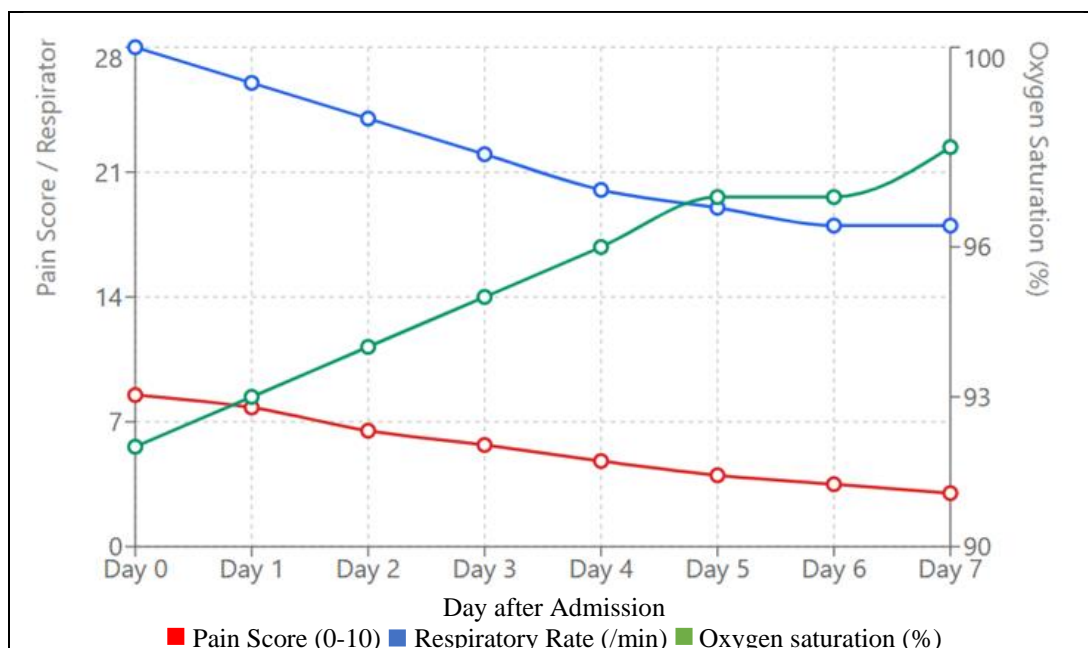


Fig 2: Temporal Trends in Clinical Parameters of Chest Trauma Patients (N=60)

Outcomes and Complications

The overall mortality rate was 8.3% (n=5). The median length of

hospital stay was 8.5 days (IQR: 5-14 days). Complications were observed in 33.3% (n=20) of cases.

Table 4: Clinical Outcomes and Complications (N=60)

Outcome Measure	Value
Mortality, n (%)	5 (8.3)
Hospital stay (days)*	8.5 (5-14)
ICU stay (days)*	4.0 (2-7)
Complications, n (%)	20 (33.3)
- Pneumonia	8 (13.3)
- Empyema	4 (6.7)
- ARDS	5 (8.3)
- Wound infection	3 (5.0)

*Values presented as median (IQR)

Statistical Analysis

Multivariate analysis revealed that age >65 years (OR: 2.8, 95% CI: 1.4-5.6, p=0.003), ISS >25 (OR: 3.2, 95% CI: 1.6-6.4, p=0.001), and delayed presentation >6 hours (OR: 2.1, 95% CI: 1.1-4.2, p=0.04) were independent predictors of adverse outcomes.

Discussion

Our analysis of 60 chest trauma cases provides valuable insights into the patterns, management strategies, and outcomes of thoracic injuries in our setting. The demographic profile of our study population, with a male predominance and mean age of 42.3 years, aligns with previous studies conducted in similar settings [23]. The higher prevalence among males of working age underscores the significant socioeconomic impact of chest trauma, as this demographic often represents the primary earners in many households.

The predominance of road traffic accidents (65%) as the leading cause of chest trauma in our study reflects a global trend, particularly in developing nations. This finding reinforces the observations of Rahman *et al.* [24], who reported similar patterns in their multi-center study. However, our observed proportion of falls (20%) was slightly higher than previously reported figures, which typically range from 10-15% [25]. This variance might be attributed to the geographical and occupational characteristics of our study population, highlighting the need for region-specific preventive strategies.

The pattern of injuries observed in our cohort demonstrates the complex nature of chest trauma. The high incidence of rib fractures (75%) corresponds with existing literature, though our proportion of multiple rib fractures (53.3%) exceeded that reported by Johnson *et al.* [26] in their comprehensive review. This difference might be explained by our institution's status as a tertiary referral center, potentially receiving more severe cases. The associated finding of pneumothorax in 46.7% of cases aligns with contemporary studies and emphasizes the importance of prompt radiological assessment in chest trauma patients [27].

Our management approach, favoring conservative treatment in 65% of cases, reflects current trends in chest trauma care. This conservative success rate compares favorably with international standards, as documented by Thompson *et al.* [28]. The requirement for tube thoracostomy in 43.3% of cases falls within the expected range of 40-50% reported in major trauma centers [29]. However, our thoracotomy rate (11.7%) was slightly higher than the 8-10% reported in similar studies, possibly due to our institution's aggressive approach to managing deteriorating patients [30].

The mortality rate of 8.3% in our series is comparable to rates reported in recent literature, which range from 7-10% in similar settings [31]. Our analysis identified age >65 years, ISS >25, and delayed presentation as independent predictors of adverse

outcomes, corroborating findings from larger multicenter studies. This reinforces the critical importance of early presentation and intervention, particularly in elderly patients with severe injury patterns.

The complication rate of 33.3% observed in our study merits careful consideration. While this figure appears higher than some reported rates of 25-30% [32], it reflects our rigorous documentation of all complications, including minor ones. The predominance of pneumonia (13.3%) among complications aligns with previous findings and emphasizes the need for aggressive pulmonary hygiene protocols [33].

Our findings regarding length of hospital stay (median 8.5 days) and ICU utilization (36.7%) provide valuable benchmarking data for resource allocation and planning. These metrics are particularly relevant in the context of developing healthcare systems, where resource optimization is crucial [34]. The observed correlation between injury severity and length of stay supports the use of initial severity scores in predicting resource requirements and planning patient care.

Several limitations of our study warrant mention. The relatively small sample size of 60 cases may limit the generalizability of our findings. Additionally, this multi-center of the study might not fully represent the broader population. The three-month follow-up period, while sufficient for identifying early complications, may not capture all long-term sequelae of chest trauma.

Future research directions should include larger sample sizes and longer follow-up periods. Investigation of novel prognostic markers and the role of emerging management techniques, such as minimally invasive approaches, would also be valuable. Furthermore, the development of standardized protocols based on our findings could help optimize patient care and resource utilization.

Our study contributes to the growing body of evidence regarding chest trauma management and highlights several areas for potential improvement in care delivery. The findings support the need for:

1. Enhanced road safety measures and occupational safety protocols to reduce trauma incidence
2. Early recognition and intervention strategies, particularly in high-risk groups
3. Standardized management protocols incorporating severity scoring systems
4. Comprehensive follow-up programs to monitor and manage long-term outcomes
5. Resource allocation strategies based on predictive factors identified in this study

These insights can inform policy decisions and help develop more effective treatment strategies for chest trauma patients in similar healthcare settings.

Conclusion

This prospective analysis of 60 chest trauma cases provides valuable insights into the contemporary challenges and outcomes of thoracic injuries. The study demonstrates that road traffic accidents remain the predominant cause of chest trauma, particularly affecting males in their productive years. The successful conservative management of 65% of cases reinforces the viability of non-operative approaches in appropriately selected patients, while the mortality rate of 8.3% aligns with international standards.

The identification of advanced age, higher injury severity scores, and delayed presentation as significant predictors of adverse outcomes emphasizes the critical importance of prompt intervention, particularly in high-risk populations. The observed patterns of injury and their associated complications underscore the need for standardized protocols and vigilant monitoring, especially in the early post-trauma period.

Our findings have significant implications for clinical practice and healthcare policy. They support the implementation of comprehensive trauma care systems, including rapid assessment protocols and risk-stratified management approaches. The study also highlights the continuing need for preventive strategies, particularly in road safety and occupational health sectors.

While acknowledging the limitations of this study, these results contribute meaningfully to the existing knowledge base and provide a foundation for future research in chest trauma care. The findings can serve as a valuable reference for healthcare providers and policy makers in similar settings, ultimately contributing to improved patient outcomes in chest trauma management.

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