ISSN: 2581 – 3633
PubMed - National Library of Medicine - ID: 101745081

International Journal of Medical Science and Advanced Clinical Research (IJMACR)

Available Online at:www.ijmacr.com

Volume – 9, Issue – 3, June – 2026, Page No.: 185 – 193

An Analysis and Management of Haemothorax and Pneumothorax in Blunt Trauma to Chest Patients at A Tertiary Care Centre

[1]Dr Suraj Undre, Senior Resident, Department of General Surgery, Shri Vasantrao Naik Govt. Medical Hospital Yavatmal, Maharashtra.

[2]Dr Vinod Rathod, Professor, Department of General Surgery, Shri Vasantrao Naik Govt. Medical Hospital Yavatmal, Maharashtra.

[3]Dr Vishal Yelke, Associate Professor, Department of General Surgery, Government Medical College Amravati, Maharashtra.

Corresponding Author: Dr Suraj Undre, Senior Resident, Department of General Surgery, Shri Vasantrao Naik Govt. Medical Hospital Yavatmal, Maharashtra.

How to citation this article: Dr Suraj Undre, Dr Vinod Rathod, Dr Vishal Yelke, "An Analysis and Management of Haemothorax and Pneumothorax in Blunt Trauma to Chest Patients at A Tertiary Care Centre", IJMACR – June – 2026, Volume – 9, Issue – 3, P. No. 185 – 193.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Introduction: Blunt chest trauma is a major contributor to morbidity and mortality, particularly among young adults exposed to high-energy impacts such as road traffic accidents. It represents nearly 70% of thoracic injuries and often leads to life-threatening complications like hemothorax and pneumothorax. Despite advances in trauma care, these injuries continue to pose diagnostic and therapeutic challenges, especially in resource-limited settings.

Aim and Objective: This study aimed to evaluate the clinico-radiological profile, prevalence, and management outcomes of hemothorax and pneumothorax in patients with blunt chest trauma, with emphasis on associated injuries and treatment modalities.

Materials and Methods: An analytical observational study was conducted in the Department of General Surgery, a tertiary care hospital, from May 2022 to June 2024. A total of 106 patients with blunt chest trauma were included through convenient sampling. Patients were assessed clinically and radiologically, with demographic details, mechanism of injury, associated injuries, treatment modalities, and outcomes recorded systematically. Data were analyzed using descriptive statistics.

Results: Most blunt chest trauma patients were young adults (21–40 years, 54.8%), mainly due to road traffic

accidents (88.6%). Rib fractures (83.9%) predominated, with hemothorax (35.8%), pneumohemothorax (18.8%), and pneumothorax (7.5%) also noted. Clavicle (26.7%) and long bone fractures (23.3%) were common. Conservative management sufficed for 86.8%, while 13.2% required chest drainage, typically 4–7 days.

Conclusion: Blunt chest trauma is largely preventable, yet remains a significant health burden. Young adults are disproportionately affected, with road traffic accidents as the leading cause. Early diagnosis, conservative management, and timely chest drainage in complicated cases are critical for favorable outcomes.

Keywords: Blunt Chest Trauma, Hemothorax, Pneumothorax, Rib Fracture, Conservative Management.

Introduction

Blunt chest trauma is one of the most frequent reasons for thoracic surgical consultations in emergency departments, representing nearly 70% of all thoracic injuries. Trauma, in general, is the third leading cause of death across all age groups after cardiovascular disease and cancer, but it remains the foremost cause of mortality among individuals in their first four decades of life [1]. Although trauma can involve multiple regions of the body, thoracic injuries are particularly significant because one in every four trauma patients dies due to chest trauma or its complications. With the global rise in high-speed automobile accidents, chest trauma has become an increasing public health concern, contributing to 20–25% of trauma-related mortality. Thoracic trauma is estimated to affect around 60% of polytrauma patients, making it a critical determinant of survival in the injured population [2].

The burden of chest trauma is profound worldwide. It directly accounts for approximately one-fifth to one-quarter of all trauma-related deaths and contributes significantly to disability-adjusted life years (DALYs) [3]. Blunt chest trauma alone is implicated in nearly 15% of trauma cases globally. Mortality estimates, however, vary because deaths may be related to both pulmonary and non-pulmonary complications. In the initial evaluation of chest trauma, it is essential to promptly identify and manage six life-threatening conditions: airway obstruction, tension pneumothorax, open pneumothorax, massive hemothorax, flail chest, and pericardial tamponade. The success of initial management often determines whether a patient survives long enough to receive definitive treatment [4].

The primary causes of blunt thoracic trauma are motor vehicle accidents, including those involving pedestrians and motorcyclists, and falls from significant heights. Among these, motor vehicle collisions remain the predominant mechanism [5]. Despite the availability of relatively straightforward treatment options, many patients succumb before reaching hospital care. The delayed pulmonary complications following blunt chest injury remain the principal cause of morbidity and mortality [6]. Globally, road traffic accidents, workplace mishaps, falls, and assaults are major contributors. According to World Health Organization projections, road traffic accidents may become the fifth leading cause of death worldwide by 2030, underscoring the urgent need for prevention and effective trauma care [7].

Thoracic injuries remain responsible for a high number of trauma-related deaths shortly after hospital admission. Many of these fatalities, however, are considered preventable if timely diagnosis and appropriate management are provided [8]. Interestingly, only about 10% of blunt chest trauma cases and between 15–30% of penetrating injuries necessitate surgical intervention. The majority of patients can be managed successfully in the

emergency department with procedures such as intercostal tube drainage, oxygen therapy, and adequate analgesia. Nevertheless, chest trauma accounts for nearly 10% of total trauma deaths and contributes substantially to pediatric trauma mortality, where it is the second leading cause of death [1].

The epidemiological impact is particularly striking in India, where trauma results in nearly 20 million hospitalizations annually, with around one million deaths attributed to trauma-related injuries [9]. Chest trauma alone is responsible for approximately 16,000 deaths each year. Every 1.9 minutes, a trauma-related death is reported, reflecting the scale of the problem [10]. Around the world, chest injuries are responsible for 10% of admissions in trauma units and contribute to as many as 25–50% of trauma-related deaths. Mortality is closely linked to both the severity of injury and the presence of comorbidities. Although the majority of patients can be managed conservatively, 20–25% of cases remain directly attributable to chest trauma [11].

The growing prevalence of high-speed vehicular travel has led to a rise in severe chest trauma, often resulting in conditions such as tension pneumothorax, massive hemothorax, and vascular injuries [12]. While the specific causes vary with environmental and sociopolitical factors across regions, road traffic accidents consistently dominate in non-conflict zones. Trauma itself is categorized into penetrating and blunt types. Penetrating injuries such as stabbings and gunshot wounds damage tissue integrity, whereas blunt injuries cause damage to underlying structures without skin disruption. Falls, vehicle accidents, and occupational mishaps are the most common mechanisms of blunt injury. The predominance of blunt injuries is well recognized, as they constitute roughly 70% of all thoracic traumas [13].

Several factors influence morbidity and mortality in blunt chest trauma. Age alone is not the only determinant; rather, the presence of multiple rib fractures, need for mechanical ventilation, pre-existing lung disease, concomitant head trauma, hypotension, and extra-thoracic organ injury all play vital roles [14]. Additionally, a low Glasgow Coma Scale (GCS) score is strongly correlated with mortality. Notably, preventable in-hospital mortality rates vary significantly worldwide, ranging between 4% and 60%, depending on healthcare infrastructure and timely interventions [1].

Blunt trauma mechanisms can be further categorized into four principal types: direct blows to the thorax, compression of the chest, acceleration-deceleration injuries, and blast injuries. Acceleration-deceleration trauma, such as that observed in motor vehicle accidents, is particularly common, often leading to vascular, bony, and soft tissue injuries. A classic example is a steering wheel deformity from driver impact, which increases the risk of thoracic complications. Compression injuries frequently occur in industrial accidents or crushing injuries, while falls from height can produce extensive chest wall and organ damage [15].

Blunt chest trauma diagnosis relies on clinical evaluation and chest imaging, as delayed recognition contributes to nearly a quarter of trauma-related deaths. Though less than 10% require surgery, most cases respond to airway management, oxygen support, tube thoracostomy, resuscitation, and pain control. Hemothorax and pneumothorax remain critical complications, with limited data on prevalence and management outcomes. Focused research is essential to improve strategies, reduce mortality, and address the rising burden of thoracic injuries that remain a major global healthcare challenge [16].

This study aims to determine the prevalence of haemothorax and pneumothorax in blunt chest trauma patients, with specific focus on mechanisms such as road traffic accidents, falls from height, simple falls, and assaults. It also seeks to assess the burden of these complications across different etiologies and evaluate the effectiveness of various management strategies in minimizing morbidity and mortality. The goal is to enhance outcomes and guide evidence-based interventions for chest trauma care.

Materials and Methods

This analytical observational study was conducted in the Department of General Surgery at a tertiary care hospital from May 2022 to June 2024, including patients with blunt chest trauma admitted during this period. The sample size, calculated using the formula for estimating proportions with 95% confidence, was 106, with convenient sampling applied. Inclusion criteria comprised patients of any age or gender with confirmed blunt chest trauma on imaging who provided informed consent, while exclusions included penetrating or iatrogenic injuries and those unable to consent. Ethical clearance was obtained from the IEC, and confidentiality of all participant data was ensured.

Results

Table 1: Age distribution of blunt chest trauma patients

Age group (in years)	No. of patients (%)
1-10	0
11 – 20	7 (6.6)
21- 30	30 (28.3)
31- 40	28 (26.5)
41-50	19 (17.0)
51-60	10 (9.9)
61-70	8 (8.0)
71-80	3 (2.9)
81-100	1 (0.8)
Total	106 (100.0)

Table shows blunt chest trauma was most common in 21–40 years (54.8%), making young adults the primary affected group. Elderly and pediatric cases were rare, indicating minimal vulnerability. This pattern reflects greater exposure of productive age groups to road traffic and occupational risks.

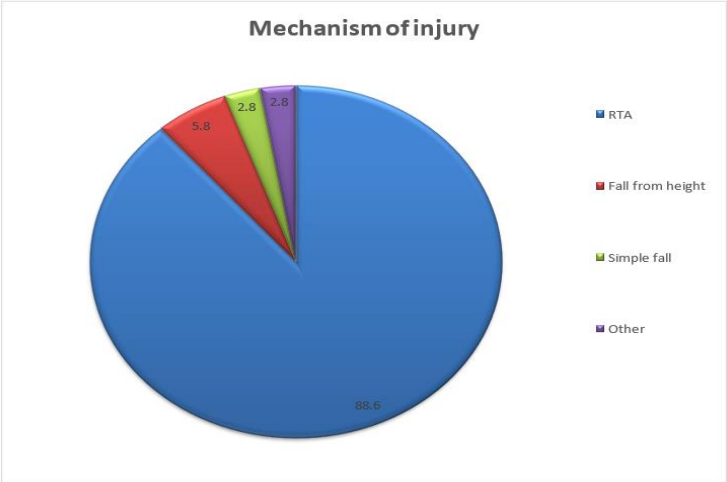

Figure 1: Mechanism of injury

Figure shows road traffic accidents as the leading cause of blunt chest trauma (88.6%), far exceeding other mechanisms. Falls from height (5.8%) and simple falls (2.8%) contributed minimally, while other causes were rare (2.8%). This emphasizes the dominance of RTAs as the major etiological factor.

Table 2: Types of chest injury

Injuries	No. of patients (%)
Rib fracture	89 (83.9)
Flail chest	4 (3.7)
Surgical emphysema	4 (3.7)
Pneumothorax	8 (7.5)
Hemothorax	38 (35.8)
Pneumohemothorax	20 (18.8)
Pulmonary contusion	4 (3.6)
Others	6 (5.6)

Table shows rib fractures were the most common chest injury (83.9%), followed by hemothorax (35.8%) and pneumohemothorax (18.8%). Pneumothorax (7.5%) and other injuries like flail chest, emphysema, and pulmonary contusion were less frequent. This indicates rib fractures and associated complications form the major burden of blunt chest trauma.

Table 3: Associated injuries

Associated injuries	No. of patients
Clavicle fracture	8 (26.7)
Scapula fracture	3 (10.0)
Long bone fracture	7 (23.3)
Spinal injury	1 (3.3)

Pelvic fracture	2 (6.7)
Intraabdominal injuries	5 (16.7)
Head injury	4 (13.3)
Total	30 (100.0)

Table shows clavicle (26.7%) and long bone fractures (23.3%) were the most frequent associated injuries, followed by intraabdominal trauma (16.7%) and head injury (13.3%). Scapula (10%), pelvic (6.7%), and spinal injuries (3.3%) were less common. This highlights that musculoskeletal injuries predominated as major associations with blunt chest trauma.

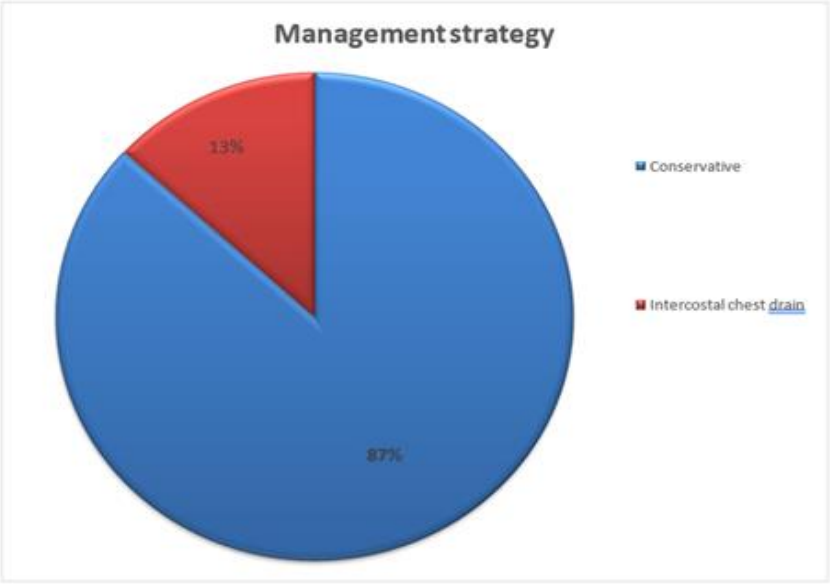

Figure 2: Distribution of patients according to management strategy

Figure shows most patients were managed conservatively (87%), while only 13% required intercostal chest drain. This indicates that the majority of blunt chest trauma cases were mild to moderate and responded to non-invasive treatment. Invasive intervention was needed only in a limited subset with complications.

Table 4: Tube duration

Tube duration	No. of patients
1 – 3 days	2
4- 7 days	11
8- 10 days	1

Table shows most patients with chest tubes required drainage for 4–7 days (11 cases), while a few needed only 1–3 days (2 cases) or prolonged 8–10 days (1 case). This reflects that the majority achieved resolution within a week, with extended duration necessary only in complicated cases.

Discussion

In the present study, the majority of blunt chest trauma patients were young adults, with 28.3% falling in the age group of 21–30 years and 26.5% between 31–40 years. This distribution highlights the vulnerability of younger, more active populations to high-energy trauma. Similar trends have been observed in previous research. Sinha et

al. (2019) from Ambala, India, reported a mean age of 33.32 years among blunt chest trauma patients, with nearly two-thirds (64%) belonging to the 18–40 years age group [17]. Likewise, studies by Kant et al. (2020) from Bihar [9], Gupta et al. (2021) from RML Hospital, New Delhi [18], and Liman et al. (2003) from Turkey [19] also concluded that blunt chest trauma predominantly affects young adults. This can be attributed to increased exposure of this demographic to outdoor and occupational activities, vehicular travel, and risk-prone behaviors.

The mechanism of injury in blunt chest trauma has been consistently dominated by road traffic accidents (RTAs). In the present study, 88.6% of cases were attributable to RTAs, underscoring their major role in chest trauma epidemiology. This finding aligns with those of Kant et al. (2020) [9], Dangi et al. [20], Dalal et al. [21], and Sharma et al. [22], who reported RTA-related trauma incidences ranging between 56% and 80%. The high prevalence of RTAs can be explained by multifactorial reasons, including non-compliance with traffic regulations, driver fatigue, alcohol consumption while driving, inadequate road lighting, poor road infrastructure, rapid urbanization, population growth, and the exponential expansion of road transport.

Regarding the types of chest injuries, rib fractures emerged as the most common presentation in the current study, occurring in 83.9% of patients. Ribs, owing to their anatomical positioning and large surface area, are the most exposed skeletal structures during blunt trauma, making them particularly susceptible. This observation is corroborated by Kant et al. (2020), who documented rib fractures in 25% of their cases [9]. Similarly, Kumar et al. reported a prevalence of 78% [23], and Sharma et al. 71% [9], confirming rib fractures as the most frequent osseous injury in chest trauma patients.

Associated injuries are frequent in polytrauma patients, and in the present study, clavicle fracture was the most common, affecting 26.7% of individuals. This is in line with findings by Kant et al. (2020) who noted clavicle fractures in 13% of cases [4], Kulshrestha et al. who reported 14.1% [24], and Kumar et al. who found a higher rate of 44% [10]. The anatomical location of the clavicle, serving as a strut between the thorax and shoulder, explains its predisposition to fractures during high-energy impacts.

In terms of management, the majority of patients (86.8%) in the current study were managed conservatively, with only 13.2% requiring intercostal chest drain (ICD) placement. This approach reflects the global preference for non-operative management of blunt chest injuries in stable patients. Kant et al. (2020) also reported conservative management in 82% of cases[4], while Sharma et al. (2017) from Ambajogai, Maharashtra, documented an even higher rate of 93.6%[9]. Conservative strategies, including analgesia, physiotherapy, oxygen support, and close monitoring, remain the cornerstone of management unless complicated by pneumothorax or hemothorax requiring drainage.

As for tube thoracostomy, most patients in the present study required ICD placement for a duration of 4–7 days, consistent with global experiences. Broderick et al. (2013) [25] and Feenstra et al. (2018) [26] also reported similar durations of chest tube requirement, highlighting that the timeline depends largely on the resolution of air leaks or fluid drainage, as well as the patient's overall recovery.

Conclusion

The present study concludes that blunt chest trauma predominantly affects young adults aged 21–40 years (54.8%), with road traffic accidents accounting for the majority (88.6%). Rib fractures were the most common injury (83.9%), while hemothorax (35.8%) and pneumothorax (7.5%) were significant clinical findings. Clavicle fracture emerged as the most frequent associated injury (26.7%). Most patients (86.8%) were managed conservatively with non-surgical approaches, and only a subset required intercostal chest drainage. Among those needing chest tubes, the majority required them for 4–7 days, highlighting the importance of supportive and minimally invasive strategies in blunt chest trauma care.

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