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http://jept.ir
doi:10.34172/jept.1799

Journal of Emergency Practice and Trauma
J Emerg Pract Trauma 2025;11(1):22-26

Original Article

Traumatic Hemothorax as an Indicator of Trauma Severity in Thoracic and Polytrauma Patients: An Institutional Incidence-Based Study

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Received: July 13, 2025
Accepted: November 12, 2025
ePublished: June 6, 2026

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Citation: Demaçi S, Krasniqi Y, Bruçi B, Stubljar D. Traumatic Hemothorax As An Indicator Of Trauma Severity In Thoracic And Polytrauma Patients: An Institutional Incidence-Based Study. J Emerg Pract Trauma 2025;11(1):22-26. doi:10.34172/jept.1799

Abstract

Introduction: Traumatic hemothorax (TH) is not a rare complication of thoracic trauma. This study aimed to assess the incidence of this complication among injured patients and assess it as an indicator of severity.

Methods: A retrospective study comprised 681 injured patients with thoracic trauma admitted to the Thoracic Surgery Department or Intensive Care Unit of the University Clinical Centre of Kosovo, Prishtina, during a period of three years (from July 2019 to June 2022). Trauma severity was assessed using indirect clinical indicators, including length of hospital and ICU stay, need for surgical intervention (thoracic drainage and urgent or elective thoracotomy), presence of associated intra- and extra-thoracic injuries, occurrence of complications, and in-hospital mortality.

Results: Traumatic hemothorax was identified in 136 of 681 patients with thoracic trauma (20.0%). Hemothorax occurred more frequently in penetrating than blunt thoracic trauma (37.7% vs. 13.8%; $P<0.01$). Definitive surgical treatment was required in 16.9% of patients with TH, including urgent thoracotomy in 8.1%. Patients with intrapleural bleeding had a significantly longer hospitalization stay compared to patients without hemothorax (20.6±17.4 vs. 9.4±10.4 days; $P<0.001$), indicating increased trauma severity.

Conclusion: Careful surveillance was necessary for thoracic trauma patients to ensure timely action would be taken for patients who required surgical intervention. Presence of any of the associated TH injuries triggered a suspicion of possible complications and contributed to the longer length of stay in the intensive care unit.

Keywords: Hemothorax drainage, Injury severity score, Thoracic trauma, Thoracostomy, Traumatic hemothorax

Introduction

Traumatic hemothorax (TH), defined as intrapleural bleeding resulting from thoracic trauma, is a common complication of blunt and penetrating chest injuries. Bleeding is a major cause of death in penetrating injuries on the battlefield as well as in injuries among civilians (1,2). The incidence among civilians who suffer from trauma is not well known. TH is mostly related to chest trauma. Data suggest that injuries of the chest account for 60% of all polytraumatic occurrences (2,3).

Hemothorax can be categorized based on etiology: spontaneous or traumatic. Traumatic hemothorax (TH) is categorized into two main types based on the mechanism of injury: penetrating and blunt. Penetrating trauma occurs when an object breaches the chest wall (e.g., stabbings, gunshot wounds, or impalement), directly damaging internal structures. While blunt trauma (e.g., car accidents) is more common overall. Spontaneous hemothorax is a rare entity, usually caused by rupture of pleural adhesions in the setting of spontaneous pneumothorax or by hemorrhagic pleural effusion associated with pleural or lung malignancies. Spontaneous hemothorax can be iatrogenic, which may be related to complications after cardiopulmonary surgery, placement of subclavian, or jugular catheters or lung and pleural biopsies (4). It generally occurs by rupture of pleural adhesions in 3–7% of cases (5,6). The considered treatment of hemothorax is blood drainage through the placement of an intercostal drain (4) or surgical evacuation of the pleural space. Meanwhile, clotted or retained hemothorax is associated with a risk of empyema and fibrothorax, so conventional drainage is not an option (7-9).

TH has been described in several reports, but the incidence is still unclear as most reports rely on a single institution and limited population. In our case, our department is the largest department in the country and serves as the major center for admitted patients who

suffer from trauma and polytrauma. In our department a valuable database has been collected in the past in order to provide an overview of traumatic patients. Trauma databases are important tools for analysis and education, as by analyzing the data we might identify patterns that can contribute to improvements in the quality of care. More importantly, they can help define preventative strategies for such patients, identify priorities for research, and provide evidence for hospital management for allocating resources and staff. In the current incidence study, we sought to describe the variety of traumas and the incidence rates of TH in our department. Therefore, the aim of the study was to determine the incidence of cases with TH as a complication among traumatic patients who needed surgical treatment and assess it as an indicator of severity.

Methods

A retrospective study comprised 681 injured patients with thoracic trauma admitted to the Thoracic Surgery Department or Intensive Care Unit of the University Clinical Centre of Kosovo, Prishtina, in a period of three years (from July 2019 to June 2022) Trauma severity was assessed using indirect clinical indicators, including length of hospital and ICU stay, need for surgical intervention (thoracic drainage, urgent or elective thoracotomy), presence of associated intra- and extrathoracic injuries, occurrence of complications, and in-hospital mortality.

The study was approved by the Departmental Scientific Committee of the University Clinical Centre of Kosovo during a regular weekly meeting. As this was a retrospective analysis of anonymized institutional records, no formal ethics committee reference number was issued. Patients were assessed according to their gender, age, nature of thoracic trauma, mechanism of injury, and complexity of trauma (mono- or poly-trauma). There were no specific eligibility criteria, so all records were included in the analysis.

Data were also assessed to evaluate the presence of conjoint injuries of the thoracic wall (intra- or extra-thoracic injuries), prior surgical or conservatory therapy, complications, morbidity, and mortality.

Statistical analyses were performed by SPSS 21 software (IBM, New York, USA). Descriptive and incidence data were extracted from the records and are presented as frequencies. Results are presented as mean values ± standard deviation, and analysis of categorical variables was performed using Pearson's chi-square test. Comparison between TH and non-TH groups were performed using a parametric *t*-test, and in case of abnormally distributed variables, the Mann–Whitney test was used. Normality of distribution was tested by the Shapiro–Wilk test. Statistical significance was set as $P < 0.05$ for all statistical analyses.

Results

Overall, 681 records of patients with thoracic trauma were assessed (Table 1). The mean age of all patients was 34.1 ± 17.2 years (range 1–78 years). TH was present in 20% of all traumas ($n = 136$). Concerning gender, 7 female (5.0%) and 129 (95.0%) male patients presented with trauma.

Table 1. Distribution of patients with thoracic trauma according to their records

Characteristics	*N* = 681
Gender M/F	597/84
Age [years]	34.1 ± 17.2
Age groups [years]	
0–17	70 (10.3%)
18–39	334 (49.0%)
40–59	181 (26.6%)
>60	96 (14.1%)
Blunt thoracic trauma	506 (74.3%)
Penetrating thoracic trauma	175 (25.7%)
TH	136 (20.0%)
Blunt thoracic trauma	70 (10.3%)
Traffic accidents	41 (58.6%)
Falls	17 (24.3%)
Assault	6 (8.6%)
During work	4 (5.7%)
Crushed (compression)	2 (2.9%)
Penetrating thoracic trauma	66 (9.7%)
Firearms	28 (42.4%)
Stab wounds	26 (39.4%)
Explosive ordinances	12 (18.2%)

Considering the age-groups of patients, there was a statistical significance in distribution ($P = 0.023$). The majority of trauma was documented in patients within the age group of 18–39 ($n = 334$; 49.0%). Considering the nature of thoracic injury with TH, 70 cases suffered from blunt thoracic trauma (BTT, 51.5%) and 66 cases from penetrating thoracic trauma (PTT, 48.5%) (Table 1). Also, most patients in both groups fell in the 18–39 age group. Moreover, PTT cases had higher prevalence in ages under 49 years, while BTT was more prevalent in ages above 40 years (Figure 1).

In general, TH was more frequently present in patients with PTT compared to the patients with BTT (37.7% vs. 13.8%, respectively; $P < 0.01$). Among patients with TH accompanied by BTT ($n = 70$), the most common associated injuries were rib fractures in 45 patients (64.3%), pneumothorax in 31 patients (44.3%), and thoracic wall injuries in 18 patients (25.7%) (Table 2). In cases of TH occurring with PTT ($n = 66$), pneumothorax was present in 36 patients (54.5%), rib fractures in 23 patients (34.8%), intrapulmonary hematoma in 12 patients (18.2%), and corpus alienum thoracis in 11 patients (16.7%) (Table 3).

Eleven urgent thoracotomies were performed to resolve intrathoracic bleeding due to PTT. Conjoint extrathoracic injuries accompanied TH in the locomotor apparatus/upper extremities in 20.6%, in the head in 19.1%, in the lower extremities in 8.8%, as neurotrauma in 5.9%, and in specific organs in 5.1%. Splenectomy was

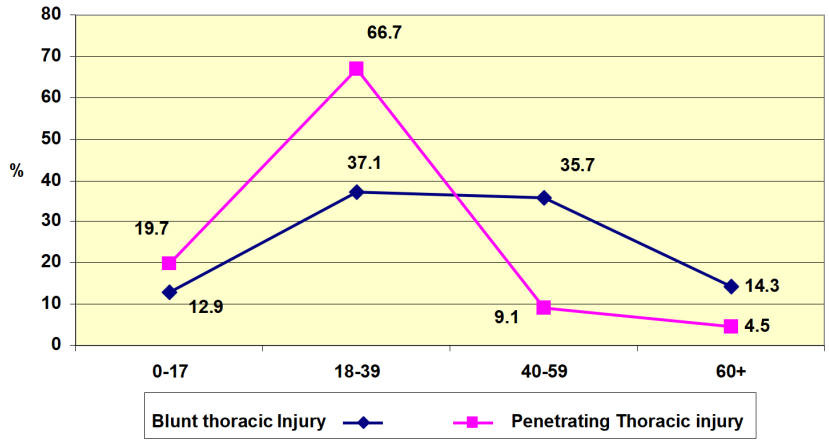

Figure 1. The age distribution of blunt and penetrating thoracic injuries

Table 2. Joint thoracic wall and intrathoracic injuries in patients with TH and blunt thoracic trauma

Type of injury	Joint injuries of TH ($n=70$)
Bilateral hemopneumothorax	1 (1.4 %)
Bilateral hemothorax	1 (1.4 %)
Bilateral pneumothorax	3 (4.3 %)
Pneumothorax	31 (44.3%)
Hemothorax solitary	7 (10.0%)
TH and injuries of thoracic wall	18 (25.7%)
Hemopericardium	3 (4.3%)
Pericardial tamponade	2 (2.9%)
Intrapulmonary hematoma	2 (2.9%)
Fractura claviculae	3 (4.3%)
Fractura scapulae	2 (2.9%)
Fractura costae simplex	11 (15.7%)
Fractura costae duplex	3 (4.3%)
Fractura costae≤3	13 (18.6%)
Fractura costae≥4 or flail chest (complex injury)	14 (5.7%)
Fractura serica costarum bill.	4 (5.7%)
Laceratio a. thoracicae internae	1 (1.4%)
Blunt injuries of lung	2 (2.9%)
Diaphragmatic rupture, right side	2 (2.9%)

Table 3. Joint thoracic wall and intrathoracic organs injuries in patients with TH and penetrating thoracic trauma

Type of injury	Joint injuries of TH ($n=66$)
Pneumothorax	36 (54.5%)
Fractura costae simplex	9 (13.6%)
Fractura costae duplex	4 (6.1%)
Fractura costarum	3 (4.5%)
Fractura costae≥4 or flail chest (complex injury)	14 (5.7%)
Fractura costarum serica bill.	1 (1.5%)
Fractura claviculae	2 (3.0%)
Fractura sternii	2 (3.0%)
Corpus alienum thoracis	11 (16.7%)
Injury of vertebral column	1 (1.5%)
Laceration of intercostal arteries	3 (4.5%)
Lung parench. injury or intrapulmonary hematoma	12 (18.2%)
Incapsulated pleural hematoma	1 (1.5%)
Lesio pericardii et myocardii	1 (1.5%)
Lesion of pulmonary vessels - intrapericardial	1 (1.5%)
Lesio auriculae cordis	3 (4.5%)
Non-specified injury of thoracic wall	12 (18.2%)

Table 4. Comparison of severity indicators between patients with and without traumatic hemothorax

Indicator	TH group ($n=136$)	Non-TH group ($n=545$)	*P*-value
Mortality	1.5%	0%	NS
Length of stay (days)	20.6±17.4	9.4±10.4	<0.001
Complications	21.3%	0%	<0.05

performed in two patients, and two others underwent nephrectomy. The most common complications were the presence of intrapulmonary hematoma in 14 patients (10.3%), posttraumatic empyema in four patients (2.9%), fibrothorax in five patients (3.7%), residual hemothorax in three patients (2.2%), and intrapleural adhesions in three patients (2.2%). Two (1.5%) patients died.

Definitive conservative management was provided to 113 patients (83.1%). This included observation and pain control in 14 patients (10.3%), thoracentesis in 17 patients (12.5%), and thoracic drainage in 82 patients (60.3%). Definitive surgical intervention was carried out in 23 patients (16.9%), consisting of urgent thoracotomy in 11 patients (8.1%), elective thoracotomy in three patients (2.2%), and thoracotomy with decortication in nine patients (6.6%). The data were statistically significant ($P<0.01$). The most frequent indications for decortication were fibrothorax (five cases) and encapsulated hemothorax (two cases). Concerning the nature of the injury, five patients (55.5%) had blunt injuries, while four patients (44.5%) had penetrating injuries. Early decortication was done in only one case, while late decortication was done in the other eight cases. Late decortication was made after two years in one case.

Fatality was higher among patients with TH compared to those without hemothorax (1.5% vs. 0%) although the

difference did not reach statistical significance (Table 4). Patients with TH had a significantly longer hospital stay compared with patients without hemothorax. The mean hospitalization stay of patients with TH was 20.6 ± 17.4 days; meanwhile, in the case of patients without TH, hospital stay was 9.4 ± 10.4 days ($P < 0.001$).

Post-traumatic complications, including intrapulmonary hematoma, empyema, fibrothorax, and residual hemothorax, were observed exclusively in patients with TH, whereas no comparable pleural complications were recorded in patients without hemothorax (Table 4).

Discussion

The present study demonstrated that TH is a frequent complication of thoracic trauma and is associated with increased injury severity. In our cohort, hemothorax occurred in 20.0% of patients with thoracic trauma and was associated with longer hospitalization, higher rates of associated injuries, need for invasive interventions, and postoperative complications. These findings support the role of TH as a clinically relevant indicator of trauma severity.

Thoracic trauma accounts for approximately 10–15% of all traumatic injuries and contributes significantly to trauma-related mortality (10). Rib fractures, frequently accompanying thoracic trauma, are well known to increase morbidity and mortality, particularly when multiple ribs are involved (10). In our retrospective analysis of 681 patients, TH was identified in 136 patients (20.0%), which is comparable with previously published institutional studies.

Blunt thoracic trauma was more common than penetrating trauma in our population, accounting for 74% of all thoracic injuries, a finding consistent with reports from European trauma centers (11). Motor vehicle accidents were the leading cause of blunt trauma, followed by falls from height, while penetrating injuries were predominantly caused by firearms and stab wounds. The distribution of injury mechanisms and etiologies in our cohort closely mirrors those reported in prior studies (12–15), suggesting that our patient population is representative of contemporary civilian thoracic trauma.

In our study, the occurrence of hemothorax was not statistically dependent on the mechanism of injury, as it was observed almost equally in blunt and penetrating trauma. This contrasts with some reports suggesting a higher incidence of hemothorax following penetrating injuries (16,17), but aligns with other studies reporting comparable rates between trauma types. Bilateral hemothorax was rare in our cohort, consistent with previous literature (16). Importantly, hemothorax following blunt trauma was strongly associated with the presence and number of rib fractures, as well as concomitant pneumothorax. This association has been well documented and reflects the increased energy transfer and chest wall instability seen in blunt trauma (12,18). In contrast, hemothorax following penetrating trauma was not related to rib fracture burden, likely due to the localized nature of penetrating injuries. Extrathoracic injuries, particularly involving the locomotor system and head, were common among patients with hemothorax, further supporting its association with more severe trauma.

The majority of patients with TH were successfully managed conservatively, most commonly with tube thoracostomy, which was required in over 60% of cases. These rates are consistent with previously reported series (13–15). Urgent thoracotomy was necessary in a minority of patients (8.1%), predominantly following penetrating trauma, which aligns with published indications and frequencies for surgical intervention (19).

Complications such as intrapulmonary hematoma, empyema, fibrothorax, and retained hemothorax were observed exclusively in patients with hemothorax, highlighting its clinical relevance. Delayed or retained hemothorax increases the risk of infection and fibrothorax, explaining the need for decortication in selected cases. In our cohort, decortication was performed mainly for fibrothorax and organized hemothorax, with timing consistent with recommended surgical practice (20). Patients with TH experienced significantly longer hospital stays compared to patients without hemothorax, reflecting increased injury severity and treatment complexity. Although overall mortality was low, deaths occurred only in the hemothorax group. These findings are consistent with literature demonstrating a linear relationship between hemorrhage volume, need for operative intervention, and mortality risk (21–23). Early recognition and appropriate management remain critical to reducing adverse outcomes.

This study had several limitations. Its retrospective design and single-center nature may limit generalizability. Data were restricted to available institutional records, and standardized trauma severity scores were not available. Additionally, long-term follow-up and post-discharge outcomes were not assessed. Nevertheless, the inclusion of all consecutive patients over a three-year period minimizes selection bias and provides a reliable overview of TH incidence and clinical impact in our setting.

Conclusion

Traumatic hemothorax is a common and clinically significant complication of thoracic trauma, associated with increased injury severity, longer hospitalization, higher complication rates, and greater need for invasive treatment. Recognition of hemothorax as an indicator of trauma severity may aid in risk stratification, early intervention, and optimization of patient management. Further multicenter prospective studies are warranted to validate these findings and refine severity assessment strategies.

Acknowledgments

The authors acknowledge the support of the Department of Thoracic Surgery and the Intensive Care Unit of the University Clinical Centre of Kosovo for providing access to clinical records and supporting this retrospective analysis.

Authors' Contribution

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Competing Interests

None.

Ethical Approval

This study was approved by the Departmental Scientific Committee of the University Clinical Centre of Kosovo. As this was a retrospective analysis of anonymized institutional records, no formal ethics committee reference number was issued.

Funding

None.

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