

Retrospective Analysis of 221 Patients with Thoracic Trauma: A Single-Center Experience

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Abstract

Background: Thoracic trauma accounts for one-quarter of all trauma cases. When pulmonary and cardiovascular structures are affected, high mortality rates are observed. This study aimed to conduct a comprehensive analysis of patients who sustained thoracic trauma. In addition, the study sought to evaluate the impact of injury types and treatment processes on patient outcomes.

Methods: This retrospective study was conducted at a single center in Turkey between December 2022 and December 2024. Adult patients (≥ 18 years) with thoracic trauma were included. Demographic features, injury types, treatment modalities, and outcomes were analyzed.

Results: A total of 221 patients with thoracic trauma were evaluated. The most common mechanisms of trauma were falls ($n=94$, 42.5%) and motor vehicle accidents ($n=94$, 42.5%). Rib fractures were the most frequently detected injury ($n=154$, 53.7%), and conservative treatment was the most commonly preferred approach ($n=189$, 85.5%). Patients with rib fractures had significantly longer the intensive care unit (ICU) and overall hospital stay durations ($Z=-2.435$, $p=0.015$ and $Z=-2.979$, $p=0.003$). The number of rib fractures was significantly higher in patients who underwent tube thoracostomy compared to those managed conservatively ($t=-44.931$, $p=0.011$). Additionally, both ICU and hospital stay duration were shorter in these patients ($Z=-2.531$, $p=0.011$; $Z=-7.234$, $p<0.01$). Sixty-four patients (29%) had concomitant extrathoracic injuries. Among these, extremity injuries were the most common ($n=32$, 33.7%). Patients with extrathoracic trauma had a higher number of rib fractures and significantly longer ICU stay duration and hospital stay duration ($Z=-3.361$, $p=0.001$; $Z=-6.717$, $p<0.05$; $Z=-6.843$, $p<0.05$). Mortality was observed in 10 patients (4.5%).

Conclusion: The development of complications such as hemothorax and pneumothorax is associated with prolonged ICU and hospital stays. Inadequate management of extrathoracic injuries accompanying thoracic trauma may contribute to increased mortality rates.

Keywords: Extrathoracic injury, Hemothorax, Pneumothorax, Rib fracture, Thoracic trauma.

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INTRODUCTION

Trauma is the third leading cause of death across all age groups, following cardiovascular diseases and cancer. It is the most common cause of death during the first four decades of life (1). In both developed and developing countries, trauma is considered a significant public health problem, particularly among the young population, due to its contribution not only to morbidity and mortality but also to loss of productivity (2,3). Thoracic trauma accounts for nearly one-quarter of all trauma cases (2–4).

Thoracic trauma is among the three most frequently encountered types of trauma in many countries (2). Involvement of pulmonary and cardiovascular structures in such injuries is associated with high mortality rates (2,4,5). Thoracic trauma is responsible for approximately 25% of all trauma-related deaths and represents the third most common cause of death in patients with multiple trauma (1,4,5). It is well established that most trauma-related deaths occur within the first 24 hours following injury (5). Therefore, accurate and timely diagnosis is critical. In addition, the implementation of effective, multidisciplinary treatment approaches plays a crucial role in achieving better clinical outcomes (2,6,7).

The primary aim of this retrospective study is to perform a comprehensive analysis of patients who sustained thoracic trauma. The secondary objective is to investigate the impact of injury types and treatment processes on clinical outcomes.

MATERIALS AND METHODS

This study was conducted between December 2022 and December 2024 at a single center located in a province of Turkey. Patients with thoracic trauma who were followed by thoracic surgeons were retrospectively evaluated. The study included patients aged 18 years and older, who had thoracic trauma and complete data available in the hospital's information system. Patients under the age of 18, those without thoracic trauma, those with uncertain diagnoses, or those with incomplete data in the hospital information system were excluded from the study. Ethical approval for the study was obtained from the Ethics Committee of Kırıkkale University (Date: 12.03.2025, Decision No: 2025.02.28). Written informed consent was obtained from the patients and/or their legal representatives. The study was conducted in accordance with the World Medical Association Declaration of Helsinki.

Demographic data, trauma causes, trauma mechanisms, assessment results, radiological imaging reports, thoracic

and extrathoracic injuries, treatment methods, intensive care unit (ICU) stay durations, hospital stay durations, and mortality were recorded from the hospital's information system. No trauma scoring system was used. Patients with fewer than three rib fractures and no other thoracic injuries were observed in the emergency department for four hours. Additionally, patients with only thoracic injuries, who had sustained the trauma more than 48 hours prior and did not require surgical intervention, were discharged from the emergency department. For patients with rib and/or sternum fractures, the minimum hospital stay was determined to be 48 hours. In cases where hemothorax, pneumothorax, or pneumomediastinum were detected, patients were observed for a minimum of 72 hours, depending on the need for surgical intervention. Patients discharged from the emergency department were routinely prescribed a combination of etodolac and paracetamol for analgesia. In cases of clinical necessity, such as contusions or tissue lacerations, antibiotics including amoxicillin-clavulanic acid, ciprofloxacin, and metronidazole were administered either individually or in combination. Tetanus vaccination was given when indicated.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics Standard Concurrent User V26 (IBM Corp., Armonk, New York, USA). Descriptive statistics are presented as mean $\pm$ standard deviation for data with normal distribution, and as median, interquartile range (IQR), minimum (min), and maximum (max) values for data without normal distribution. The normality of numerical variables was assessed using the Shapiro-Wilk test. Homogeneity of variances was tested using Levene's test. For the comparison of numerical variables between two categorical groups, independent t-tests were used for data with normal distribution, and the Mann-Whitney U test was applied for data without normal distribution. For comparing numerical variables between more than two categorical groups, one-way analysis of variance (ANOVA) was used for normally distributed data, and the Kruskal-Wallis test was applied for non-normally distributed data. In case of a statistically significant Kruskal-Wallis result, pairwise comparisons were performed using the Dunn-Bonferroni test. For comparisons of categorical variables, the Exact method-based Chi-square test was used. If the Chi-square test yielded a significant result, subgroup analyses were conducted using the Bonferroni-corrected two-propor-

tion z-test. A p-value of <0.05 was considered statistically significant for all comparisons.

RESULTS

General Characteristics of the Patients

A total of 221 patients were included in the study, comprising 75 females (33.9%) and 146 males (66.1%). The mean age of the patients was 54.3 ± 1.1 years. The most

common mechanisms of trauma were falls (n=94, 42.5%) and motor vehicle accidents (n=94, 42.5%). Evaluation of thoracic trauma distribution revealed that rib fractures were the most frequently observed injury (n=154, 53.7%). This was followed by superficial chest wall injuries (n=41, 14.3%) and hemothorax (n=31, 10.8%), respectively (Table 1). Rib fractures were most commonly located in the right hemithorax (n=76, 46.9%) (Figure 1A). The median number of rib fractures was two (min:1 – max:14, IQR:4).

Table 1. General information about patients

	n (%)
Gender	
Female	75(33.9)
Male	146(66.1)
Age, (year) $\bar{x} \pm SD$	54.3 ± 1.1
Mechanism of injury	
Fall	94(42.5)
Motor vehicle accident	94(42.5)
Assault	24(10.9)
Animal-related injury	3(1.4)
Gunshot wound	3(1.4)
Stab wound	3(1.4)
Type of Thoracic Injury	
Rib Fracture	154(53.7)
Superficial Thoracic Wall Injury	41(14.3)
Hemothorax	31(10.8)
Pneumothorax	28(9.8)
Hemopneumothorax	11(3.8)
Sternal Fracture	10(3.5)
Pulmonary Contusion	7(2.4)
Pneumomediastinum	4(1.4)
Flail Chest	1(0.3)
Treatment	
Conservative Management	189(85.5)
Tube Thoracostomy	21(9)
Extremity Surgery	10(4.5)
Spinal Surgery	1(0.5)
Intensive Care Unit Admission	
Yes	30(13.6)
No	191(86.4)
Intensive Care Unit Length of Stay, (day) M (min-max), IQR	3(1-12), 4
Hospital Length of Stay, (day) M (min-max), IQR	0(0-20), 3
Mortality	
Yes	10(4.5)
No	211(95.5)
n: number of patients, %: percentage of patients, x: mean, SD: standart deviation, M: median, min: minimum value, max: maximum value, IQR: inter quantile range.	

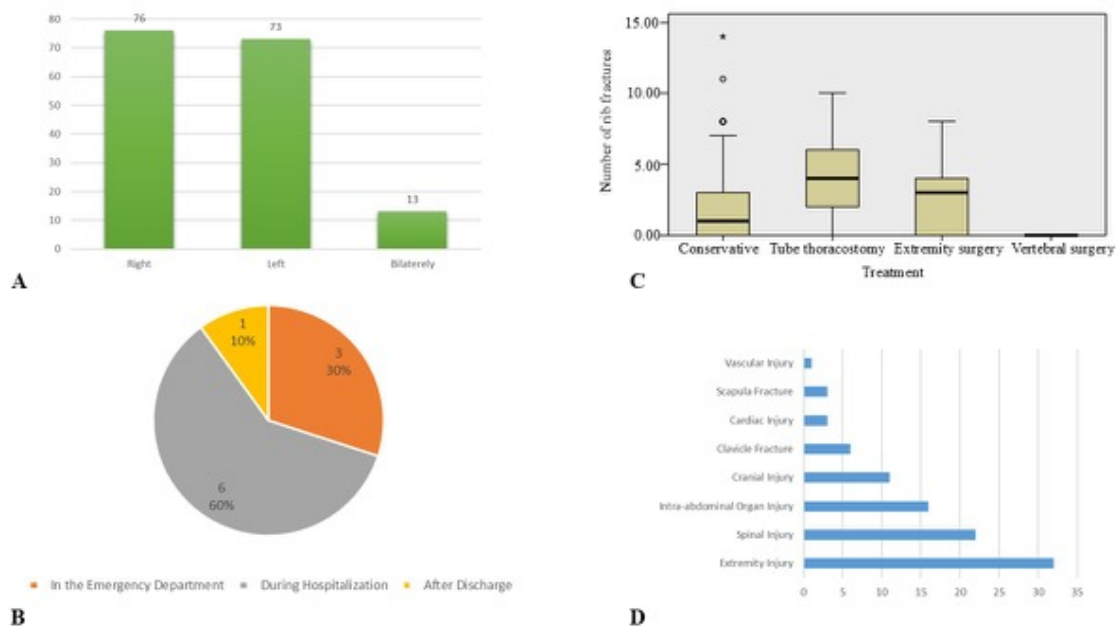


Figure 1: A) Side of rib fractures B) Mortality distribution C) Number of rib fractures according to treatment types D) Extrathoracic injuries

When treatment approaches following trauma were analyzed, conservative management was the most frequently preferred modality ($n=189$, 85.5%), followed by tube thoracostomy ($n=21$, 9%). None of the patients required advanced thoracic surgical procedures such as thoracotomy, sternotomy, or video-assisted thoracoscopic surgery (VATS). Eleven patients (5%) underwent non-thoracic surgical procedures. A total of 30 patients (13.6%) required ICU admission. Mechanical ventilation was required in 11 of these patients (36.7%). The median ICU stay was three days (min:1 – max:12, IQR:4), while the median hospital stay was zero days (min:0 – max:20, IQR:3). Trauma-related mortality occurred in ten patients (4.5%) (Table 1). Of these, six patients (60%) died during hospitalization, three (30%) in the emergency department, and one (10%) within the first ten days after discharge (Figure 1B). Of the 10 total deaths, only one was directly attributable to thoracic trauma (a gunshot wound). The remaining nine deaths occurred in patients with significant extrathoracic injuries or related complications: three in the emergency department, five during hospitalization, and one within ten days after discharge due to pulmonary thromboembolism.

Analysis of Patients with Rib Fractures

Patients with rib fractures had significantly longer ICU and hospital stays ($Z=-2.435$, $p=0.015$) ($Z=-2.979$, $p=0.003$).

The number of rib fractures was significantly higher among patients admitted to the ICU ($Z=-4.598$, $p<0.05$). There was no statistically significant association between the presence of rib fractures and overall mortality or the timing of mortality ($p>0.005$) ($Z=4.575$, $p=0.167$). Patients who underwent tube thoracostomy had a significantly higher number of rib fractures compared to those managed conservatively ($t=-44.931$, $p=0.011$).

Analysis of Patients Managed Conservatively

When patients managed conservatively were compared with those receiving other treatment modalities, no significant differences were found in terms of trauma mechanisms or mortality rates ($t=6.969$, $p=0.182$) ($p=0.162$). The number of rib fractures was significantly lower in the conservatively managed group ($Z=-2.667$, $p=0.008$) (Figure 1C). In addition, the incidence of extrathoracic trauma and ICU admissions was significantly lower in this group ($p<0.01$) ($p=0.021$). Both ICU length of stay and hospital length of stay were significantly shorter among conservatively treated patients ($Z=-2.531$, $p=0.011$) ($Z=-7.234$, $p<0.01$).

Analysis of Patients Who Underwent Tube Thoracostomy

Among the types of thoracic trauma, tube thoracostomy was most frequently performed in patients with pneu-

mothorax ($t=48.578$, $p<0.01$). These patients had a significantly higher number of rib fractures compared to those who did not undergo the procedure ($Z=-3.101$, $p=0.002$). Although the rate of ICU admission was lower among patients who underwent tube thoracostomy ($p=0.013$), their ICU length of stay was significantly longer ($Z=-2.703$, $p=0.007$). Likewise, the hospital stay was also prolonged in this group ($Z=-5.003$, $p<0.001$). Among the patients who underwent tube thoracostomy, one developed a prolonged air leak and another developed empyema. Both conditions resolved spontaneously without the need for additional surgical interventions.

Analysis of Patients with Extrathoracic Injuries

A total of 64 patients (29%) had extrathoracic injuries. The most common type of extrathoracic injury was extremity trauma ($n=32$, 33.7%) (Figure 1D). The presence of extrathoracic trauma was significantly associated with bilateral rib fractures, ICU admission, and mortality ($t=10.607$, $p=0.004$) ($t=46.874$, $p<0.05$) ($t=10.792$, $p=0.01$). Patients with extrathoracic trauma had a higher number of rib fractures, as well as significantly longer ICU and hospital stays ($Z=-3.361$, $p=0.001$) ($Z=-6.717$, $p<0.05$) ($Z=-6.843$, $p<0.05$) (Table 2).

Table 2. Analysis of Patients with Extrathoracic Injuries

	Extrathoracic injury			
	Yes n=64(%29)	No n=157(%71)	Test value	<i>p</i>
Gender				
Female	15(23.4)	60(38.2)	3.795	0.051
Male	49(76.6)	97(61.8)		
Age, (year) $\bar{x} \pm$ SD	52.3 $\pm$ 16.9	55.1 $\pm$ 17.8	-1.298	0.194
Rib fracture				
Yes	48(75)	111(70.7)	0.231	0.631
No	16(25)	46(29.3)		
Number of rib fracture M (min-max), IQR	2.5(0-14),4.7	1(0-10),3	-3.361	0.001
Rib fracture side				
Right	17(35.4)	59(51.8)	10.607	0.004
Left	22(45.8)	51(44.7)		
Bilaterely	9(18.8)	4(3.5)		
Intensive Care Unit Admission				
Yes	25(39.1)	5(3.2)	46.874	<0.05
No	39(60.9)	152(96.8)		
Intensive Care Unit Length of Stay, (day) M (min-max), IQR	0(0-12),2	0(0-5),0	-6.717	<0.05
Hospital Length of Stay, (day) M (min-max), IQR	3(0-20),6.7	0(0-10),2	-6.843	<0.05
Mortality				
Yes	8(12.5)	2(1.3)	10.792	0.010
No	56(87.5)	155(98.7)		
n: number of patients, $\bar{x}$: mean, SD: standart deviation, M: median, min: minimum value, max: maximum value, IQR: interquantile range.				

DISCUSSION

Thoracic trauma most commonly results from motor vehicle accidents, falls, and acts of violence (2–4,8). Blunt thoracic trauma is particularly associated with motor vehicle accidents as the predominant cause. These injuries are generally more prevalent among male patients. Furthermore, thoracic injuries due to acts of violence have also been reported more frequently in males (2,8–11). The data from our study are largely consistent with the existing literature. Thoracic trauma was most commonly observed in male patients, with traffic accidents and falls ranking as the leading causes. Some studies place falls as the second most common cause of blunt thoracic trauma after traffic accidents, attributing this to advanced age (2,8,11,12). The mean age of our patients was close to the upper limit of the middle-aged group, and falls—alongside traffic accidents—were identified as the most frequent causes, leading us to make a similar interpretation.

Thoracic injuries may range from superficial abrasions to life-threatening injuries involving vital organs (2). Rib fractures are the most commonly encountered type of thoracic injury (2,4,8,11,13). These fractures are generally managed conservatively; however, in the presence of complications such as pneumothorax or hemothorax, interventions such as tube thoracostomy or open surgery may be required (1,2,14,15). In our study, rib fractures were also the most frequently identified thoracic injury. Patients with rib fractures had longer ICU and hospital stays, although no statistically significant association with mortality was observed. Additionally, patients who underwent tube thoracostomy had a higher number of rib fractures compared to those managed conservatively.

Approximately 20.4% of patients with multiple traumas present with rib fractures. Accurate diagnosis and evaluation of rib fractures in conjunction with adjacent structures are crucial in the management of thoracic trauma (1,2,16,17). Mortality related to rib fractures usually occurs in the presence of concomitant extrathoracic injuries (14). Although isolated rib fractures are generally not fatal, fractures involving the first rib are associated with a mortality rate of approximately 36% due to potential tracheobronchial, vascular, and cardiac injuries. Fractures of the mid-rib region (4th to 9th ribs) are typically linked with pneumothorax and hemothorax. Fractures of the last two ribs may be associated with intra-abdominal organ injuries (1,16,17). It should also be noted that bilateral rib fractures are a known risk factor for increased mortality

(18,19). In our study, a greater number of rib fractures were observed in patients with extrathoracic injuries. Patients with bilateral rib fractures had a higher requirement for ICU admission, and this condition was found to be associated with increased mortality. Therefore, we believe that rib fractures in thoracic trauma patients should be closely monitored for complications. Accurate diagnosis and comprehensive evaluation are particularly important due to the potential for associated extrathoracic injuries.

Fewer than 10% of patients with blunt thoracic trauma and 15–30% of those with penetrating thoracic trauma reportedly require surgical intervention (1,20). Conservative treatment typically involves pain management and physiotherapy (1,2,14,15,21). Currently, a “selective conservative approach” remains a valid and widely adopted strategy in the management of thoracic trauma, especially in developing countries (21,22). In our study, the majority of patients were treated conservatively. Tube thoracostomy was the second most commonly performed intervention. No patients required open thoracic surgery or other thoracic surgical procedures. Patients managed conservatively had fewer rib fractures, along with shorter ICU and hospital stays. Among patients who underwent tube thoracostomy, pneumothorax was the most common indication. Although a relatively small number of these patients required ICU admission, both their ICU and hospital stays were prolonged. These findings reminded us of the adage, “Decision is more important than incision.”

In our cohort, hemothorax and hemopneumothorax were among the most frequently encountered thoracic complications following trauma. Consistent with current literature, the majority of these patients were managed with tube thoracostomy, which remains the standard initial intervention for draining intrapleural blood and relieving respiratory compromise (23,24). The decision to perform tube thoracostomy was based on clinical and radiological findings, including the extent of hemothorax on imaging and the presence of respiratory distress. Surgical intervention (e.g., thoracotomy or VATS) was not required in our series, as none of the patients exhibited ongoing bleeding exceeding 1500 mL initially or >200 mL/hour for 3 consecutive hours—common thresholds for operative management (25). The absence of surgical procedures in these cases may also reflect institutional practice patterns favoring conservative management unless hemodynamic instability or radiological progression occurs. Our findings support the use of a selective approach, reserving surgical intervention for

patients who fail initial conservative management or present with massive or retained hemothorax (24,26).

Thoracic trauma is frequently accompanied by extrathoracic injuries, which complicate patient management and may significantly impact morbidity and mortality. Therefore, a systematic and multidisciplinary approach is essential in both diagnosis and treatment (8,16, 27-31). One study reported a 17% rate of extrathoracic injuries accompanying thoracic trauma (27), while another study reported a rate of 42% (28). Although the types and frequencies of extrathoracic injuries vary among studies, intra-abdominal organ injuries, spinal injuries, cranial trauma, and extremity injuries are commonly encountered (8,16,28-31). In our study, the rate of extrathoracic injuries was 29%, with extremity trauma being the most frequent. Patients with extrathoracic injuries had longer ICU and hospital stays. Furthermore, except for one case, all instances of in-hospital mortality in our study were primarily attributable to extrathoracic injuries. For this reason, we believe thoracic surgeons must remain vigilant and attentive to potential extrathoracic injuries. Given their impact on both hospital length of stay and mortality, we consider a multidisciplinary approach to be of critical importance in such cases.

Limitations

The main limitations of this study are its retrospective design, single-center setting, and relatively small sample size. In addition to these, there are certain limitations shared with similar studies (5). These include the inclusion of only patients aged 18 years and older, as well as the lack of data on patients who died at the scene or during transport to the hospital following trauma. This condition is expected to have a potential impact on mortality rates.

Thoracic trauma continues to represent a substantial clinical challenge due to its association with high morbidity and potential mortality. Our findings highlight that while conservative management remains appropriate for most patients, particular attention must be paid to complications such as pneumothorax and hemothorax, which significantly prolong hospital and ICU stays. Moreover, the presence of concomitant extrathoracic injuries—often overlooked—plays a critical role in determining prognosis and should prompt early multidisciplinary evaluation. Thoracic surgeons, therefore, must maintain a high index of suspicion for associated injuries and coordinate care accordingly to improve patient outcomes.

REFERENCES

- Dogrul BN, Kiliccalan I, Asci ES, Peker SC. Blunt trauma related chest wall and pulmonary injuries: An overview. *Chin J Traumatol*. 2020;23(3):125-138.
- Gonçalves HS, Rezende ML, Cunha IVDS, Cesar AS, Cabral FLD, Trindade LMDF. Clinical-epidemiological evaluation of victims of thoracic trauma in a reference hospital in Aracaju-SE. *Rev Col Bras Cir*. 2023 Nov 13;50: e20233542.
- Beshay M, Mertzluft F, Kottkamp HW, Reymond M, Schmid RA, Branscheid D, Vordemvenne T. Analysis of risk factors in thoracic trauma patients with a comparison of a modern trauma centre: a mono-centre study. *World J Emerg Surg*. 2020;15(1):45.
- Edgecombe L, Sigmon DE, Galuska MA, Angus LD. Thoracic Trauma. 2023 May 23. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-.
- Benhamed A, Ndiaye A, Emond M, Lieutaud T, Boucher V, Gossione A, Laumon B, Gadegebeku B, Tazarourte K. Road traffic accident-related thoracic trauma: Epidemiology, injury pattern, outcome, and impact on mortality-A multicenter observational study. *PLoS One*. 2022;17(5): e0268202.
- Kibu OD, Nguefack-Tsague G, Maqungo S, Ngeekeng S, Dissak Delon FN, Touko D, Oke R, Umoh C, Mfondoum R, Christie SA, Juillard C, Chichom-Mefire A. Factors associated with mortality in thoracic trauma patients in Cameroon. *Heliyon*. 2024;11(1): e41499.
- Bates-Powell J, Basterfield D, Jackson K, Aujaeyeb A. Physician-Led Thoracic Trauma Management in a Specialist Emergency Care Centre. *J Clin Med*. 2021;10(24):5806.
- Haberal MA, Şengören Dikiş Ö, Akar E. Toraks Travması: 440 Olgunun Değerlendirilmesi. *Kafkas Journal of Medical Sciences*. 2019;9(2):97-102.
- Pertiwi ND, Muthmainnah N, Rizkianti RA, Wulandari EA. Changes in causes and outcomes of thoracic trauma cases during the COVID-19 pandemic: Literature review. *Magna Sci Adv Res Rev*. 2024;12(2):48-52.
- Thoracic trauma review. Seven Editora eBooks; 2023. Available from: <https://doi.org/10.56238/colleinternhealthscienv1-076>
- Altunkaya A, Aktunç E, Kutluk Cevat A, Büyükkateş M, Demircan N, Demir Semra A, et al. Analysis of 282 patients with thoracic trauma. *Türk Gogus Kalp Dama*. 2007; 15:127-132.
- Çetin M, Solak N, Özdemir Çiflik B, Türk İ, Ermancik SS, Aydoğdu K. Thoracic trauma in the geriatric population and possible preventive measures: a retrospective analysis of 261 cases. *Türk J Med Sci*. 2024;54(5):1013-1020.
- Mazcuri M, Ahmad T, Abid A, Thapaliya P, Ali M, Ali N. Pattern and Outcome of Thoracic Injuries in a Busy Tertiary Care Unit. *Cureus*. 2020;12(10):e11181.
- Zargar M, Khaji A, Karbakhsh Davari M. Thoracic injury: a review of 276 cases. *Chin J Traumatol*. 2007 Oct;10(5):259-62. PMID: 17919361.
- Aydogdu K, Ciflik BO, Cetin M, Ermancik SS, Sural F, Buyukevli M, Kaplan T. The analysis of earthquake victims with thoracic trauma: Kahramanmaraş earthquake. *Indian J Surg*. 2024; 86:925-30.
- Kundu R, Suklabaidya A, Thengal MH. A study on the different clinical presentation patterns of blunt thoracic trauma and associated morbidity following road traffic accident in a tertiary care centre. *Int J Adv Res*. 2024;12(9):752-773.
- Yüksel HS, Aslaner MA, Coşkun Yaş S, Karakök B, Demircan A. Rib Fractures in Trauma Patients: Prevalence, Associated Injuries, and Mortality Trends. *Cureus*. 2024;16(9): e70137.
- Baram A, Kakamad FH. Bilateral thoracic trauma; presentation and management, a case series. *Ann Med Surg (Lond)*. 2019; 43:25-28.
- Novakov IP, Timonov P, Stefanov Ch, Petkov G. Rib fractures in blunt chest trauma – morbidity and mortality: self-experience study. *Trakia J Sci*. 2014;12(3):272-6.

20. Ak AK, Anjum F. Tracheobronchial Tear. 2023 Jul 17. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan–.
21. Adam B, Szentkereszty Z, Szentkereszty Z, Vass KK, Urban F. Treatment of blunt thoracic trauma in a Level 1 Trauma Center. *Magy Traumtol Ortop Kezseb Plasztikai Seb.* 2024;67(1):1–10.
22. Kong VY, Oosthuizen GV, Clarke DL. Selective conservatism in the management of thoracic trauma remains appropriate in the 21st century. *Ann R Coll Surg Engl.* 2015;97(3):224–8.
23. Porcel JM. Chest Tube Drainage of the Pleural Space: A Concise Review for Pulmonologists. *Tuberc Respir Dis (Seoul).* 2018;81(2):106–115.
24. Kirkpatrick AW, Sirois M, Laupland KB, Liu D, Rowan K, Ball CG, et al. Hand-held thoracic sonography for detecting post-traumatic pneumothoraces: the Extended Focused Assessment with Sonography for Trauma (EFAST). *J Trauma.* 2004;57(2):288–95.
25. Uribe RA, Pachon CE, Frame SB, Enderson BL, Escobar F, Garcia GA. A prospective evaluation of thoracoscopy for the diagnosis of penetrating thoracoabdominal trauma. *J Trauma.* 1994;37(4):650–4.
26. DuBose J, Inaba K, Demetriades D, Scalea TM, O'Connor J, Menaker J, et al. Management of post-traumatic retained hemothorax: a prospective, observational, multicenter AAST study. *J Trauma Acute Care Surg.* 2012;72(1):11–22.
27. Singh AK, Prasad G, Mishra P. The Impact of Thoracic Trauma on Morbidity and Outcomes: A Six-Year Experience From a Tertiary Care Level 1 Center. *Cureus.* 2024;16(11):e73580.
28. Gupta A, Sharma A, Suthar N, Giriya H, Verma V, Jindal S. Epidemiological pattern of blunt trauma chest in Western India. *Apollo Medicine.* 2020;17(2):66.
29. Sharma RG, Kumar Sinha P, Sridhar R, Singh N, Devi D, Shankar A, et al. Prospective Study of Blunt Trauma Chest. Vol. 12, *Indian Journal of Public Health Research & Development.*
30. Al-Saigh A, Fazili FM, Allam AR. Chest trauma in children: a local experience. *Ann Saudi Med.* 1999;19(2):143–6.
31. Bahl A, Harna B, Arya S. Epidemiology of Trauma Patients Admitted to a Trauma Center in New Delhi, India. *Indian Journal of Critical Care Medicine.* 2020;24(12):1193–7.

Abbreviations list

ICU: Intensive care unit
 IQR: Interquartile range
 min: minimum
 max: maximum

Ethics approval and consent to participate

Ethical approval for the study was obtained from the Ethics Committee of Kırıkkale University (Decision No: 2025.02.28).

Consent for publication

Informed consent for the use of clinical data for scientific purposes was obtained from all patients or their legal guardians.

Availability of data and materials

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare that there is no conflict of interest.

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Authors' contributions

Idea/Concept: KBÇ. Design: KBÇ. Control/Supervision: KBÇ, ÖA, SK. Data Collection And/Or Processing: KBÇ, ÖA, SK. Analysis and/or Interpretation: KBÇ. Literature Review: KBÇ. Writing The Article: KBÇ. Critical Review: KBÇ, ÖA, SK. References and Fundings: KBÇ. Materials: KBÇ, ÖA, SK. Other: KBÇ, ÖA, SK.

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