



## Evaluation of Thoracic Trauma in the Emergency Department

Thoracic trauma

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### Abstract

**Aim:** The aim of this study was to evaluate patients with thoracic trauma in the emergency unit, to detect life-threatening injuries, and to plan a treatment method. **Material and Method:** The patients were investigated with regard to age, gender, cause of trauma, clinical findings and level of consciousness, intra-thoracic pathologies, accompanying injuries, seasonal relations of the traumas, treatments and surgical interventions, morbidity, and mortality. **Results:** Among the 251 patients enrolled in the study, 224 (89.2%) were male and 27 (10.8%) were female; the mean age was 42.5 years (range: 6-91) among women and 36.4 years (range: 9-85) among men. The type of trauma was blunt thoracic trauma in 183 patients (72.9%) and penetrating thoracic trauma in 68 (27.1%). The most common causes of trauma were in-vehicle accidents in 82 (32.7%) and falls from heights in 56 (22.3%). Parenchymal thoracic pathologies were hemopneumothorax in 134 (53.4%) patients, pulmonary contusion in 102 (44.6%), pneumothorax in 75 (29.9%), and hemothorax in 40 (16%) patients. 232 (92.4%) of the cases were conscious, whereas 18 (7.2%) had varying levels of consciousness between somnolence and coma. The treatment methods included tube thoracostomy in 219 (87.6%) patients, thoracotomy in 16 (6.4%), and lobectomy in 1 patient. Mortality was observed in 2.4% of the cases (6 cases). **Discussion:** Since thoracic traumas may lead to mortality and can be accompanied by injuries including multiple systems, patients should be evaluated by a multidisciplinary team experienced in traumas, and treatment should begin immediately.

### Keywords

Emergency Unit; Thoracic Traumas; Traffic Accidents; First Treatment

DOI: 10.4328/JCAM.5753 Received: 05.02.2018 Accepted: 05.03.2018 Published Online: 11.03.2018 Printed: 01.09.2018 J Clin Anal Med 2018;9(5): 386-90  
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## Introduction

Traumas, which have become the most important health problems of today, are the third most common cause of death among all age groups after cardiovascular diseases and malignancies [1]. Moreover, trauma has been reported to be the most common cause of death at a young age (1-44 years of age) [2]. More than 16,000 individuals die due to traumas each year in the United States. Thoracic trauma constitutes 20-25% of these deaths [3].

Thoracic traumas are classified as blunt and penetrating traumas. Blunt traumas are generally accompanied by multiple traumas. Injuries include thoracic wall and parenchymal organ exposure. A wide spectrum of injuries are observed that vary from simple arm fractures to major vascular injuries. The etiology includes car accidents, cutting and piercing injuries, firearm injuries, falls from heights, and occupational and sports injuries. Mortality rates are lower in isolated thorax traumas, whereas they increase when accompanied by cardiovascular organ damage in particular. The time elapsed until the initial intervention is important in the treatment. Morbidity and mortality rates increase in thoracic traumas accompanied by multiple traumas. On-time and proper intervention of serious injuries at the scene of the accident, and the initial intervention at the emergency unit would decrease mortality rates significantly. With rapid and proper out-of-hospital primary intervention and patient transfer, it is believed that 30% of these deaths could be avoided [4]. The aim of this study was to compare thoracic traumas in our region, the causes of trauma, trauma-related thoracic pathologies, accompanying thoracic pathologies, treatment approaches, and the morbidity and mortality rates, with the data in the literature.

## Material and Method

Among the patients taken to the emergency unit of Dursun Odabaş Medical Center Yüzüncü Yıl University Medical Faculty with thoracic wall and pranechymal organ injury traumas and those who had been directed to the Chest Surgery department due to thoracic trauma and hospitalized at the anesthesia intensive care unit, 251 patients were retrospectively evaluated. The data of the participants were obtained from the automation system of the hospital. The patients were investigated with regard to age, gender, cause of trauma, clinical findings and consciousness level, intrathoracic pathologies, accompanying injuries, seasonal relations of the traumas, treatments and surgical interventions, morbidity, and mortality. The continuous variables were expressed as mean, median, and standard deviation; the nominal variables were expressed as numbers and percentages.

## Results

Among the 251 patients enrolled in the study, 224 (89.2%) were male and 27 (10.8%) were female; the mean age was 42.5 (range: 6-91) years among women and 36.4 (range: 9-85) among men (Figure 1).

The type of trauma was blunt thoracic trauma in 183 patients (72.9%) and penetrating thoracic trauma in 68 (27.1%). The most common causes of traumas were in-vehicle accidents in 82 (32.7%) and falls from heights in 56 (22.3%) (Table 1). Tho-

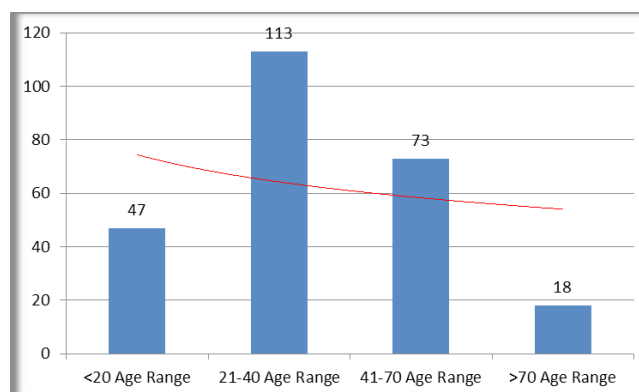


Figure 1. Distribution of thoracic trauma according to age groups

Table 1. Distribution of the etiological causes of thoracic trauma

| Trauma etiology     | Number of cases | Percentage % |
|---------------------|-----------------|--------------|
| In-car accident     | 82              | 32.7         |
| Out-of-car accident | 20              | 8            |
| Falls from heights  | 56              | 22.3         |
| CPI *               | 49              | 19.5         |
| FAI**               | 19              | 7.6          |
| Blow                | 12              | 4.8          |
| Sports injuries     | 7               | 2.8          |
| Animal injuries     | 6               | 2.4          |
| Total               | 251             | 100          |

\*Cutting and piercing injuries, \*\*Fire-arm injuries

racic wall pathologies included costal fractures in 126 (50.2%) patients; among these, 46 (18.3%) were on the right, 60 (23.9%) were on the left, and 20 (8%) were bilateral. Thoracic wall fractures included the sternum in 1 (0.4%) patient, the clavicle in 10 (4%), and the scapula in 3 (1.2%). The parenchymal pathologies of the thorax were hemopneumothorax in 134 (53.4%) patients, pulmonary contusion in 102 (44.6%), pneumothorax in 75 (29.9%), and hemothorax in 40 (16%) (Table 2).

Table 2. Post-traumatic intrathoracic pathologies

| Intrathoracic pathology | Number of cases | Percentage(%) |
|-------------------------|-----------------|---------------|
| Pneumothorax            | 75              | 29.9          |
| Hemothorax              | 40              | 16            |
| Hemopneumothorax        | 134             | 53.4          |
| Pulmonary contusion     | 102             | 44.6          |
| Pericardial tamponade   | 5               | 2             |
| Diaphragm rupture       | 6               | 2.4           |

Injuries accompanying thoracic traumas include cranial, abdominal, vertebral, and extremity pathologies (Table 3). The number of cases with intraabdominal organ injuries and vertebral fractures were observed to be 14 (5.6%) and 19 (7.6%), respectively (Figures 2, 3).

Cranial injuries included subarachnoid bleeding in 6 (2.8%) cases, subdural bleeding in 2 (0.9%), cerebral contusion in 2 (0.9%), and cranium fracture in 1 (0.4%). The number of cases with extremity fracture was 6 (2.4%). Seasonal evaluation of thoracic traumas revealed 24 cases (9.6%) in winter and 97 cases (38%) in the summer. The level of consciousness in the patients who had been admitted to the emergency unit depended on the

severity of thoracic traumas and the accompanying injuries, in particular, head traumas. 232 (92.4%) of the cases were conscious, whereas 18 (7.2%) had varying levels of consciousness between somnolence and coma. Invasive treatment methods included tube thoracostomy in 219 (87.6) patients (Figure 4). The number of exitus was 6 (2.4%) and the number of cases discharged with recovery was 243 (96.8%). One patient rejected the treatment, and one patient was referred to another healthcare center.

Table 3. Accompanying injuries to thoracic traumas

| Accompanying injury | Number of cases | Percentage (%) |
|---------------------|-----------------|----------------|
| Extremity fracture  | 6               | 2.4            |
| Abdominal injury    | 14              | 5.6            |
| Cranial injury      | 11              | 4.4            |
| Vertebral fracture  | 14              | 5.6            |
| Pelvic fracture     | 7               | 2.8            |
| Renal laceration    | 2               | 0.8            |

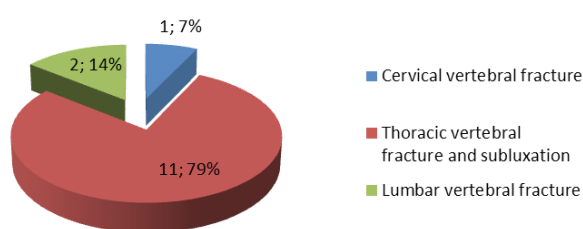


Figure 2. Accompanying abdominal injuries

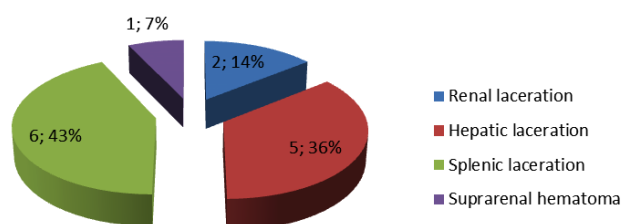


Figure 3. Vertebral fracture rates

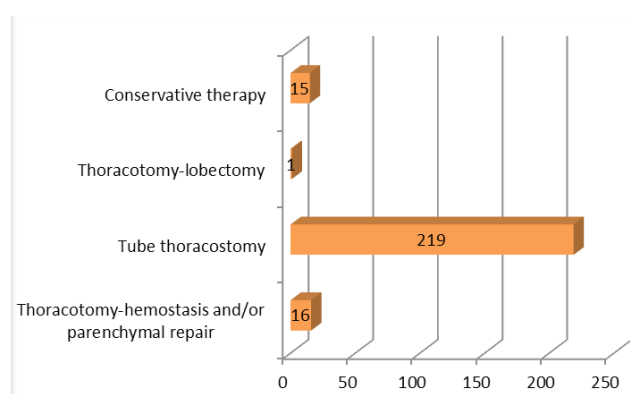


Figure 4. Treatment methods according to cases

## Discussion

Thoracic trauma is present at a significant rate of patients evaluated at the emergency unit. Approximately one third of those who are hospitalized have thoracic traumas [5].

Thoracic traumas are blunt in 70% and penetrating in 30% of the patients [6]. Studies carried out in Turkey have revealed the blunt and penetrating injury rates as follows: Çakan et al. [7]: 72% and 28%; Şentürk et al. [8]: 80% and 20%; Cangir et al. [9]: 84.21% and 15.79%; Yücel et al. [10]: 50.4% and 49.6%, respectively. In our study, 72.9% of the cases had blunt traumas, whereas 27.1% had penetrating traumas. These rates varied according to the sociocultural structure and frequency of car accidents in the regions of the centers in which the study was conducted. Our rates were similar to those in the literature.

The Major Trauma Outcome Study (MTOS) has attributed 34.7% of blunt traumas to motor-car accidents and 16.5% to falls from heights [11]. The most frequent cause of blunt trauma was car accidents with a rate of 76% in the study of İnci et al. [12]. Er et al. have reported [13] 40% car accident, 25% cutting and piercing injury, 16% firearm injury. Çobanoğlu et al. [14] have reported 399 (59.7%) blunt and 269 (40.2%) penetrating traumas among 668 patients with thoracic trauma, which included 173 patients (64.3%) with cutting and piercing injury and 96 patients (35.6%) with firearm injury. Kandış et al. [15] have reported 83% cutting and piercing injury and 17% firearm injuries among 215 cases with penetrating thoracic trauma. In our study, car accident was the most frequent cause of blunt traumas, which was observed in 108 (43.2%) of the patients, and falls from heights were the second, which were observed in 53 (21.2%) of the cases. Among the penetrating thoracic traumas, cutting and piercing traumas were the most frequent cause, which was observed in 49 (19.5%) of the cases and firearm injuries were the second in 19 (7.6%).

The age range of the patients with thoracic trauma was 20-40 years in 64.4% of the patients with penetrating trauma, and 30-50 years in 50.5% of the patients with blunt trauma. [16]. In another study, 53.6% of the patients with blunt trauma and 46.4% of the patients with penetrating trauma were between 40-50 years of age [17]. 45% of the patients were within the 21-40 age group in our study (Figure 1).

Rib fracture is the most common pathology in thoracic traumas. It is commonly observed in relation to blunt traumas. Studies have revealed a costal fracture rate of over 50%. In the study of Leblebici et al. [16], multiple costal traumas were observed in 58.6% of blunt thoracic traumas. In the study of Çobanoğlu et al. [15], costal fractures were unilateral in 184 (50.9%) cases with blunt trauma and in 15 (4.1%) cases with penetrating trauma, and bilateral in 37 (10.2%) and 2 (0.55%), respectively. The study of Kemmerer [18] revealed a costal fracture rate of 39%, and 45.2% in the study of Afacan et al. [19] in their series with 305 cases. Sanidas et al. [20] reported that the most frequent injury was costal fracture in their study including 488 cases. Costal fracture was observed in 126 of our patients (50.2%). The rate of costal fractures in our study is similar to those observed in the literature. Pain control is important in preventing complications in patients with costal fracture. Non-opioid analgesics, opioid analgesics, intercostal nerve blockage, and patient controlled analgesia may be administered in pain control.

Other bony structure injuries related to thoracic traumas were evaluated by Yörük et al. [21] in their series including 239 cases, which revealed clavicular fractures in 24 patients (10%), sternum fractures in 8 (3.3%), and scapula fractures in 4 (1.7%). In our study, sternum fracture was observed in 1 case (0.4%), clavicular fracture was observed in 10 (4%), and scapular fracture was observed in 3 (1.2%). These rates are close to the rates reported in the literature.

The most common intrathoracic pathologies are hemothorax and pneumothorax [5]. The rates of pneumothorax and hemothorax were 28% and 21% in the series of Çakan et al. [7] and 19% and 21.5% in the study of Şentürk et al. [8], respectively. In our study, intrathoracic pathologies were hemopneumothorax in 134 cases (53.4%), pulmonary contusion in 102 (44.6%), pneumothorax in 75 (29.9%), and hemothorax in 40 (16%). In our study, the rates of hemothorax and pneumothorax were similar to those observed in the literature.

Tube thoracostomy is still the most common treatment method in thoracic traumas. Tube thoracostomy is the most preferred and sufficient method used in traumatic hemothorax. This method is recommended in all circumstances in the treatment of traumatic pneumothorax. The most frequently used treatment method in patients with thoracic pathology was tube thoracostomy in 601 (52.6%) patients in the study of Şentürk et al. [8]. In the series of Çakan et al. [7], the tube thoracostomy rate was reported as 68%. In our study, tube thoracostomy was the most preferred treatment method as well, and was performed in 219 (87.3%) cases.

When major surgery rates among all thoracic traumas are compared, the study of Başıoğlu et al. [4] revealed a rate of 2.9% among 521 case-series, while the study of Yörük et al. revealed [21] a rate of 8.4% among 239 case-series. In our study, 16 patients (2.4%) among 251 received thoracotomy, and our rates were similar to those observed in the literature.

Factors that increase mortality risk in thoracic traumas depend on the severity of thoracic injury and accompanying organ injuries. Accompanying organ injuries were reported to be between 5-37% and 15.5% in the studies of Galan et al. [22] and Shorr et al. [23], respectively. An accompanying pathology was determined in 685 (59%) of 1142 cases in the study of Şentürk et al. [8]. The most common accompanying trauma type was abdominal injury, which was observed in 261 (23%) of the cases. In the study of Regel et al. [24] of 3406 cases, the most common additional injury with thoracic trauma was extremity fracture, which was followed by head trauma. The most common accompanying systemic injury was head trauma in the study of Kandış et al. [15]. In our study, the most common accompanying injuries were abdominal trauma and vertebral fracture. It is noteworthy that our rates are lower than those observed in the literature (5.6%).

The morbidity rates among thoracic injuries were observed to be 36% in the study of Shorr et al. [23], 4.6% in the study of Çakan et al. [7] including 987 case-series, and 12.7% in the study of İmamoğlu et al. [25]. In our study, the mortality rate was 2.4%, which was observed in 6 cases. The rate observed in our study is close to that observed in the study of İmamoğlu et al. [25] including 110 cases. The low mortality and morbidity rates observed in our study may be related to concomitant tho-

racic and cardiovascular surgeries, the advanced intensive care conditions in our hospital, and to the low rate of accompanying pathologies in our cases.

### Conclusion

Thoracic traumas are usually observed as multiple traumas. The mortality rate is high due to accompanying severe extrathoracic injuries. Many patients lose their lives at the site of the accident due to major injuries. On the other hand, in case of life-threatening injuries, rapid and accurate first intervention may be life-saving. Thus, the patient should be evaluated by an experienced and multidisciplinary team, and proper treatment should be given immediately. Accurate diagnosis and a proper surgical approach form the basis of the reduction in mortality and morbidity rates in thoracic traumas. The rates would further be reduced if car accidents and violence in our country are reduced, if the initial intervention and transport are accelerated, and when prompt diagnosis and treatment are provided at the hospital.

### Scientific Responsibility Statement

*The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.*

### Animal and human rights statement

*All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.*

### Funding

*None*

### Conflict of interest

*None of the authors received any type of financial support that could be considered potential conflict of interest regarding the manuscript or its submission.*

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**How to cite this article:**

**Öncü MR, Çobanoğlu U. Evaluation of Thoracic Trauma in the Emergency Department. *J Clin Anal Med* 2018;9(5): 386-90.**