

Original Article

Single center experience of war-related thoracic injuries in Syria

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ABSTRACT

Background: The Syrian civil war caused serious deaths and injuries. Thoracic surgery has shown its effectiveness in this war as it is a war surgery. In this study, we aimed to analyze and convey our experience with 47 war-related chest trauma patients to describe the chest trauma profile and determine the predictive morbidity and mortality.

In this study, we aimed to analyze and convey our experience with 47 war-related chest trauma patients to describe the chest trauma profile and determine the predictive morbidity and mortality.

Materials and Methods: From 2012 to 2017, 47 consecutive patients underwent surgical treatment for chest trauma at the Gaziantep University Hospital, in Turkey. The demographic and relevant clinical information was retrospectively collected from the hospital records. Data included mechanism of injury, gender, age, findings, treatment modality complications, length of hospital stay, morbidity, and mortality. Injuries were classified as penetrating (gunshot or shrapnel wounds) and blunt injuries.

Results: The average age of patients was 25.4 years (range, 4 to 43 years) and 40 patients were males (85%). Sadly, 6 patients were under 18 years old. 41 patients (87.2%) with penetrating and 6 (12.8%) with blunt injuries. The most penetrating injuries to the chest were caused by shrapnel (61.7%). Eleven patients had already had emergency thoracotomy in another hospital before admission. In our study, 28 patients had pneumothorax, and 22 patients had hemothorax (Some patients have multiple diagnoses). However, there were 26 (23.64%) lung contusions in patients. No surgery-related deaths or major morbidity occurred. So, in all cases, the mortality rate was 2.13%.

Conclusions: Intervention in thoracic trauma patients is lifesaving and satisfying compared to other system injuries. Most thoracic injuries can be treated with tube thoracostomy and conventional therapy.

Keywords: war, thoracic injury, surgery, trauma, penetrating injury, blunt injury

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Introduction

The Syrian civil war caused serious deaths and injuries. Thoracic surgery has shown its value in this war. Necessary interventions and treatments were carried out on patients from neighboring Syria, which has deficiencies in terms of equipment.

Thoracic trauma is a major cause of morbidity and mortality in urban trauma centers [1]. Trauma is known to be the leading cause of death in the first four decades of life [1]. Thoracic traumas constitute a significant part of trauma-related deaths, but when all trauma numbers are considered, it is in third place after cranium and limb traumas [2]. Chest trauma is the most common cause of traumatic death in the United States after head trauma, accounting for approximately 20% of deaths [1,3]. Thoracic trauma includes injury to the chest wall, tracheobronchial tree, lungs, diaphragm, esophagus, heart, and great vessels. The overall profile of chest injuries varies widely between different centers [4]. Most chest trauma can be managed without thoracotomy [5]. Aggressive management of the pulmonary system and prompt treatment of associated injuries is essential for optimal patient outcomes [6].

In a study of military emergency departments in Iraq and Afghanistan from January 2007 to August 2016, the most common mechanism of injury was explosives (55.3%), followed by gunshot wounds (23.6%) [7]. In these patients, hemorrhage was the most frequent cause of death, followed by a compromised airway. In a study examining battlefield fatalities from October 2001 to June 2011, torso hemorrhage accounted for 61.2% of 976 preventable deaths [3]. During the war in Iraq, a thoracic injury occurred in 10% of casualties and related mortality was around 10% [8].

In this study, we aimed to analyze and convey our experience with 47 war-related chest trauma patients admitted to Gaziantep University hospital to describe the chest trauma profile and determine the predictive morbidity and mortality.

Materials and Methods

Data Analyses

From 2012 to 2017, 47 consecutive patients underwent surgical treatment for chest trauma at the Gaziantep University Hospital, in Turkey.

The demographic and relevant clinical information was retrospectively collected from the hospital records. Data included mechanism of injury, gender, age, findings, treatment modality complications, length of hospital stay, morbidity, and mortality.

Injuries were classified as penetrating (gunshot or shrapnel wounds) and blunt injuries. Diagnosis classi-

fied as contusion of the lung, injury of blood vessels of the thorax (including thoracic aorta), injury of the heart (pericardial), traumatic pneumothorax, traumatic hemothorax, injury of thoracic trachea, injury of diaphragm, injury of lymphatic thoracic duct, injury of esophagus (thoracic part), injury of brachial plexus.

Management

The initial management of the trauma patients was carried out in the emergency room. The Advanced Trauma Life Support protocol was followed for all patients. The primary and secondary surveys were performed. Most patients had lateral cervical spine, pelvic, and chest radiographs. Computed tomographic scanning of the head, abdomen, and chest; ultrasonography; echocardiography; bronchoscopy; and esophagoscopy were performed as indicated. The orthopedic, neurosurgical, abdominal, or chest surgical interventions were performed when indicated.

The operation (if required) was performed under general anesthesia using a single/double-lumen endotracheal tube. Chest tubes were removed after 24 hours with no air leak, less than 150 mL of fluid discharge, and a complete expansion of the lung. Approval was obtained from the respective institutional review boards before commencing the study.

Statistical Analysis

Continuous variables such as age and length of hospitalization were expressed as mean ± standard deviation and analyzed by the two-sample t-test. All statistical analyses were performed with SPSS 25 for Windows.

Results

The mean age of patients was 25.4 years ± 9.4 SD (range, 4 to 43 years). 40 patients were males (85%). Sadly, 6 patients were under 18 years old. Eleven patients had already had emergency thoracotomy in another hospital before admission. These patients' surgery aimed to control hemorrhage due to hemothorax and great vessel injury.

The mechanisms of injury in patients are shown in table 1. The most penetrating injuries to the chest were caused by shrapnel (61.7%)

Table 1. Mechanisms of injury in patients with thoracic trauma.

Dominant mechanism	N (%)
Penetrating trauma	41 (87.2)
Shrapnel	29 (61.7)
Gunshot wound	12 (25.5)
Blunt trauma (due to explosion)	6 (12.8)

The number of each thoracic trauma injury seen in patients is shown in table 2. As multiple diagnoses, there were 45.45% pneumothorax, hemothorax, or both in patients.

The management of 47 cases of chest injury is shown in table 3. Video-assisted thoracic surgery was performed on 1 patient with shrapnel near the aorta. Bronchoscopy was done in only 1 patient due to a gunshot bullet in the main bronchus. In 6 cases, primary closure was performed after debriding broken ribs and necrotic tissues. No graft was used in thoracic wall reconstruction.

5 cases were operated on together with cardiovascular surgery. One case was taken to dialysis after a nephrology consultation due to crush syndrome. One case was followed up by obstetrics because of being pregnant. One case had a maxillofacial fracture and was followed up by otolaryngology

Late complications of the initial injury or subsequent treatment occurred in only 4 cases (8.5%). Two cases with a prolonged air leak were cured with conservative treatment. One case with tracheoesophageal fistula was cured with an esophageal and tracheal stent. One case with mediastinitis was cured with drainage and medical treatment. The mean length of hospitalization was at 12 days.

No surgery-related deaths or major morbidity occurred. One patient died 35 days after admission; the causes of death in this patient included broncho-biliary fistula, hypovolemic shock, and sepsis. Thereby, in all cases, the mortality rate was 2.13%.

Table 2. Rates of thoracic trauma types.

Diagnosis (ICD 11)	N	%
Traumatic pneumothorax	28	25.45
Traumatic hemothorax	22	20.00
Contusion of the lung	26	23.64
Injury of the thoracic trachea	4	3.64
Injury of the esophagus (Thoracic part)	4	3.64
Injury of blood vessels of the thorax (including thoracic aorta)	5	4.55
Injury of the diaphragm	1	0.91
Injury of the heart (Pericardium)	3	2.73
All chest wall traumas	6	5.45
Injury of the brachial plexus	1	0.91
Bronchopleural fistula	1	0.91
Injury of the thoracic duct	1	0.91
Parenchymal laceration	7	6.36
Bronchobiliary fistula	1	0.91
Total*	110	100

**Some patients have multiple diagnoses.*

Table 3. Management of cases.

Procedure	N	%
Foreign body removal (bullet/shrapnel)	15	24.19
Conservative treatment	13	20.97
Lung parenchyma repair	7	11.29
Chest wall reconstruction	6	9.68
Great vessel repair	5	8.06
Chest tube insertion alone	4	6.45
Esophagus repair	4	6.45
Trachea resection and reconstruction	3	4.84
Pericardial window opening	3	4.84
Diaphragm rupture repair	1	1.61
Ductus thoracicus ligation	1	1.61
Total	62	100

Discussion

Our study reports our war-related thoracic injury experience with patients’ surgical treatment of blunt and penetrating chest injuries.

Thoracic injuries are among the most severe forms of trauma and a leading cause of morbidity and mortality centers [1]. Some patients sustain severe solitary or multiple injuries and arrive at the hospital in an unstable status. After a meticulous clinical and imaging evaluation, some patients require early surgical intervention to complete the investigation or treat the intrathoracic injury. In the literature, tube thoracotomy and exploratory thoracotomy were the only therapeutic modalities [9]. Kandahar et al, in 1354 disease study, applied to the emergency trauma center in 2007, only cases of thoracotomy were applied to 18%. The number of patients undergoing thoracotomy was reported as 2.6% [10]. Our study required thoracotomy in 11 cases (23.4%).

Thoracic trauma is a notable cause of morbidity and mortality in American trauma centers, where 25% of traumatic deaths are related to injuries sustained within the thoracic cage [4]. These data and a review of the literature confirm that in patients with chest trauma. We strongly believe that these death rates will be reduced with new applications in the modern management of trauma.

Patients who develop hemopneumothorax after chest trauma are followed up after tube thoracotomy. In case of an increase in hemothorax or pneumothorax and meeting the criteria of emergency thoracotomy, the patient is treated with thoracotomy [11,12]. We also operated on patients with emergency thoracotomy indications after chest tube application.

Most authors agree that patients with the best outcomes are those with the following features: isolated chest injury; single versus multiple chest injuries; penetrating rather than blunt mechanism; stab wounds rather than gunshot wounds; vital signs on presentation; and prehospital intubation [4,13]. The most penetrating injuries to the chest were caused by shrapnel. Eleven patients required emergency thoracotomy in the operation room of another hospital before admission. These patients' surgery aimed to control hemorrhage due to hemothorax and great vessel injury.

Several previous studies have also suggested that thoracotomy in the OR (operation room) results in a better outcome, although this is related to patient selection [4,6]. Finally, varying definitions of what constitutes an "ER (emergency room) resuscitative thoracotomy" as well as differences in patient populations and prehospital systems confound generalizations [14,15].

The most common chest injuries identified were pneumothorax, pulmonary contusion, and chest wall trauma (including rib fractures). This pattern agrees with the Propper et al report [16]. This study aimed to determine the incidence and mortality of combat-related thoracic trauma (CRTT) and identify factors associated with mortality. We conclude that most chest injury patients can be managed conservatively with observation and tube thoracotomy. In our series, 23.4% percent of the injuries were treated successfully by either single or double tubes. Minimal pneumohemothorax was treated by close observation, repeated chest X-ray films, and antibiotics. Late complications of the initial injury or subsequent treatment occurred in only 4 cases. The mean length of hospitalization was at 12 days. No surgery-related deaths or major morbidity occurred. One patient died 35 days after admission; the causes of death in this patient included broncho-biliary fistula, hypovolemic shock, and sepsis. So, in all cases, the mortality rate was 2.13%.

We think that one of the reasons for the high success of the treatment is that not all cases can be referred to us. As stated in the article, thoracotomy was performed in some cases in another center and tube thoracostomy was performed in some cases. Some cases may have died before they can be referred to us in another center. This was the limit of our study.

In conclusion, most thoracic injuries may be treated

with tube thoracostomy and conventional therapy. Thoracotomy is indicated for severe bleeding, chest wall damage, and heart and esophagus injuries. However, intervention and referral to patients with thoracic trauma during the war should be fast and effective. Intervention in thoracic trauma patients is lifesaving and satisfying compared to other system injuries.

Declaration of conflicting interests

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

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Ethical approval

Ethical approval was obtained from Gaziantep University Clinical Research Ethical Committee (Approval no: 2020/157).

Authors' contribution

AU; conceptualized and designed the study. IET; data presentation. MS; collected and analyzed data. AU, IET, MS, AFI; revised the final version of the manuscript. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

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