

## Assessment of Patients with Thoracic Trauma in Emergency Department

Abdulrahman Fayeze Kinsara<sup>1</sup>, Warda Dakheel Al.Masodi<sup>2</sup>, Abdullah Musari Alanazi<sup>3</sup>,  
Abdulaziz Abdulrahman Alghamdi<sup>4</sup>, Turki Jafar Abdulmajid<sup>5</sup>, Hanan Showei H Fageeh<sup>6</sup>,  
Ahmed Abdulelah Al Jishi<sup>7</sup>, Badr Wadee S Abulhamail<sup>8</sup>, Alsuhaymi, Zuhair Hamdan A<sup>9</sup>,  
Nouf Awad S Albalawi<sup>10</sup>, Alruwaili Amirah Radhi M<sup>10</sup>, Mishari Talal Al-Harbi<sup>1</sup>

1- King Faisal Hospital Makkah , 2- Faculty of Medicine , Umm Al-Qura University , 3- Prince Abdulaziz Bin Musaed Hospital- Arar , 4- Royal College Of Surgeons, RCSI, Dublin, Ireland , 5- Imam Abdulrahman Al Faisal Hospital , Resident , 6- East Jeddah Hospital , 7- Anak General Hospital , 8- King Abdulaziz University Hospital , 9- Mikhwah General Hospital , 10- Tabuk University

### ABSTRACT

**Objective:** Thoracic trauma is a common cause of significant morbidity and mortality. The present study presents a series of thoracic trauma and evaluation of epidemiologic features, distribution of pathologies, diagnosis, additional systemic injuries, management and outcome.

**Materials and Methods:** Between May 2016 and April 2017, all patients with thorax trauma admitted to the emergency service of King Abdulaziz hospital were retrospectively reviewed with respect to age, gender, etiological factors, distribution of pathologies, additional systemic injuries, diagnosis, treatment modalities, referral and outcome.

**Results:** A total of 228 patients with thorax trauma were encompassed in the study. Of all the patients, (140) , 61.4% were male and 88 (38.6%) were female. The majority of the patients presented with blunt thoracic trauma (218 of 228 [95.6%]), whereas 10 (4.4%) presented with penetrating injuries. Etiological factors included falls in 158 (69.3%) patients, motor vehicle accidents in 52 (22.8%), animal related accidents in 8 (3.5%) and penetrating injuries in 10 (4.4%). Among penetrating injuries, 6 (2.6%) were stabbing injuries and 4 (1.8%) were firearm injuries. The patients aged between 16 and 85 (mean 52.2±16.9) years. The vast majority (69.3%) of the patients aged between 31 and 70 years. Blunt thoracic traumas were observed most frequently in patients aged 51-70 years (36.8%), while penetrating traumas were observed most frequently in those aged 31-50 (32.5%) years.

**Conclusion:** Even though majority of the patients with thorax trauma received treatment as outpatients; thoracic traumas can be a life threatening condition, and should be recognized and treated immediately. Mortality differs based on etiological factors, additional systemic pathologies, capabilities of the hospital especially diagnostic and treatment facilities in emergency services. We believe that a multidisciplinary method to the patients with severe thorax trauma, and the opportunities of emergency bedside thoracotomy in emergency services will significantly decrease the morbidity and mortality.

**Keywords:** Thoracic trauma, Pneumothorax, Rib fractures, Hemothorax, Mortality.

### INTRODUCTION

Mortality as a result of trauma rank third after cardiovascular diseases and cancers amid the causes of adult death worldwide.

Thoracic trauma constitutes 20-25% of all death as a result of trauma in the first four decades<sup>[1]</sup>.

As esophagus, heart, trachea, diaphragm and large vessels could be injured along with chest cage and lungs in thoracic trauma, it might be a life-threatening condition in some cases<sup>[2]</sup>. Therefore, we intended retrospective clinical study of patients with thorax trauma with the purpose to evaluate epidemiologic features, distribution of pathologies, further systemic injuries, diagnosis, management and outcome.

### MATERIALS AND METHODS

Records of all patients with thorax trauma admitted to the emergency service of King Abdulaziz Hospital between January 2007 and

December 2011 were retrospectively reviewed in terms of age, gender, distribution by seasons and years, pathologies in thorax, rates of emergent tube thoracostomy, additional systemic injuries, hospitalization time, and mortality rates. Pediatric patients under 16 years of age were excluded. After admission, all the patients were assessed by baseline physical examination, plain radiography, electrocardiography and blood tests. Ultrasonography and computed tomography of thorax were utilized in some cases when required. Tube thoracostomy was performed in all patients with pneumothorax or hemopneumothorax by a

thoracic surgeon either at the emergency service or at thoracic surgery clinic. The patients were assessed in terms of coexisting pathologies by the concerned traumatology physicians at the emergency service. Most of the patients with thorax trauma were hospitalized at thoracic surgery clinic, and others who were hospitalized at other clinics as a result of additional pathologies were followed up closely.

**The study was done according to the ethical board of King Abdulaziz university.**

**RESULTS**

A total of 228 patients with thorax trauma were encompassed in the study. Of all the patients, 140 (61.4%) were male and 88 (38.6%) were female. The majority of the patients presented with blunt thoracic trauma (218 of 228 [95.6%]), whereas 10 (4.4%) presented with penetrating injuries. Etiological factors included falls in 158 (69.3%) patients, motor vehicle accidents in 52 (22.8%), animal related accidents in 8 (3.5%) and penetrating injuries in 10 (4.4%). Among penetrating injuries, 6 (2.6%) were stabbing injuries and 4 (1.8%) were firearm injuries (Table 1).

**Table 1.** Etiological reasons in thoracic traumas

		N	%
Blunt thoracic traumas	Low impact fall (while walking, stairs, etc.)	104	45,6%
	High impact fall (2 m and above)	54	23,7%
	Accident inside vehicle	19	8,3%
	Accident outside vehicle	33	14,5%
	Animal accident	8	3,5%
Penetrating thoracic traumas	Stabbing injuries	6	2,6%
	Firearm injuries	4	1,8%
Total		228	100,0%

The patients were aged between 16 and 85 (mean 52.2±16.9) years. The vast majority (69.3%) of the patients were aged between 31 and 70 years. Blunt thoracic traumas were observed most frequently in patients aged 51-70 years (36.8%), while penetrating traumas were observed most frequently in those aged 31-50 (32,5%) years (Table 2).

**Table 2.** Distribution of thoracic traumas according to age range

N	Total	16-30 years		31-50 years		51-70 years		>70 years	
		N	(%)	N	(%)	N	(%)	N	(%)
Total	228	22	9,6%	74	32,5%	84	36,8%	48	21,1%
Low impact fall	104	9	8,7%	34	32,7%	39	37,5%	22	21,2%
High impact fall	54	4	7,4%	19	35,2%	20	37,0%	11	20,4%
Accident inside vehicle	19	2	10,5%	6	31,6%	8	42,1%	3	15,8%
Accident outside vehicle	33	3	9,1%	9	27,3%	13	39,4%	8	24,2%
Animal accident	8	1	12,5%	2	25,0%	2	25,0%	3	37,5%
Stabbing injuries	6	2	33,3%	3	50,0%	1	16,7%	0	0,0%
Firearm injuries	4	1	20,0%	1	20,0%	1	20,0%	1	20,0%

In term of thoracic pathologies; rib and sternum fractures, pneumothorax, hemopneumothorax, and coexisting injuries were observed in the patients. 151 (66.2%) of patients had no fracture, while sternal fractures were diagnosed in 4 (1.8%), and one or more rib fractures were diagnosed in 75 (32.8%), in which 20.2% (n=46) had single, 8.8% (n=20) had two, 3.1% (n=7) had three or more, 0.9% (n=2) had bilateral rib fractures. In single rib fractures, fracture was right sided in 22 (0.1%) and left sided in 24 (10.5%). In 2 rib fractures, fractures were right sided in 9 (4%) and left sided in 12 (5.3%). In rib fractures more than 3, fractures were right sided in 3 (1.3%) and left sided in 4 (1.8%). Pneumothorax was diagnosed in 12 (5.3%) patients (4 right sided, 7 left sided and 1 bilateral). Hemothorax was diagnosed in 7 (3%) patients (3 right sided, 3 left sided and 1 bilateral), and hemopneumothorax was diagnosed in 8 (3.5%) patients (3 right sided, 4 left sided and 1 bilateral). Pneumothorax was observed frequently in blunt traumas, whereas hemothorax and hemopneumothorax were observed more obvious in penetrating traumas. Coexisting injuries were detected in 58 of the patients; brain injury in 10, abdominal injury in 19, and musculoskeletal injury in 29. The vast majority of these were related with blunt traumas.

138 (60.5%) of the cases were treated as outpatients, while 84 (36.8%) patients were hospitalized for treatment. The average length of hospitalization was 7 days. Emergency thoracotomy was performed in 2 patients with penetrating injury at operating room. Of these; 1 patient who had severe intercostal artery bleeding, pulmonary and diaphragm injuries were operated successfully, unfortunately 1 died due to major vascular and cardiac injuries during surgery. All of these were intubated in emergency service, and cardiopulmonary resuscitation was performed. Blood transfusion was also carried out in patients in hemorrhagic shock.

### Discussion

Thoracic injuries mostly arise as a component of multiple traumas. Early diagnosis and management is life-saving for acutely injured patients. The treatment principles are simple and direct. The best treatment for these patients comprises early mobilization, aggressive pain control, proper fluid treatment, and respiratory physiotherapy. Endotracheal intubation ought to be reserved for the patients with airway compromise, decreased mental status, refractory problems with

gas exchange, and hypoventilation. Prophylactic intubation is not a preferred measure for severe chest wall injury<sup>[3]</sup>. The elderly patients carry the greatest threat for multiple organ failure, respiratory failure, and pneumonia. Distinctive efforts at aggressive regional pain control are possibly beneficial in this group of high risk patients<sup>[4]</sup>.

The most complications in these patients contain respiratory failure as a result of altered chest wall mechanics from the fractures and respiratory distress from fracture-associated pain. Primary pulmonary contusion plays a noticeable role in the hypoxia that advances after chest wall injury. This complex pathophysiology often requires endotracheal intubation, prolonged intensive care unit length of stay, prolonged mechanical ventilation, and tracheostomy<sup>[5]</sup>. Moreover, poor pulmonary function and mechanical ventilation rise the danger for the development of pneumonia, which is a frequent cause of death<sup>[6]</sup>. Numerous factors such as age, the total number of fractures, and the presence of bilateral fractures have been shown to contribute to the morbidity and mortality related with thoracic wall injury.

Thoracic trauma constitutes majority of the trauma cases in emergency clinics. One third of the hospitalizations for trauma involve thoracic injuries. In this regard, the outcomes of the current study are comparable with the literature. The incidences of blunt trauma and penetrating injuries have been reported as 57-75% and 23-42% respectively<sup>[1,2]</sup>. Another study reported incidence of blunt thoracic trauma as 96.3%<sup>[7]</sup>. In the present study, 95% of the patients had blunt and 5% had penetrating thoracic trauma, which was comparable to the out comes gained in a Canadian study. We believe that different outcomes are related to different socio-economic status, developmental levels and opportunities in emergency clinics. Low ratio of penetrating injury in our study might be associated to the facts that some of the patients with penetrating injury were taken to a third level hospital or some lost their lives before hospital entry. Distribution of the thoracic traumas by seasons and years were similar in our study. The vast majority (70%) of the patients were aged between 31 and 70 years. Blunt thoracic traumas were perceived most frequently in patients aged 51-70 years, whereas penetrating traumas were perceived most regularly in those aged 31-50 years. Motor vehicle accidents and falls are the most regularly perceived etiological

factors in thoracic traumas<sup>[8]</sup>. Motor vehicle accidents have been described as the most common etiological factor with incidence between 41% and 80% in large series<sup>[9, 10]</sup>. In the present study, falls were the most frequent etiological factor with a ratio of 69%, and falls were followed by motor vehicle accidents (26%).

Postero-anterior lung X-ray is the most valued diagnosis method in thoracic traumas. Routine postero-anterior lung X-ray is sufficient to diagnose rib fractures, hemothorax, pneumothorax and lung contusions. Trupka et al.<sup>[11]</sup> indicated that computed tomography is superior to posterior-anterior lung X-rays in imaging contusion, pneumothorax and hemothorax screening in blunt thoracic trauma and that it ought to be the first technique to be utilized in those having multiple injuries and suspected to have thoracic trauma. We believe that postero-anterior X-ray must be achieved in patients having thoracic trauma and computed tomography ought to be utilized if additional examination is necessary.

Clinical features in thoracic trauma differs from a simple soft tissue damage to a life-threatening condition. Pneumothorax, hemopneumothorax, hemothorax, pulmonary contusion and rib fractures are the most regularly perceived findings. Fractures arise regularly as a result of blunt thoracic traumas. In the present study, one or more rib fractures were diagnosed in 33% of the patients, and practically all of the rib fractures happened as a result of blunt thoracic trauma. Sternal fracture is observed in 3-8% of the cases with blunt thoracic trauma<sup>[12]</sup>, while 1.7% of the patients had sternal fracture in the present study. It is known that 18-62% of sternal fractures are accompanied with cardiac injury<sup>[13]</sup>. We think that one of the reasons of sudden deaths at early stage is cardiac contusion, as one of the patient died as a result of cardiac contusion in our series. Consequently, electrocardiography and cardiac enzyme panel was carried out in all the patients suspected to have sternal fracture. The most regularly perceived intrathoracic pathologies in thoracic trauma are pneumothorax, hemothorax or both, and the first stage of treatment is tube thoracostomy<sup>[14, 15]</sup>. In the present study, pneumothorax was diagnosed in 5% of patients. All of these patients were subjected to tube thoracotomy.

There are publications reporting that life-threatening complications such as tension pneumothorax could be prevented by this way. Conversely, Menger et al.<sup>[16]</sup> described the ratio of tube complications as 20%. We advocate that chest tube ought to be inserted in all pneumothorax and

hemopneumothorax cases by experienced physicians. In the present study, 0.9% (n=2) of the patients underwent emergency thoracotomy. The indications were hemorrhagic shock, and hemorrhagic drainage greater than 1500 cc following tube insertion, or bleeding >100 cc/hr within 6-8 hours, or >200 cc/hr within 3-4 hours. The most significant factors influencing mortality in thoracic trauma is coexisting injuries in other systems and organs. In a study including 3406 cases, Regel et al.<sup>[17]</sup> described that thoracic traumas were most frequently accompanied by extremity fractures and this is followed by brain injuries. In similar studies, thoracic traumas have been reported to be accompanied most frequently by musculoskeletal injuries<sup>[1, 9]</sup>. In the present study, 26% of the patients had coexisting systemic injuries, in which the musculoskeletal injuries were the most regularly perceived one. In thoracic trauma, physicians in emergency service ought to be alert for coexisting systemic injuries.

In the present study, 60.5% of the cases admitted to the emergency service were treated as outpatients, and 36.8% were hospitalized for treatment. Emircan et al.<sup>[18]</sup> studied factors affecting mortality of patients with thoracic trauma, and reported that Trauma Revised Score-Injury Severity Score has been the prevailing factor in determining mortality and thus patients with thoracic trauma ought to be treated as a high risk group and diagnosis and treatment should be aggressive. Even though our method towards the patients with thoracic trauma was aggressive too, early stage mortality was observed in 1.1% of the patients. In some studies, mortality rates have been found to be increased in patients aged 45 and less, and 65 and over. Mortality rates have been found to be significantly higher in penetrating injuries and traffic related injuries to pedestrians when compared to other injuries.

## CONCLUSION

Although some of the patients with thorax trauma receive treatment as outpatients; thoracic traumas can be a life threatening condition, and ought to be identified and treated immediately. Mortality varies based on etiological factors, further systemic pathologies, capabilities of the hospital particularly diagnostic and treatment facilities in emergency services. We believe that a multidisciplinary approach to the patients with severe thorax trauma, and the opportunity of emergency bedside thoracotomy in emergency services will significantly reduce the morbidity and mortality.

## REFERENCES

1. **Altunkaya A, Aktunc E, Kutluk AC, Buyukates M, Demircan N, Demir AS *et al.*(2007):** Analysis of 282 patients with thoracic trauma. *Turk J ThoracCardiovasc Surg.*,15:127–132.
2. **Graeber GM, Prabhakar G, Shields T(2005):** Blunt and penetrating injuries of the chest wall, pleura and lungs. In: Shields TW, LoCicero J3rd, Ponn RB, Rusch VW, editors. *General thoracic surgery*. 6th ed. Philadelphia: Lippincott Williams & Wilkins.
3. **Bolliger CT, Van EedenSF(1990):** Treatment of multiple rib fractures Randomized controlled trial comparing ventilatory with nonventilatory management. *Chest*, 97:943–948.
4. **Todd SR, McNally MM, Holcomb JB, Kozar RA, Kao LS, Gonzalez EA *et al.*(2006):** A multidisciplinary clinical pathway decreases rib fracture-associated infectious morbidity and mortality in high-risk trauma patients. *Am J Surg.* ,192:806–811.
5. **Flagel BT, Luchette FA, Reed RL, Esposito TJ, Davis KA, Santaniello JM *et al.*(2005):** Half-a-dozen ribs: the breakpoint for mortality. *Surg.* ,138:717–723.
6. **Brasel KJ, Guse CE, Layde P, Weigelt JA(2006):** Rib fractures: relationship with pneumonia and mortality. *Crit Care Med.* ,34:1642–1646.
7. **Hill AB, Fleiszer DM, Brown RA(1991):** Chest trauma in a Canadian urban setting - implications for trauma research in Canada. *J Trauma*,31:971–973.
8. **Senturk E, Dogan Y, Yoldas E(2010):** Chest Trauma; Analysis of 1142 Cases. *Turkish Thoracic J.* ,11:47–54.
9. **Leblebici IH, Kaya Y, Kocak AH(2005):** Analysis of 302 cases with chest trauma. *Turkish J ThoracCardiovasc Surg.* ,13:392–396.
10. **Cakan A, Yuncu G, Olgac G, Alar T, Sevinc S, OrsKaya S(2001):** Thoracic trauma: analysis of 987 cases. *Turkish J Trauma Emerg Surg.* ,7:236–241.
11. **Trupka A, Waydhas C, Hallfeldt KK, Nast-Kolb D, Pfeifer KJ, Schweiberer L(1997):** Value of thoracic computed tomography in the first assessment of severely injured patients with blunt chest trauma: results of a prospective study. *J Trauma*,43:405–411.
12. **Brookes JG, Dunn RJ, Rogers IR(1993):** Sternal fractures: a retrospective analysis of 272 cases. *J Trauma*,35:46–54.
13. **Heyes FL, Vincent R(1993):** Sternal fractures: what investigations are indicated? *Injury*,24:113–115.
14. **Sirmali M, Turut H, Topcu S, Gulhan E, Yazici U, Kaya S *et al.*(2003):** A comprehensive analysis of traumatic rib fractures: morbidity, mortality and management. *Eur J Cardiothorac Surg.* ,24:133–138
15. **Boyd AD(1989):** Pneumothorax and hemothorax. In: Hood RM, Boyd AD, Culliford AT, editors. *Thoracic trauma*. Philadelphia.
16. **Menger R, Telford G, Kim P, Bergey MR, Foreman J, Sarani B *et al.* (202):**Complications following thoracic trauma managed with tube thoracostomy. *Injury*,43:46–50.
17. **Regel G, Lobenhoffer P, Grotz M, Pape HC, Lehmann U, Tscherne H(1995):** Treatment results of patients with multiple trauma: an analysis of 3406 cases treated between 1972 and 1991 at a German Level I Trauma Center. *J Trauma*,38:70–78.
18. **Emircan S, Ozguc H, Aydin SA, Ozdemir F, Koksall O, Bulut M(2011):** Factors affecting mortality in patients with thorax trauma. *Turkish J Trauma Emerg Surg.*,17:329–333.