ORIGINAL ARTICLE

Thoracic Trauma: Presentation and Management Outcome

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ABSTRACT

Objective: To determine the presentation and management outcome of thoracic trauma in a tertiary care setting.
Study Design: Case series study.
Place and Duration of Study: The study was carried out in the Department of Surgery, Pakistan Institute of Medical Sciences (PIMS), Islamabad from January to December 2005.
Patients and Methods: A total of 143 patients, who presented with chest trauma, were included in the study. All the patients were assessed by the history, physical examination and ancillary investigations. Appropriate managements were instituted as required. Data was described in percentages.
Results: Out of 143 patients, 119 (83%) were males and 24 (17%) were females. Most of the patients belonged to the age group of 21-50 years. Ninety seven (66%) patients were admitted for indoor management. Blunt injury was found in 125 (87.4%) patients, while penetrating injuries in only 18 (12.6%) patients. Road Traffic Accidents (RTAs) were the commonest cause of trauma (n=103, 72%). Rib fracture was the commonest chest injury (74% patients). Head injury was the most frequently associated injury (18% of the patients). Tube thoracostomy was the commonest intervention undertaken in 65 (45 %) patients. Seventeen (11.88 %) patients were managed with mechanical ventilation. There were 17 deaths with a mortality rate of 11.88%.
Conclusion: Thoracic trauma is an important cause of hospitalization, morbidity and mortality in the younger population. RTAs constitute the leading cause of thoracic trauma in our setup. Tube thoracostomy is the most frequent and at times the only invasive procedure required as a definitive measure in thoracic trauma patients. A policy of selective hospitalization helps to avoid unnecessary hospital admissions.

Key words: *Thoracic trauma. Tube thoracostomy. Hospitalization. Road traffic accident. Rib fracture.*

INTRODUCTION

The history of chest trauma is as old as that of man itself. One of the earliest writings of chest trauma is found in the Edwin Smith Surgical Papyrus, written in 3000 BC.[1] Over the last century, there has been considerable reduction in the mortality of chest trauma owing to improved perioperative care, availability of positive pressure ventilation, increasing availability of antibiotics, advent of radiologic techniques, introduction of emergency thoracotomy and improved lung toilet measures etc.[1,2]

Chest trauma implies trauma to anyone or combination of different thoracic structures, which can arbitrarily be divided into 4 distinct anatomical regions i.e. the chest wall, the pleural space, the lung parenchyma and the mediastinum.[3]

Trauma is one of the top ranking causes of accidental or unnatural deaths. Chest trauma is a significant source of morbidity and mortality worldwide.[4] Overall, it accounts for 20-25% of all trauma-related deaths and is implicated in an additional 25% of patients, who died from injuries. In most cases, blunt chest trauma is by far the commonest and RTAs account for 70-80 % of such injuries. Firearm Injuries (FAIs), falls from height, blasts, stabs and various acts of violence are the other causative mechanisms.[4]

Thoracic trauma, though not uncommon, has been the subject of very few local studies from Pakistan. This study was undertaken to document the presentation and management outcome of thoracic trauma in our setup by finding out the various causes, presenting features, frequency of different thoracic and extra-thoracic injuries, duration of hospital stay, morbidity and mortality.

PATIENTS AND METHODS

This case series study was carried out during the period from January 2005 to December 2005 at the Department of Surgery, Pakistan Institute of Medical Sciences (PIMS), Islamabad. Patients over 14 years of age who had thoracic trauma were included by convenience sampling technique.

It included all patients reporting to accident and emergency department, admitted to the surgical department or referrals/ consultations from other units.

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Patients not consenting to participate in the study were excluded. The patients were assessed by history, physical examination and relevant investigations. The latter included Chest X-rays (CXR) in all patients and other investigations such as Arterial Blood Gases (ABGs), ultrasound chest/abdomen etc., where indicated. Analgesia in the form of diclofenac sodium and tramadol was employed in all cases with additional epidural analgesia with bupivacaine when required. Patients, who presented with stable vitals, uncomplicated thoracic trauma and did not require any interventional procedure were observed for 6 hours in emergency department and their vitals were recorded serially. If their vitals remained stable and physical findings did not deteriorate and the repeat CXR at 6 hours did not dictate any intervention, they were discharged on oral medication with advice regarding lung toilet measures including breathing exercises. All patients with tube thoracostomy received a combination of co-amoxiclav and klarithromycin in optimal doses until 12 hours after removal of the tube.

Data was collected with the help of a pre-designed proforma that included patients' demographic profile, age, gender, cause of trauma, presenting symptoms, various chest and other associated injuries, underlying co-morbidities, interventional procedures undertaken, length of hospital stay, duration of tube thoracostomy, duration of ventilatory support, length of hospital stay, complications, mortality and follow-up.

The data were analyzed through SPSS for Windows version 10. Nominal variables were reported as frequency and percentages. Numerical data was reported as mean ± standard deviation.

RESULTS

Out of 143 patients, 119 (83%) were males and 24 (17%) females. The male - female ratio was 4.9:1. The ages of the patients ranged between 15 - 80 years. The mean age was 36.53 ± 14.43 years. Over 50% of the patients were in their 2nd and 3rd decades of life. Blunt thoracic trauma was found in 125 (87.4%) patients, while penetrating injuries in only 18 (12.6%) patients (p value <0.05). Overall, RTAs remained the leading cause of thoracic trauma and motor-bikes were the most frequently involved vehicles accounting for 46% of them.

The presenting symptoms included chest pain in all patients with aggravation on inspiration in 40%, dyspnea in 20% and shock in 15% patients.

Ninety seven (66%) patients were admitted for indoor management out of whom 17 (17.52%) were managed in intensive care unit with mechanical ventilator support. Forty six (34%) patients, who had uncomplicated chest trauma were discharged home after necessary investigations, treatment and 6 hours observation in the accident and emergency department.

The observed chest and other associated injuries are depicted in Table I and Table II respectively. The interventional procedures undertaken are shown in Table III. Extra thoracic injuries were managed by the relevant specialities.

Table I: Pattern of chest injuries in 143 patients.

Type of injury	Blunt (n=125)	Penetrating (n=18)
Rib fracture	103	3
Flail chest	4	-
Hemothorax	15	9
Pneumothorax	2	-
Hemopneumothorax	11	2
Fractured clavicle	34	1
Fractured scapula	7	-
Chest wall injuries	15	2
Surgical emphysema	19	4
Thoracic vertebral injuries	5	-
Lung contusions	2	2
Traumatic diaphragmatic rupture	4	-

Table II: Associated injuries (n=69).

Injuries	Number (%)
Head injury	26 (37.68%)
Fractured limb bones	23 (33.33%)
Fractured pelvis	10 (14.49%)
Spinal injuries (other than thoracic)	6 (8.69%)
Fractured metacarpal bones	4 (5.79%)
Acetabular fractures	2 (2.89%)
Fractured mandible	1 (1.44%)
Splenic injury	2 (2.89%)
Liver trauma	2 (2.89%)

Table III: Various treatments offered (n=143)

Treatment instituted	Blunt trauma (n=125)	Penetrating trauma (n=18)
Conservative / observation	48 (38.4%)	6 (33.33%)
Tube thoracostomy	54 (43.2 %)	11 (61.11%)
Mechanical ventilator	17 (13.6 %)	-
Laparotomy	6 (4.8 %)	-
Thoracotomy	-	1 (5.55%)

The duration of tube thoracostomy retention ranged from 1-43 days (mean 9.15 ±12.16 days). The duration of mechanical ventilatory support ranged from 1-43 days with a mean of 16 ±13.56 days. The duration of hospital stay was 1-47 days with a mean of 12 ± 12.67 days. Complications included pneumonia in 2 (1.39%) patients on mechanical ventilators, atelectasis in one (0.69%) patient, inferior placement of tube in one (0.69%) and spontaneous tube expulsion in 3 (2.09%) patients. All these complications were managed conservatively. There was no case of empyema thoracis.

The mortality rate was 11.88% with a total of 17 deaths. All the surviving patients had uneventful course at 2 months follow-up.

DISCUSSION

Chest trauma continues to be a major public health issue both in the developing and developed world. It is responsible directly for one quarter of all traumatic deaths and is a major contributor in another 25% of trauma-related deaths. United States' chest trauma frequency estimates show that injuries occur in 12 person per million population per day and approximately 33% of these injuries require hospitalization.[4]

RTAs, FAIs and falls are the leading causes of thoracic trauma. All of these affect the relatively younger male population. Hence, the socioeconomic implications are even more devastating. In this series, 83% of the patients were male and 75% female in their 3rd through 5th decades of life. Predominant involvement of young males further amplifies the grave implications of this serious problem. Male predominance and more frequent involvement of the relatively younger population has been reported in other studies as well.[3-7]

RTAs accounted for 72% of all cases. Among those, approximately half were caused by motor-bikes. There was a relatively higher frequency of RTAs as compared to that in the West. The condition of roads, road-side environment, types of vehicles, low driving standards, violation of traffic rules, unsafe attitude of pedestrians, sharing of roads by animals and humans etc. have all been known to contribute to the high frequency of RTAs. However, motor-bikes had a clear preponderance over the others in this study. In fact there is a need to introduce safer practices in order to reduce the motor-bike associated accidents.

All chest injury patients do not need hospital care and only selective hospital admission is more appropriate. In this study, only two thirds of the chest injured patients were managed on indoor basis and the rest were sent home after necessary treatment and observation in the accident and emergency department. Most of the isolated rib fractures occur in, otherwise young, healthy individuals and can safely be managed this way. Similar protocols have been evaluated to be safe and cost-effective by other workers as well.[8]

Rib fracture was the most frequent chest injury encountered in 74% patients. It has also been reported as the commonest chest injury.[1,3,4] Head injury was the most common extra-thoracic injury followed by extremity trauma. Frequent involvement of these has been reported to be associated with higher mortality which is in conformity with this study.[1,4]

There were 4 cases of traumatic diaphragmatic rupture. All were due to blunt trauma, involving the left posterolateral diaphragm and 2 were additionally associated with splenic injury. All were managed with laparotomy. Traumatic diaphragmatic rupture is often an elusive condition and can easily be missed initially. Special attention should be paid not to miss it in the secondary chest survey. Any patient who sustains blunt abdominal trauma and presents with dyspnea or gas filled gut loops in the lung fields should be suspected of having traumatic diaphragmatic rupture. Auscultation of bowel sounds in chest, appearance of nasogastric tube in lung field on CXR and investigations such as contrast studies, computerized tomograms of chest, laparoscopy and thoracoscopy etc. may aid in the diagnosis. Abdominal approach is the best for their management. This not only allows adequate primary repair of the diaphragm but also facilitates exploration for associated abdominal organ injuries.[1,4,9-11] Splenic injuries necessitate splenectomy.

Tube thoracostomy was the most frequent intervention undertaken among the hospitalized patients (67%). Tube thoracostomy effectively drains the pleural space and provides the definitive treatment in the great majority of thoracic trauma patients. It is effective for obtaining rapid re-expansion of the injured lung, complete evacuation of the pleural space and monitoring the injured chest for any continued heavy blood loss following insertion. Many other studies have also reported it to be the most frequently performed interventional procedure in thoracic trauma patients. By and large, it is a safe procedure, however, it is not risk-free and carries a 2-10% incidence of complications, which are frequently due to poor technique.[12,13] Tube thoracostomy is an emergency procedure performed by clinicians with differing skill levels, often under less than optimal surgical circumstances. For effective drainage of the pleural space, correctly placed and well-positioned tube thoracostomy is imperative. Optimal technique of the tube insertion is mandatory to accomplish this goal. It also helps to prevent the various complications associated with tube thoracostomy.

There was only one case of emergency thoracotomy in this series. In other local studies, the rate of thoracotomy is also not in keeping with that reported from the rest of the world.[14-17] Bhopal *et al.* reported no case of formal thoracotomy in a series of 45 patients with penetrating thoracic trauma.[18] Khan *et al.*[5] reported only 10% rate of thoracotomy in a large series of 120 patients with isolated penetrating chest trauma. In yet another large series of 173 children, Khan *et al.*[6] reported no case of emergency thoracotomy and only 2 cases of late thoracotomies. Hanif *et al.*[19] observed a 9% rate of thoracotomy in 106 patients. In fact, the local system has recognized limitations and constraints and hence the management pattern is different than that of the developed world. In the latter, thoracotomy rate is upto 10% in patients with blunt chest trauma and upto 30 % in patients with penetrating chest trauma.[1-4] There

is no system of on-spot medical care and service for RTAs patients. Moreover, their transportation to the health care facility is also usually unacceptably delayed. As a result, patients with life threatening injuries or those who are potential candidates for emergency thoracotomy mostly died on the scene or en-route to the hospital.

The value of prophylactic or presumptive antibiotics in thoracic trauma patients has been established since long.[20-22] Cant *et al.*[23] reported no empyema in individuals with stab wounds chest who were prophylaxed with cefazolin for 24 hours compared to a 5% incidence in the placebo group. Two meta analyses [21,22] have proved the significant impact of prophylactic antibiotics on reducing the incidence of empyema. Same results were found in the present series.

Prophylactic antibiotic cover in thoracic trauma patients requiring tube thoracostomy is primarily aimed at reducing the incidence of empyema. It is also helpful in reducing bacterial pneumonitis. The microbes responsible for the infection vary according to the mechanism of contamination. For instance, in patients with tube thoracostomy, the empyema typically will culture gram-positive *Staphylococcus aureus* or *Streptococcus* species. Secondary contamination from pneumonic processes or other routes of spread often involve gram-negative or mixed pathogens.[21,23]

CONCLUSION

Thoracic trauma constitutes an important cause of hospitalization, morbidity and mortality in younger population. RTAs constitute the leading cause of thoracic trauma in our setup. Tube thoracostomy is the most frequent, and at times, the only invasive procedure required as a definitive measure in thoracic trauma patients. The use of prophylactic antibiotics in patients with chest intubation helps to reduce infective complications.

A policy of selective hospitalization helps to avoid un-necessary hospital admissions.

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