THORACIC TRAUMA
PROFILE IN TWO SEMIURBAN UNIVERSITY HOSPITALS IN NIGERIA

ORIGINAL
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ABSTRACT... Objective: To assess the pattern of thoracic trauma in two semi urban university hospitals in Nigeria, to determine the injuries associated with thoracic trauma, its management and outcome in a setting of small thoracic units and limited intensive care unit facilities. **Study Design:** Observational **Method:** The hospital records of 142 patients who sustained thoracic trauma between September 2007 and September 2010 were reviewed. The mode of injury, specific intrathoracic trauma, associated injuries, management and outcome were analyzed. **Results:** Eighty-two percent (82%) of patients were males and 73% of patients were above 40 years. Blunt thoracic trauma accounted for 77% of thoracic injuries. Road Traffic Accident (RTA) was the commonest cause of Blunt Chest Trauma (90%) while Gunshot injuries constituted the commonest cause of Penetrating Chest Trauma (73%). The commonest specific thoracic injuries were Rib fractures and Haemopneumothorax. Extremity injuries were the commonest associated extrathoracic injuries. Mechanical ventilatory assistance was indicated in 8.5% of patients. Only 1.4% of patients had delayed thoracotomy on account of clotted haemothorax and Empyema Thoracis. 2.8% of patients had Laparotomy for repair of Traumatic Diaphragmatic hernia. Others were managed conservatively. The mortality rate was 9.9%. Mortality was mainly among patients who required mechanical ventilatory support and those with associated severe extra thoracic injuries. Most of the patients were discharged before 20 days on admission. **Conclusions:** The incidence of chest trauma can be reduced by minimizing the frequency of road traffic accidents, abating violence and improving security. Most patients that sustain thoracic trauma can be managed conservatively. Mortality usually occurs in patients with associated severe extrathoracic trauma and those who require ventilatory support. Improving Intensive care unit facilities and training more trauma/thoracic surgeons and intensivists in the developing countries will help to reduce the mortality rate of chest trauma.

Keywords: Thoracic trauma, chest trauma, blunt, penetrating

.INTRODUCTION

Worldwide, thoracic trauma is an important cause of morbidity and mortality, accounting directly for 25% of all trauma deaths and contributing to another 25% of deaths[1]. This is even likely to be worse in a developing country like Nigeria where facilities for resuscitation and intensive care are not optimal. Unfortunately, the frequency of chest trauma is increasing due to rising incidence of violence and high speed driving on the roads[2].

Thoracic trauma has been described as due to blunt or penetrating injuries. Advanced Trauma life support (ATLS) protocol forms the bedrock for the assessment and treatment prioritization of these patients.

Twelve (12) major life threatening injuries may be encountered in victims of thoracic trauma. Six of them must be rapidly diagnosed and swiftly treated within the time frame of the primary survey because they have the potential to cause death (Lethal six)[3]. They include Airway obstruction, Tension Pneumothorax, Flail chest, Cardiac Tamponade, Open Pneumothorax and Massive haemothorax. The remaining six injuries tend to be unspecific, delayed, or obscured by other injuries and may actually be overlooked until heralded by ensuing, late onset complications (Hidden six)[3]. These injuries include Tracheobronchial disruption, Pulmonary contusion, Traumatic disruption of the aorta, Blunt cardiac injury, Esophageal perforation and Diaphragmatic tear.

Rib fractures are the commonest specific thoracic injury[4] and they are commonly associated with other thoracic

injuries. Pneumothorax ranks second to rib fractures as the commonest manifestation of traumatic chest injury and is noted in 40-50% of patients with chest trauma[5,6,7].

Thoracic trauma may occur in isolation or may be associated with concomitant orthopaedic, neurologic or abdominal trauma. Multiply-injured patients with thoracic injuries require significantly longer periods of mechanical ventilation and longer intensive care unit lengths of stay compared with non thoracic injury trauma patients[8].

Ninety percent (90%) of all thoracic injuries can be treated conservatively with analgesics, oxygen, chest tube drainage and secretolysis. Primary surgical therapy is indicated in 10%[9].

METHODS

A descriptive retrospective study was carried out on 142 patients admitted into the Accident and Emergency units of Imo State University Teaching Hospital, Orlu between September 2007 and December 2009 and in Irrua Specialist teaching Hospital, Irrua between January 2010 and September 2010 with thoracic trauma with or without associated injuries. The sources of information were the patient's case notes and surgeon's personal records.

The patients were reviewed by the cardio thoracic unit who carried out the initial assessment and resuscitation. Thoracic trauma was classified as Blunt or Penetrating injuries.

Age , sex, modes of injury, specific intra thoracic injuries, associated injuries, surgical management, need for ventilatory assistance based on clinical assessment and outcome of management(mortalities and duration of hospital stay) were documented. All the patients had chest radiograph before transfer to the ward, operating room or intensive care unit. Only one patient did chest computerized tomography scan on account of suspected aortic injury. Patients who sustained extra thoracic injuries also had other relevant investigations done. Length of hospital stay was tabulated at intervals of 10 days.

All the patients were managed by the authors. Both institutions are tertiary referral institutions located in a semi urban setting in Nigeria. Both have small thoracic units and limited Intensive Care Unit Services at the time of this research. Only one thoracic surgeon was available on ground at most times. Pressure and volume generators with positive end-expiratory pressure (PEEP) and IMV were not available at most times and anaesthetic machines were improvised when necessary. Cardiac monitors were available but there were no facilities for invasive haemodynamic monitoring and measurement of arterial blood gases.

RESULTS

Out of 142 patients seen, 82% (116) were males while 18% (26) were females. The age range of patients seen was between 3 years and 90 years. Most of the patients were aged between 21-40 years (56.3%). 26.8% of patients were less than 20 years, 11.3% of patients were between 41-60 years and 5.6% of patients were above 60 years.(Table I)

Table-I. Distribution of patients according to age and sex

Age range (years)	Males	Females	Total
0-20	30	08	38 (26.8%)
21-40	66	14	80 (56.3%)
41-60	13	03	16 (11.3%)
>60	07	01	8 (5.6%)
Total	116 (82%)	26 (18%)	142

Blunt chest trauma accounted for 77% of all injuries. RTA was the commonest cause of blunt chest trauma and was responsible for 90% of all blunt chest trauma. Nine (9) patients fell from height while 2 patients sustained blunt chest trauma from physical assault. (Table IIa). Gunshot injuries were responsible for 73% of Penetrating chest injuries (Table IIb). Gunshot injuries were sustained from low velocity riffles during robbery attacks (16), high velocity riffles during student's unrest (4), accidental discharges (2) and unknown sources (2).

The commonest specific thoracic injuries were isolated rib fractures (49.3%) and haemopneumothorax (36.6%).

Table-IIa. Aetiology of blunt thoracic trauma

Blunt injuries	Males	Females	Total
RTA	80	18	98 (90%)
Fall from height	08	01	9 (8.2%)
Others	02	-	2 (1.8%)
Total	90	19	109 (77%) of all chest injuries

Table-IIb. Aetiology of penetrating thoracic trauma

Penetrating injuries	Males	Females	Total
Gunshot injuries	18	06	24 (73%)
Stab wound	08	01	9 (27%)
Total	26	07	33 (23%) of all chest injuries

Rib fractures were also found in association with other intrathoracic injuries (Pneumothorax, Haemothorax, Haemopneumothorax, Pulmonary contusion, Diaphragmatic tear and Pneumonia). Flail chest was considered as a separate entity. (Table III) Extremity injuries were the commonest associated injuries in 25 patients (17.6%) followed by abdominal injuries in 12 patients (8.5%) (Table IV). Patients who sustained moderate and severe head injury and the only case with associated spinal injury with paraplegia secondary to high velocity riffle injury were transferred to a nearby neurosurgical facility.

One Hundred and Thirty six patients (96%) were managed conservatively including the use of closed tube thoracostomy drainage in patients in whom it is indicated. Two (2) patients had delayed thoracotomy on account of clotted haemothorax and Empyema Thoracis. A patient with infected lung haematoma from penetrating chest injury signed against medical advice while the patient with Aortic injury was referred for further investigation and treatment. 2.8% of patients had laparotomy and repair for traumatic diaphragmatic hernia. A patient with multiple rib fractures, severe respiratory insufficiency and traumatic diaphragmatic hernia died before surgery

Table-III. Specific chest injuries

Specific chest injuries at presentation	No. of patients	%age
Rib fractures (single and multiple)	70	49.3%
Pneumothorax*	35	24.6%
Haemothorax*	30	21.1%
Haemopneumothorax*	52	36.6%
Pulmonary contusion*	23	16.2%
Myocardial contusion	07	4.9%
Flail chest	09	6.3%
Diaphragmatic Tear*	05	3.5%
Pneumomediastinum & subcutaneous emphysema only	03	2.1%
Pneumonia*	01	0.7%

**injury with and without associated rib fractures*

Table-IV. Associated injuries with thoracic trauma

Associated injuries	No. of patients	%age
Extremity injuries	25	17.6%
Abdominal injuries	12	8.4%
Head injuries	09	6.3%
Spinal injury with paraplegia	02	1.4%
Maxillofacial injuries	02	1.4%

due to delay in presentation and surgery. Other patients that had associated abdominal injury had laparotomy for either a hollow and/ solid viscera injury. (Table V).

Twelve patients (8.5%) required mechanical ventilatory assistance. These included 6 patients with flail chest associated with severe pulmonary contusion, severe head injury, and shock and 6 patients that presented with multiple rib fractures with severe pulmonary contusion with or without associated injuries. (Table VI)

Mortality rate was 9.9%. 58.3% of patients that died

Table-V. Surgical management

Surgical management	No. of patients	%age
Conservative (including the use of closed tube thoracostomy drainage)	136	96%
Operative management Thoracotomy		
Acute	-	-
Delayed	-	-
Clotted Haemothorax	01	0.7%
Empyema Thoracis	01	0.7%
Laparotomy (for diaphragmatic repair)	04	2.8%

Table-VI. Need for mechanical ventilatory assistance

Need for mechanical ventilatory assistance	No of patients (%)	No of patients that died (%)
Indication for mechanical ventilatory assistance Flail chest ● with severe pulmonary contusion (4) ● with severe head injury (1) ● Shock (1) Pulmonary contusion with multiple rib fractures ± associated injury (6)	12 (8.5%)	7 (58.3%)
No indication	130 (91.5%)	7 (41.7%)

required ventilatory support. 6 patients died from respiratory insufficiency, 3 patients died from associated severe head injury, 3 patients died from severe abdominal injuries. 1 patient died from overwhelming sepsis and another patient with associated pelvic fracture died of suspected pulmonary embolism (Table VII). Out of the 6 patients that died from respiratory insufficiency, 3 patients had flail chest with associated severe pulmonary contusion, 1 patient died from flail chest with shock while 2 were poly traumatized patients with multiple rib fractures and severe pulmonary contusion. Two (2) of the 3 mortalities from severe head injury head injuries had no underlying respiratory insufficiency. The patient that died from associated abdominal injuries had multiple injuries to the colon and solid viscera injuries with haemoperitoneum and fecal peritoneal contamination.

Table-VII. Mortalities

Causes of death	No. of patients
Respiratory insufficiency	06
Associated severe head injury	03
Abdominal injury	03
Sepsis	01
Suspected embolism	01

Table-VIII. Duration of hospital stay

Duration of hospital stay (days)	No of patients
<10	43
10-20	70
20-30	20
>30	09

Most of the patients were discharged before 20 days on admission (Table-III).

DISCUSSION

Traumatic injuries are the most common cause of death in persons younger than 40 years[10]. The most affected age group in this study are patients between 21 to 40 years, an age group known for aggressive lifestyle and tendency to frequent traveling. Male predominance (82%) as demonstrated in this study has also been reported by others[11,12,13].

Blunt chest trauma was responsible for most cases of chest injuries in Irrua and Orlu. This is comparable with the results of previous studies on thoracic trauma in Nigeria[13,14]; Road Traffic accident being the commonest cause of blunt chest trauma[12]. However in Cape Town, Penetrating thoracic injury is prevalent, with up to 1,000 cases admitted annually with penetrating chest wounds

between 1982 and 1997[15]. Ali and Gali reported penetrating injury as the predominant cause of chest trauma, occurring in 61.5% of cases in Maiduguri, Nigeria[11]. Gunshot injury is the commonest cause of Penetrating chest trauma as also documented in other studies[16].

In our study, rib fractures were the commonest specific thoracic injury. The diagnosis of rib fracture was both clinical and radiological, since the routine chest radiograph has only a sensitivity of only 20-50% in detecting rib fractures[17] and chrondral rib fractures are almost always invisible on chest radiograph unless the fractures involves a strongly calcified cartilage. Clinical diagnosis was based on the findings of pain on breathing, localized tenderness and presence of bony crepitus. Studies have shown that Ultrasound scan has a higher sensitivity than plain chest radiograph in detecting rib fracture[18,19] while others have shown either it is either equally sensitive or slightly better[20]. Rib fractures were commonly associated with other thoracic injuries. Studies have revealed pneumothorax, haemothorax, and pulmonary contusion as the most common intra thoracic injuries associated with rib fractures[21,22,23]. The development of a pneumothorax and/or haemothorax is 25% in patients with one or two rib fractures and over 80% in patients with more than two rib fractures[24].

It is possible that some cases of pneumothorax must have been missed in our study because the chest radiographs for patients with suspected pneumothorax were all done in supine or erect position. In supine position, approximately 500ml of pleural gas is needed for definitive diagnosis of pneumothorax, however cadaveric studies has shown that the lateral decubitus view is the most sensitive (85%) for diagnosis of pneumothorax, followed by erect (59%) and supine (37%) views[25]. Myocardial contusion was diagnosed in seven patients. It is the commonest form of blunt cardiac injury. The incidence of myocardial contusion following chest trauma has been reported to vary from 7% to 55%[26]. The diagnosis was based on a history of major mechanism of injury, marked pain and tenderness over the sternum, the presence of unexplained marked and persistent tachycardia and ECG findings of dysrhythmias. We did not request for cardiac enzymes as we did not have facilities for this. No case of Penetrating cardiac injury was seen. Suspicion of aortic injury was made in a patient based on radiological features of mediastinal widening >8cm, (L) sided haemothorax and fracture of the 2nd left rib. Pneumomediastinum with Subcutaneous Emphysema that occurred in the absence of bony injury in 3 patients may have been due to Alveolar rupture as there was no evidence of tracheobronchial or oesophageal injuries.

Most cases of thoracic trauma are managed conservatively[9]. 96% of cases in our study were managed conservatively. This includes the use of closed tube thoracostomy drainage in patients in whom it is indicated. There were no acute indications for acute thoracotomy but unevacuated clotted haemothorax; empyema thoracis and infected lung haematoma were indications for late posttraumatic thoracotomy in our study. The patient with infected lung haematoma resulting from Penetrating lung injury refused surgery and signed against medical advice. Early intervention with Video assisted thoracic (VAT) surgery may be a more efficient and economical strategy for managing retained haemothoraces after trauma,[27] but we lack the facilities and expertise for VAT. Four out of five patients with traumatic diaphragmatic rupture had Laparotomy which facilitated repair of associated intra abdominal injury.

In our study, six out of nine patients with flail chest required mechanical ventilation. In patients with flail chest, both thoracic wall injury and pulmonary contusion are serious conditions, but contusion is the single most important in terms of its contribution to respiratory failure[28,29]. Severe respiratory distress is a definite indication for ventilation in a patient with flail chest. Other indications may include Grade III/IV shock, severe associated injuries, severe head injury, previous pulmonary disease, large flail chest (fractures of > 8 ribs) and Age >65 years[30]. We do not have the expertise for operative fixation of flail chest in our center. In patients without indication for mechanical ventilation, we used Trinkle's regimen with some modifications to treat underlying lung injury. However, it is been shown that most of the patients who underwent open fixation

required short term ventilatory support postoperatively and mortality rate in the surgical group is less than non surgical groups[31].

Most of the mortalities were from patients who had indications for mechanical ventilatory assistance and those with associated severe extrathoracic injuries. Unfortunately in most cases, there was no reliable means of ventilation. Continuous positive pressure ventilation (CPAP) has been shown to be a reliable mode of ventilation for patients with flail chest.[31].

The mortality rate in our study (9.9%) appear to be slightly higher than most of the others reported in the literature[11, 32,33,34]. Mortality was 16% when the patient had either a flail chest or a pulmonary contusion, but it increased to 42% if patients had both injuries[35].

Hospital mortality rates for chest trauma has also been found to increase from 4-8% to 13–15% when another organ system was involved and to 30–35% when more than one organ system was involved[36].

CONCLUSIONS

The incidence of chest trauma can be reduced if adequate preventive measures are taken. Adequate intensive care facility is very important in managing patients with respiratory compromise and those with severe extra thoracic injuries.

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