



## BLUNT TRAUMA CHEST : A STUDY ON CLINICAL AND MANAGEMENT PATTERN IN JODHPUR

### Surgery

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### ABSTRACT

**BACKGROUND:** Chest injuries constitute a continuing challenge to the trauma or general surgeon practicing in a developing country. This study reviews the pattern and management of these injuries mainly by general surgeons.

**METHODS:** A prospective study of 50 patients attending to emergency room in Tertiary care teaching Hospital with chest injuries between February 2017 and August 2017.

**RESULTS:** Over 6 months period, 50 patients with various forms of chest injuries were managed among them, Males were commonly affected than female with 4.5:1 ratio, Maximum incidence was in age group 41-60 years (66%). Mean age was 44.78 years, Mean Hospital stay was 10.78 days.

**CONCLUSION:** Most of the injuries were due to Motor Vehicle Accidents (MVA), commonest injury being Rib Fracture, followed by Pneumothorax, Pulmonary contusion and Haemothorax. The commonest associated injury being Clavicle Fracture. Most common solid abdominal organ injury was Liver injury (16%) followed by Splenic injury (8%). Overall 76% patients required tube thoracostomy and 24% patients were managed conservatively. Overall Mortality was 8% in the study.

### KEYWORDS

Chest trauma, Pattern, MVA, Thoracostomy

### INTRODUCTION:

Injuries to the thorax are common in more than 20% of trauma patients.<sup>[1]</sup> It is estimated that by the year 2020, 8.4 million people will die every year from injury and injuries from road traffic accidents will be the third most common cause of disability worldwide and the second most common cause in the developing world<sup>[2]</sup>. According to the National Trauma Database (NTDB annual report 2016), chest injuries were present in 15.1% of all trauma patients. The differences in the severity and complexity of these injuries constitute a challenging issue for clinicians around the world and therefore advanced health care methods are needed in order to reduce morbidity and mortality rates. The overall mortality rate of chest trauma is 9.53% (NTDB annual report 2016). Thoracic trauma constitutes the third most common cause of death after abdominal injury and head trauma in polytrauma patients<sup>[3]</sup>. The mortality rate of blunt thoracic trauma ranges from 9.5%-47.5%, depending upon the severity of injury sustained. The most common cause is MVA, followed by fall. MVAs account for 70-80% of such injuries. Industrial crush injuries, sports, crime and blast injuries are the other causes.

The three major mechanisms involved in blunt thoracic trauma are direct compression, rotational mechanism and deceleration. Blunt injury to the chest can affect any one or all of the components of chest wall and thoracic cavity. These components include the bony skeleton (ribs, clavicles, scapulae, sternum), lungs and pleurae, trachea bronchial tree, oesophagus, heart, great vessels of the chest, and the diaphragm. Often a combination of injuries is present. Blunt thoracic trauma is often associated with injuries to the other organs, especially the abdominal solid organs as the upper part of the abdomen is overlapped by the thoracic cage. Optimal care of severely injured patients requires a coordinated approach from the point of injury, through a hospital facility organised to cope with the demands of looking after multisystem problems, to a rehabilitation structure that can return the patient to his or her maximum potential level of function within society.

**OBJECTIVE:** The purpose of this study was to investigate the epidemiology, characteristics, incidence and management of polytrauma patients with chest injury admitted to our tertiary care facilities, trauma center in order to indicate factors influencing management, possible complications and patient mortality.

**MATERIALS AND METHODS:** Study design : A Prospective

study. Duration of study : 6 months (February 2017 to August 2017). Number of subjects : 50. Setting : Mathura Das Mathur Hospital, a Tertiary Care Teaching Hospital attached to Dr S.N. Medical College, Jodhpur.

**INCLUSION CRITERIA :** Patients presenting to emergency department with blunt trauma to chest with age above 16 years.

**EXCLUSION CRITERIA :** Patients with severe head injury. Detailed information including patient charts were noted from hospital records. Data collection included demographic details and mechanism of injury. Patients were thoroughly investigated and their CBC, RFT, LFT, ECG & chest x-ray were done. Higher radiological investigations viz ultra sonogram and CT thorax were done as and when required. Management of patients, surgical procedures, length of intensive care unit (ICU) stay, length of hospital stay, as well as injury related complications of these patients were recorded. Factors affecting mortality were evaluated. The mechanism of injury, time of injury, clinical assessment were accurately documented. Because different mechanism of injury were observed among different age intervals, we compared our findings between two age groups of patients: 16-50 years and over 50 years old in order to investigate differences in the treatment and outcome between younger and elderly patients.

**RESULTS :** The study is conducted in patients presenting to our emergency department with blunt trauma to chest.

**AGE:** Maximum number of patients belonged to the age group 21 to 40 years, i.e. 66%. Mean age is 30.5 years (Table 1).

**Table 1: DISTRIBUTION ACCORDING TO AGE**

Age (in years)	Number of patients
16-20	3
21-30	14
31-40	15
41-50	9
51-60	6
61-70	2
>70	1

**SEX:** Male to female ratio was 15.66:1 (Table 2).

**Table 2: MALE AND FEMALE**

Sex	Number of Patients
Male	47
Female	3

**MODE OF INJURY:** Majority of patients sustained injury following MVA or fall from height. MVAs contributed 74% and fall from height 16%. We had 3 patients who sustained chest trauma following fall of heavy objects onto chest. One patient sustained injury due to fall following attack by camel and other two by bull (Table 3).

**Table 3: MODE OF INJURY**

Mode of injury	Number of Patients
Motor vehicle accidents	37
Fall from height	8
Fall of objects onto chest	2
Animal attack	3

**TYPE OF CHEST INJURY:**

In our series all patients had rib fracture. With nearly 96% of them involving three or more ribs. There was a 20 % incidence of bilateral rib fractures. In 4 cases flail chest was present. The diagnosis of flail chest was made in case of clinical chest wall instability and radiographic confirmation of the diagnosis on chest CT scan (fracture of three or more adjacent ribs in at least two places). The most common associated thoracic injuries were pneumothorax, haemothorax and pulmonary contusion. The incidence of pneumothorax was 70 %, while the incidence of haemothorax was 30 %. Pulmonary contusions were observed in 68% patients. Lung collapse was seen in 16 % of cases and we had 2 cases of lung laceration. We had 1 case of cardiac injury. The least common injuries were lung laceration and cardiac injury (Table 4).

**Table 4: TYPE OF CHEST INJURY**

Types of Injury	Number of Patients
Single rib fracture	2
Multiple rib fractures	48
Bilateral rib fractures	10
Flail chest	4
Haemothorax	15
Pneumothorax	35
Surgical emphysema	36
Lung contusion	34
Lung collapse	8
Lung laceration	2
Cardiac injury	2
Tracheobronchial injury	1

**ASSOCIATED INJURIES:** The most common associated injury was clavicle fracture (22 %). Vertebral injuries were seen in 16 % of cases. The most common associated abdominal solid organ injury was that of liver (32 %), followed by spleen (8%), pancreas (2%) and kidney (2%). Intestinal injury was noted in 4%. Hemoperitoneum was found radiologically in 32% of cases (Table 5).

**Table 5: TYPE OF ASSOCIATED INJURY**

Types of Injury	Number of Patients
Clavicle fracture	11
Scapula fracture	2
Vertebral Injury	8
Hemoperitoneum	16
Liver Injury	10
Spleen Injury	4
Pancreatic Injury	1
Renal Injury	1
Intestinal injury	2
Sternal Fracture	1

**MODALITIES OF MANAGEMENT:** Regarding management, 38/ 50 patients (76 %) were treated with chest tube thoracostomy in the emergency department to relieve pneumothorax and /or haemothorax. 10 % all cases required bilateral tube thoracostomy. 12 of our thoracic patients with chest trauma were treated conservatively (24%). However, observation was possible for patients suffering from small pneumothorax without underlying respiratory disease or the need for positive pressure ventilation. Median duration of chest tube treatment was 10.5 days (range 1–32 days) depending on the amount of fluid in

the drainage chamber, evidence of air leak, and/or expected further surgical operations needing positive pressure ventilation. 4 patients underwent laparotomy (Table 6).

**Table 6: MODALITIES OF MANAGEMENT**

Modalities of management	Number
Unilateral ICD insertion	33
Bilateral ICD insertion	5
Mechanical ventilation	4
Tracheostomy	4
Laparotomy	4
Conservative	12

**Length Of Intensive Care, Mechanical Ventilation And Hospital Stay:** The median hospital length of stay of polytrauma patients with chest injuries was 21 days (range 1–34 days). Eight patients (16%) required ICU treatment with a median ICU length of stay of 11 days (range 1– 34 days). Intubated patients were referred to the ICU directly, whereas all other patients were transferred to an intermediate care unit (section of the ICU) for further surveillance. Intubation and mechanical ventilation was necessary in 8 patients. The median duration on the ventilator was 11 days (range 1–34 days). Five patients (8 %) were discharged home and 3 died in ICU.

**COMPLICATIONS AND MORTALITY:** The most common complication was pneumonia (10/ 50 patients, 20%) followed by septicemia. Sepsis was observed in 7 patients (14 %), and multi-organ failure in 2 patients (4%) and ARF in 2 patients (4%). Overall 32 day mortality was 8 % (4/50 patients) (Table 7).

**Table 7: COMPLICATIONS AND MORTALITY**

Complications	Number
Pneumonia-consolidation	10
Septicaemia	7
COPD exacerbation	2
MODS	2
Mortality	4

**DISCUSSION:** The American Academy of Science describes trauma as the “neglected disease of modern society”<sup>[4]</sup>. Trauma is usually considered as the main cause of mortality and morbidity in individuals between 1 - 44 years<sup>[5]</sup>. Chest injuries are common reasons for emergency medical care. In civilian practice, chest trauma is commonly caused by road traffic accidents. We studied a total of 50 patients with blunt trauma chest in this series. Majority of patients sustained injury following MVA or fall from height. MVAs contributed 74 % and fall from height 16%. We had 2 patients who sustained chest trauma following fall of heavy objects onto chest. 2 patients were injured by bull. Camel trampled 1 patient and finally sat on him. World over RTA is the most common cause of blunt trauma chest. In a study conducted by Robert M. Shorr et al of Maryland Institute for Emergency Medical Services Systems (MIEMSS)<sup>[6]</sup> The causes of these injuries encompassed automobile (70.9%), pedestrian (9.5%), and motorcycle accidents (7.8%); falls (7.6%); and miscellaneous causes (4.2%). In this study, RTA, falls and animal attack contributed 74%, 16% and 6% respectively. Fall of objects onto chest contributed 4% of cases. In our study motor bike accidents were the main cause of blunt trauma chest and in MIEMSS automobiles were the main cause, this difference is due to more use of motorcycles as compared to automobiles in our region. This reflects that RTA is the commonest cause of blunt trauma chest and there is difference in the injury caused by fall from height and animal attack. Here fall from height is the second main cause of blunt trauma chest. Most of the cases were occupational hazards especially fall from trees while cutting branches for animal feed and fall sustained at construction sites. This reflects the difference in occupational patterns of these nations. Maximum number of patients belonged to the age group 21 to 40 years, i.e., 66%. Mean age is 30.5 years. In the MIEMSS study the mean age was 36.9 years and male to female ratio was 2.7:1. In study by Konstantina Chrysou et al median age was 48.5 years and male to female ratio was 2.79 to 1<sup>[7]</sup>. In a study done in Qatar, "Rib fracture patterns predict thoracic chest wall and abdominal solid organ injury" by Al Hassani A et al, the sex ratio was 21%<sup>[8]</sup>. We had only 3 female cases, i.e., a male to female ratio of 15.66:1. This study shows a considerable difference in the sex ratio between various nations. This can be attributed mainly to the cultural and social background of these nations. In developed nations, more ladies sustain injuries mainly because more ladies drive motor vehicles compared to developing nations. This is partly because of the

low representation of women in Indian workforce and exposure on roads. Hospital stay was 15 days in a study conducted in the Department of Thoracic and Cardiovascular Surgery Erciyes University Medical Faculty Kayseri, Turkey, by Cemal Kahraman et al "Blunt Thoracic Trauma: Analysis of 1730 Patients"<sup>[9]</sup>. In study by Konstantina Chrysou et al the median hospital stay of Polytrauma patients with chest injuries was 11 days. Mean hospital stay in this study was 14.5 days. The commonest injury was rib fracture with or without associated pneumothorax, haemothorax, surgical emphysema, lung contusion and so on. Often a combination of these injuries were present.

Incidence of rib fracture was 100 %, compared to 86.4 % in the study conducted by Konstantina Chrysou et al. Patients presenting with rib fractures only were treated conservatively. 4 patients required intercostal nerve block for 5-6 days.

We had 4 cases of flail chest, i.e., 8 %, compared to 6.4 % in the study by Konstantina Chrysou et al. Chest tube was placed in all the 4 cases. Eight cases required mechanical ventilation and 4 required tracheostomy. Incidence of pneumothorax was 70 % as compared to 59.1% in the study by Konstantina Chrysou et al and 18.45% in the MIEMSS study. All cases of pneumothorax were treated with tube thoracostomy. ICD was removed usually within 5 to 6 days.

In the study conducted by Konstantina Chrysou et al 75% of the chest tubes were placed in the emergency department, because of the severity of the patients' general condition, especially in case of tension pneumothorax, traumatic symptomatic pneumothorax and haemothorax, respectively.

In our study 80% of the chest tubes were placed in the emergency department.

As Lesquen et al.<sup>[10]</sup> mentioned in their review, all traumatic pneumothoraces and symptomatic traumatic hemothoraces should be considered for chest tube insertion in the first 48 h following blunt chest trauma.

However, observation is possible for selected patients without respiratory disease or the need for positive pressure ventilation presenting with small unilateral pneumothoraces.<sup>[11]</sup>

Late drainage is usually required in patients with progression of pneumothoraces, hemothoraces or respiratory distress.<sup>[12,13]</sup>

In studies by Pape HC et al, Marasco SF et al, Veysi et al. that an early simple tube thoracostomy in the first 48 h in case of severe pneumothorax, an aggressive pain control including epidural analgesia when necessary (i.e. insufficient pain control with opioids), and intensive chest physiotherapy are the most important factors influencing the outcome after blunt chest trauma.<sup>[14,15,16]</sup>

In our study simple tube thoracostomy was done in first 36 hours in pneumothorax, and pain control was done with opioids and NSAIDs.

Incidence of haemothorax was 30% as compared to 21.8 in the study by Konstantina Chrysou et al. Minimal haemothorax found on CT were treated conservatively.

Most cases required ICDT. CT was found to be more sensitive for haemothorax, rib fractures and parenchymal lung injuries.

Prophylactic antibiotics, bronchodilators, nebulisation and incentive spirometry were given to patients who underwent tube thoracostomy.

Decision for ICDT was most often taken based on Plain chest x-ray findings.

Chest x-ray (CXR) was found to be sensitive particularly for rib fractures, pneumothorax and surgical emphysema.

ICD tube was inserted in the triangle of safety in all cases.

All cases of pneumonia and lung collapse were partial and most improved with incentive spirometric exercise.

One case had residual collapse during follow-up. We had 2 cases of lung laceration and were managed conservatively. We had 2 cases of

cardiac injury i.e., a 4% incidence as compared to 10 % in the study by Konstantina Chrysou et al. Altogether we had 19 cases of associated fractures, i.e. 38%. The most common associated fracture with blunt chest trauma was that of clavicle (11 cases, i.e., 22%), 16% cases had vertebral fractures and 1 case of Sternal fracture as compared to Clavicle (18.9%), Sternal (15.5%) and Scapula (12.7%) in the study by Konstantina Chrysou et al. 4% cases had scapula fracture. 32% cases sustained abdominal solid organ injury. They found liver injuries in 13.5% cases as opposed to 20 % in our series. Splenic trauma was found in 8 % of cases in our study. Liver injury was the most common abdominal solid organ injury followed by spleen. 10 patients had liver injury. Four cases required laparotomy and packing was done in 2 cases of liver laceration. Other 2 cases improved with conservative measures. Four patients sustained splenic injury. Two had splenectomy and other two were managed conservatively. We had one case each of pancreatic and renal injury. Patient with renal injury had right kidney lower pole injury and perivesical hematoma patient was managed conservatively. The tube was inserted in the triangle of safety in supine position in all cases. They were given antibiotics throughout the period of intercostal drainage. The decision for tube removal was taken based on clinical & radiological improvement as well as the amount of drainage and absence of air leak. 12 cases were managed conservatively, i.e., 24%. Mechanical ventilation was given for 8 patients. 4 patients underwent laparotomy. Two patients underwent perihepatic packing for liver laceration. Most common complication seen was pneumonia (20%), All cases responded to antibiotics and supportive therapy. We had a total of four deaths, i.e., 8% mortality rate as compared to 15.5% in the MIEMSS study.

**CONCLUSION :** Early diagnosis and prompt treatment of blunt chest trauma with timely chest tube thoracostomy whenever necessary, optimal pain control and chest physiotherapy resulted in good outcome in the majority of patients.

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