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Blunt Trauma Chest: A Study on Clinical Pattern

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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 cross sectional study of 200 patients attending to emergency room in Tertiary care teaching Hospital with chest injuries between January 2013 and December 2016.*
Results: *Over 3 years period, 200 patients with various forms of chest injuries were managed among them Males were commonly affected than female with 4.5 : 1 ratio, Maximum incidence in age group 41-60 years with 66%. Mean age 44.78 years, Mean Hospital stay 10.78 days*
Conclusion: *Most of the injuries are due to Motor Vehicle Accidents (MVA), Commonest injury being Rib Fracture (78%) followed by Hemothorax (60%) and Pneumothorax (44%) commonest associated injury is Clavicle Fracture. Most commonest solid abdominal organ injury is Liver (16%) followed by Spleen (8%). Overall 76 % patients required tube thoracostomy and 24% patients were managed conservatively. Overall Mortality was 6% in the study.*
Keywords: *Chest trauma, Pattern, MVA, Thoracostomy*

I. Introduction

Injuries to the chest are common, with up to 20% of trauma patients presenting with thoracic injuries. Chest trauma is a significant source of morbidity and mortality. The incidence of chest injuries are on a rise, with motor vehicle accidents (MVA) playing the most important role. 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 [1]. According to the National Trauma Database (NTDB), chest injuries are present in 13.8% of all blunt trauma patients. The overall mortality rate of chest trauma is 8.4%. 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 other causes. Direct compression, as well as deceleration and rotational physical mechanisms contribute to blunt thoracic trauma.Blunt injury to the chest can affect any one or all components of the 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 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. Although sophisticated prehospital and trauma centre systems have been shown to reduce the number of preventable deaths after trauma [2], maximum impact in reducing the burden of trauma must come from injury prevention strategies.

Objectives
1) The proportionate various types of injuries.
2) The various mechanisms by which chest injuries are sustained.
3) The proportion of associated abdominal solid organ injuries.

II. Materials And Methods

Study design: Cross-sectional study
Duration of study: 3 years
Number of subjects: 200
Setting: Tertiary Care Teaching Hospital
Inclusion criteria:
Patients presenting to emergency department with blunt trauma to chest
Exclusion criteria:
Patients with severe head injury

III. Results

The study is conducted in patients presenting to our emergency department with blunt trauma to chest. The mechanism of injury, time of injury, clinical assessment will be accurately documented. Thereafter the patient will be subjected to the appropriate primary investigations viz Haemoglobin concentration, PCV & chest x-ray. Higher radiological investigations viz ultra sonogram and CT thorax will be done as and when required. The patients will be duly followed up during their hospital stay to monitor their progress and to identify the development of complications. Maximum number of patients belonged to the age group 41 to 60 years, i.e 66%. Mean age is 44.78 years.

Age (years)	Number of patients
13-20	8
21-30	44
31-40	28
41-50	44
51-60	48
61-70	28
>70	nil

82% of the patients were males. We had only 36 female cases, i.e a male to female ratio of 4.5 :1

Sex	number of patients
Male	164
Female	36

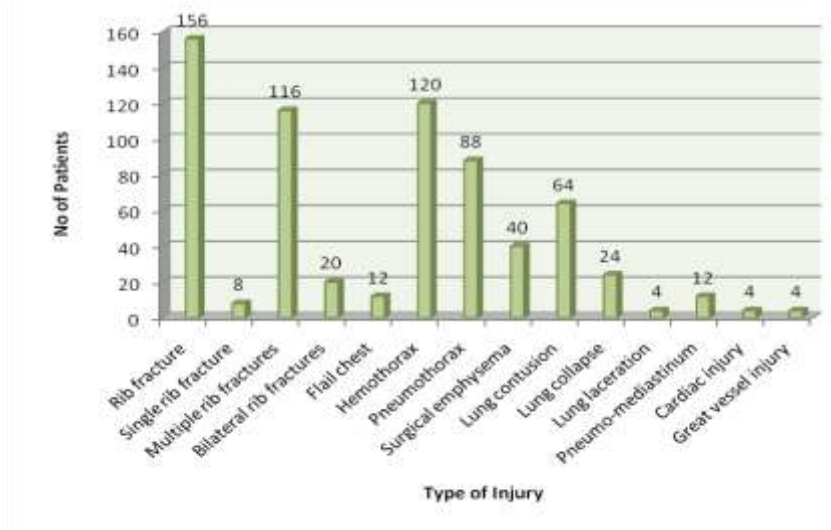
Average hospital stay 10.78 days

Types of chest injuries

The commonest injury in this series is rib fracture (78%) followed by haemothorax (60%) and pneumothorax (44%). Often a combination of these injuries were present. Rib fractures were often multiple (58%). The least common injuries were lung laceration, cardiac and great vessel injuries. We had 12 cases of flail chest. Lung contusion (32%) was the most common parenchymal lung injury. Lung collapse was seen in 12% of cases and we had 4 cases of lung laceration. We had 4 cases each of cardiac, aortic and diaphragmatic injuries.

Type of injury	**Number**
Rib fracture	156
Single rib fracture	8
Multiple rib fractures	116
Bilateral rib fractures	20
Flail chest	12
Hemothorax	120
Pneumothorax	88
Surgical emphysema	40
Lung contusion	64
Lung collapse	24
Lung laceration	4
Pneumo-mediastinum	12
Cardiac injury	4
Great vessel injury	4

Graph 1 : Types of chest injuries

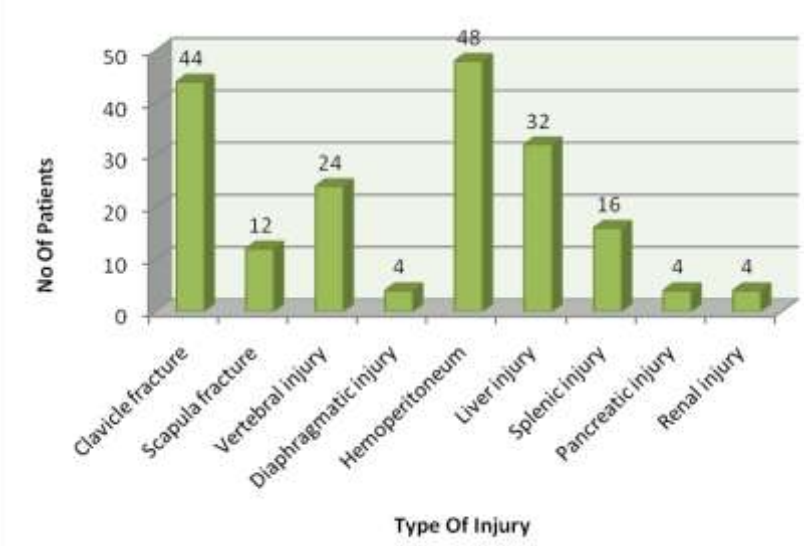


Associated injuries

The most common associated injury was clavicle fracture (22%). Vertebral injuries were seen in 12% of cases.The most common associated abdominal solid organ injury was that of fiver (16%), followed by spleen (8%), pancreas (2%) and kidney (2%). Hemoperitoneum was found radiologically in 24% of cases.

Type of injury	Number
Clavicle fracture	44
Scapula fracture	12
Vertebral injury	24
Diaphragmatic injury	4
Hemoperitoneum	48
Liver injury	32
Splenic injury	16
Pancreatic injury	4
Renal injury	4

Graph 2 : Associated injuries



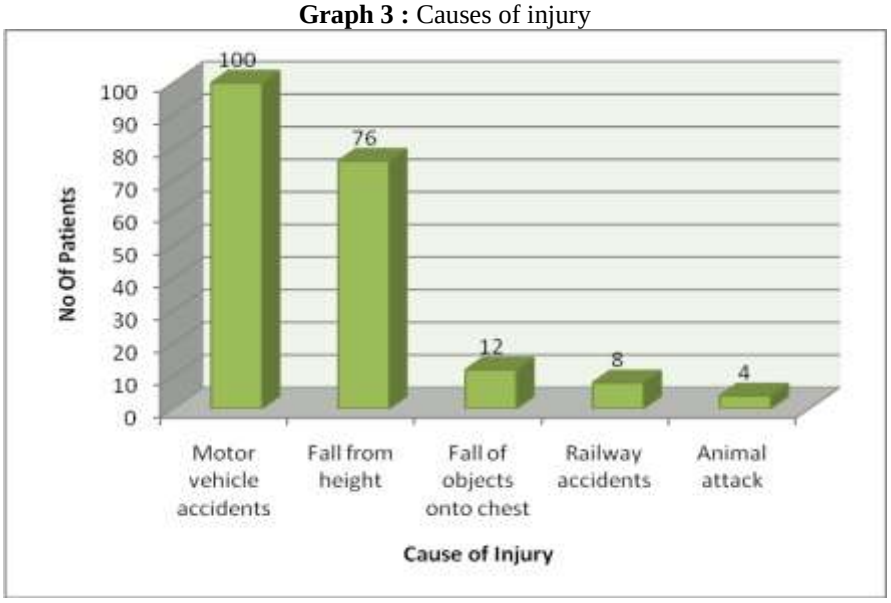
Causes of injuries

Majority of patients sustained injury following MVA or fall from height. MVAs contributed 50% and fall from height 38%. We had 3 patients who sustained chest trauma following fall of heavy objects onto chest.

Two patients sustained injuries following railway accidents. One patient sustained injury due to fall following attack by Stray dog.

Cause of injury	**Number**
Motor vehicle accidents	100
Fall from height	76
Fall of objects onto chest	12
Railway accidents	8
Animal attack	4

Graph 3 : Causes of injury



Mechanism of iniury

The three major mechanisms involved in blunt thoracic trauma are direct compression, rotational mechanism and deceleration. Direct compression played sole role in 96% of cases. Rotational mechanism and deceleration played role in 16 and 12 cases respectively.

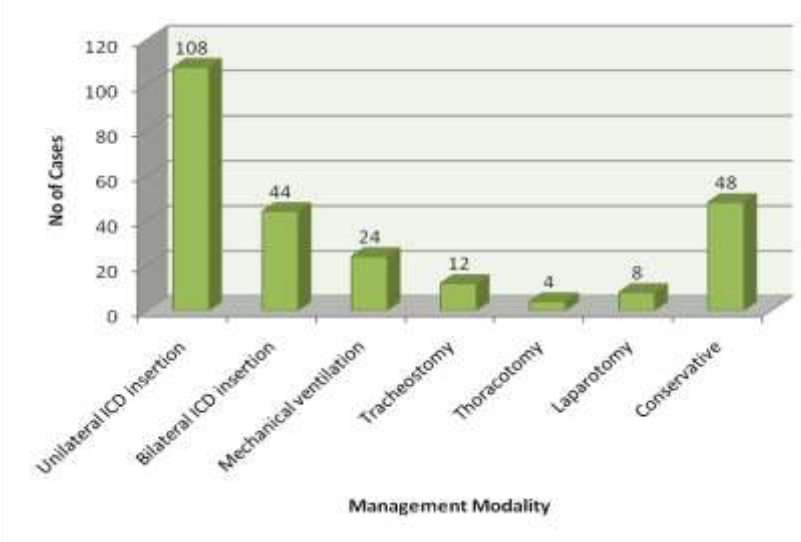
Mechanism of injury	**Number**
Direct compression	200
Rotational mechanism	16
Deceleration	12

Modalities of Management

Altogether 76% cases required tube thoracotomy. 22% cases required bilateral tube thoracostomy. Only 4 cases of cardiac injury required thoracotomy. 8 patients underwent laparotomy. 24% of cases were managed conservatively.

Modalities of management	**Number**
Unilateral ICD insertion	108
Bilateral ICD insertion	44
Mechanical ventilation	24
Tracheostomy	12
Thoracotomy	4
Laparotomy	8
Conservative	48

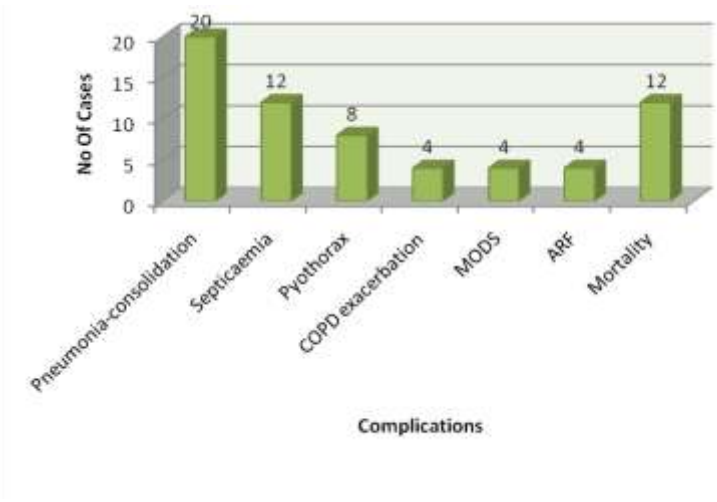
Graph 4 : Modalities of management



Complications

Pneumonia was the most common complication encountered followed by septicaemia and pyothorax.

Complications	**Number**
Pneumonia-consolidation	20
Septicaemia	12
Pyothorax	8
COPD exacerbation	4
MODS	4
ARF	4
Mortality	12



Overall mortality rate in this series is 6%.

IV. Discussion

The American Academy of Science describes trauma as the "neglected disease of modern society"[3]. Trauma is usually considered as the main cause of mortality and morbidity in individuals between 1 - 44 years [4].Chest injuries are common reasons for emergency medical care. In civilian practice, chest trauma is commonly caused by road traffic accidents. Most of the injuries are found among young adult males between the ages of 20 and 40 years the very productive period of life. [5-7].

A total of 200 patients with blunt thoracic trauma were studied in this series, Majority of patients sustained injury following MVA or fall from height. MVAs contributed 50% and fall from height 38%. We had 12 patients who sustained chest trauma following fall of heavy objects onto chest. Two patients sustained injuries following railway accidents, 4 patients sustained injuries due to fall following attack by stray dog.

World over MVA is the most common cause of blunt chest trauma. In a study conducted by Robert.M.Shorr etal of Maryland Institute for Emergency Medical Services Systems (MIEMSS), MVAs contributed 70.9% of cases, falls 7.6%% and animal attack 0.2% (8). In my series, MVA, falls and animal attack contributed 50%, 38% and 2% respectively. Fall of objects onto chest while carrying load contributed 6% of cases. This reflects that there is considerable difference in the modes of injury between developed and developing nations. Here fall from height contributed substantially. Most of the cases were occupational hazards especially fall from coconut tree and arecanut tree, and fall sustained by masons at construction sites. This reflects the difference in occupational patterns of these nations. In a study - "Pattern and outcome of chest injuries at Bugando Medical Centre in Northwestern Tanzania" done by Lema M.K et al, MVAs contributed 50.7% of cases. In our region animal attack and railway accidents are more common. More number of railway accidents may be attributed to lack of safety precautions and unmanned level crosses. Maximum number of patients belonged to the age group 41 to 60 years, i.e., 66%. Mean age is 44.78 years. In the MIEMSS study the mean age was 36.9 years. 82% of the patients were males. We had only 9 female cases, i.e., a male to female ratio of 4.5 : 1. In the MIEMSS study, the ratio is 2.7 : 1. 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% (9). This 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. Mean hospital stay in this study was 10.78 days. It 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" (10). Mean hospital stay in a study conducted by Cardiothoracic Surgery Unit Lagos University Teaching Hospital College of Medicine of University of Lagos, Lagos, Nigeria by Martins Oluwafemi Thomas et al was 6.6 days (11). The commonest injury was rib fracture with or without associated pneumothorax, hemothorax, surgical emphysema, lung contusion and so on. Often a combination of these injuries were present. Incidence of rib fracture was 78%, compared to 62% in the study conducted in Nigeria. Pure rib fractures were treated conservatively. 24 patients required intercostal nerve block for 3-4 days. We had 12 cases of flail chest, i.e., 6%, compared to 5.5% in the Nigerian study.

All three cases required tube thoracostomy. Four cases required mechanical ventilation and tracheostomy. Incidence of pneumothorax was 44% as compared to 24% in the Nigerian study 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. Twelve patients had pneumo-mediastinum. Incidence of hemothorax was 60% as compared to 20% in the Nigerian study. Minimal hemothorax found on CT were treated conservatively. Most cases required ICD. CT was found to be more sensitive for hemothorax, rib fractures and parenchymal lung injuries. Prophylactic antibiotics, bronchodilators, nebulisation and incentive spirometry were given to patients who underwent tube thoracostomy. Decision for ICD 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. CXR showed mediastinal widening in the only case of thoracic aortic injury in this series. ICD tube was inserted in the triangle of safety in all cases. All cases of lung collapse were partial and most improved with incentive spirometric exercise. One case had residual collapse during follow-up. We had 4 cases of lung laceration and it required thoracostomy only. We had 4 cases of diaphragmatic injury. Left dome was disrupted with herniation of splenic flexure and gastric fundus into thoracic cavity in 2 cases underwent laparotomy and repair of diaphragm. We had 4 cases of cardiac injury i.e., a 2% incidence as compared to 0.8% in the study conducted in Nigeria. One patient sustained ventricular septal rupture following fall from bicycle. Emergency closure of the defect with PTFE was done under cardiopulmonary bypass. On follow-up he had mild residual defect with pan systolic murmur. One patient sustained two tears in ascending aorta with surrounding hematoma formation (post-mortem report) . He died inspite of resuscitative efforts.

Altogether we had 18 cases of associated fractures, i.e 36% as compared to 22.4% in the study conducted in Turkey. The most common associated fracture with blunt chest trauma was that of clavicle(44 cases, i.e., 22%),12% cases had vertebral fractures. 6% cases had scapula fracture. 22% cases sustained abdominal solid organ injury. In a study conducted by Section of Trauma Surgery, Department of Surgery, Hamad General Hospital Doha, Qatar, the proportion of abdominal solid organ injury was 29%. They found liver injuries in 13.5% cases as opposed to 16% in our series. Splenic trauma was found in 15% and 8% cases respectively in their and our study. Liver injury was the most common abdominal solid organ injury followed by spleen. 32 patients had liver injury. Four cases required laparotomy and suturing of liver laceration. All other cases improved with conservative measures. Sixteen patients sustained splenic injury. All were managed conservatively. We had four cases each of pancreatic and renal injury. The three major mechanisms involved in blunt thoracic trauma are direct compression, rotational mechanism and deceleration. Direct compression played sole role in 96% of cases. Rotational mechanism and deceleration played role in 16 and 12 cases respectively. Altogether 152 cases required tube thoracostomy, 44 underwent bilateral procedure. i.e., 76% as compared to

82.4% in the Nigerian study. 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. We had four cases of thoracotomy as compared to 67 out of 896 patients in the study conducted in Nigeria. 48 cases were managed conservatively, i.e., 24% as compared to 9.8% in the Nigerian study. Mechanical ventilation was given for 24 patients. Most of them were given SIMV for a few days. 8 patients underwent laparotomy. Four under patients underwent suturing of liver laceration and the other repair of diaphragm. Most common complication seen was pneumonia (10%), All cases responded to antibiotics and supportive therapy. In the study conducted in Turkey, the most common causes of morbidity were atelectasis (10.06%) and pneumonia (5.32%). We had a total of Twelve deaths, i.e., 6% mortality rate as compared to 5.61% in the Turkish study and 15.5% in the MIEMSS study.

V. Conclusion

1) Motor vehicle accidents were the leading cause of blunt chest trauma in this series, followed by fall from height. Direct compression of chest against static surfaces or objects contributed to almost all cases, with rotational mechanism and deceleration playing minor roles.

2) Males were more often affected with a sex ratio of 4.5 : 1. Maximum number of patients belonged to the age group 41 to 60 years, i.e., 66%. Mean age is 44.78 years. The mean hospital stay was 10.78 days.

3) The commonest injury was rib fracture (78%) followed by hemothorax (60%) and pneumothorax (44%).Often a combination of these injuries were present. Lung contusion (32%) was the most common parenchymal lung injury. Lung collapse was seen in 12% of cases and we had one case of lung laceration. We had Four cases each of cardiac, aortic and diaphragmatic injuries.

4) The most common associated injury was clavicle fracture (22%). The most common abdominal solid organ injury was that of liver (16%), followed by spleen (8%), pancreas (2%) and kidney (2%).

5) Altogether 76% cases required tube thoracostomy of which 22% cases required a bilateral procedure. Four cases of cardiac injury required thoracotomy. 8 patients underwent laparotomy. 24% of cases were managed conservatively. Pneumonia was the most common complication encountered followed by septicaemia and pyothorax. The overall mortality rate in this series was 6%.

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