

Original research article

A study to evaluate the clinico-etiologic profile and management of patients with trauma to the chest in a tertiary care Hospital**Dr. Kumar Chandra Kant^{1*}, Dr. Kumar Shashi Kant², Dr. Md Noman³**¹Senior Resident, Department of General Surgery, All India Institute of Medical Science, Patna, Bihar, India²Assistant professor, Department of Orthopaedics, Patna medical college & Hospital, Patna, Bihar, India³Senior Resident, Department of General Surgery, A. N. Magadh Medical College & Hospital, Gaya, Bihar, India**Corresponding Author: Dr. Kumar Chandra Kant****Abstract****Aim:** The aim of the study to evaluate the trauma to the chest.**Methods:** This was a prospective observational study conducted in the Department of General Surgery, Anugrah Narayan Magadh Medical College & Hospital, Gaya, Bihar, India for 10 months. 100 cases were included in this study. Radiological, blood investigations done and subsequent management done according to clinical and radiological findings. Additional workup like blood grouping and cross matching, arterial blood gas, ultrasonography of chest and abdomen, computed tomography or other radiological investigation as and when required were done and recorded. Both blunt and penetrating chest trauma were taken into consideration.**Results:** The incidence of chest trauma in this study was 21.19%. The mean average age was 36.25 years. The male to female ratio in this study was M:F=3.54:1. The commonest mode of injury was RTA comprising of 63%. Next common cause was assault followed by accidental fall accounting for 15 cases (15%) and 13 cases (13%) respectively. Accidental injuries were the major group comprising of 91% whereas rest were homicidal cases 9%. Blunt force was the most common mechanism of injury comprising of 93% of cases whereas penetrating force contributed to 7% of cases. Rib fracture was the commonest skeletal injury in 25% cases. Clavicle fracture was the next common in 13% patients. In this study most of the patients (82%) were treated by the conservative line of management. Management with tube thoracostomy was required in 15% for the patients with significant haemothorax, pneumothorax, hemopneumothorax, tension pneumothorax. Of these 15 cases 1 patients required mechanical ventilation. Pain management is an important aspect in management of chest trauma. The severity of pain in our study patients was evaluated with the help of visual analogue scale (VAS).**Conclusion:** Chest trauma commonly affects young males with RTA causing significant morbidity and mortality. Majority of patients can be treated conservatively.**Keywords:** Chest trauma, Thoracotomy, Intercostal nerve block, Tube thoracostomy**Introduction**

Blunt trauma is physical trauma by a non-penetrating impact through a blunt object or surface to a body part. Blunt trauma is the primary trauma, from which develops more specific types such as contusions, abrasions, lacerations, and/or fractures. Traumatic injury is the leading cause of death under the age of 45 worldwide. Approximately 5.8 million people die each year as a result of injuries. This accounts for 10% of the world's deaths, more than the number of fatalities from malaria, tuberculosis, and HIV/AIDS combined. In India, every 1.9 min, trauma

related death occurs. Approximately 1 million people die and 20 million are hospitalized every year due to injuries.¹ Chest trauma is one of the most serious injuries of the chest and also a common cause of significant disability and mortality. Chest trauma is the leading cause of death from physical trauma after head and spinal cord injury. Thoracic injuries are primary or a contributing cause of about one fourth of all trauma-related deaths. The mortality rate in these cases is about 10%. Thoracic injuries account approximately 20–25% of deaths due to trauma. 16,000 deaths occur per year in India alone as a result of chest trauma. Blunt trauma chest contributes to major accidental injuries in India due to increased incidence of road traffic accidents (RTAs) (6% of global vehicular accidents) due to increased road traffic, availability of new high-speed vehicles and less awareness regarding traffic rules. A very few studies had been conducted to analyze its magnitude and management in the Indian scenario.²

Thoracic cage contains the most vital organs - heart, lungs and the great vessels and it has to give protection to the vital organs as well as preserve the unique function of expansion of lungs to ensure proper oxygenation of blood. Although, the ribs sternum and vertebral column which form this sturdy but pliable rib cage gives enough protection, there are certain weak points in this structure like the intercostal spaces, angles of ribs and costochondral junctions. These areas are more susceptible to trauma. As chest is a large and exposed portion, it is likely to get traumatized in most of the impact injuries. In India trauma is becoming the leading cause of mortality and morbidity during the first four decades of life. The direct cost to society in caring to the needs of trauma victims is enormous and with majority of the patients affected being young individuals, their loss of productivity to the family and to the society is immense.

Mortality rates are higher in patients with blunt abdominal trauma than in those with penetrating wounds, because of the lack of early diagnostic facilities and optimal management.³ It is rather more difficult to diagnose a patient with intraabdominal injuries because abdominal examination alone does not reliably categorize and differentiate all patients with intra-abdominal injuries.⁴ Delay in management of blunt abdominal trauma increases morbidity and mortality due to bleeding from solid organs or vascular injury.⁵

Current study was designed to see the total number of chest trauma patients, their clinical profile, aetiology, sites of injury, type of injuries, associated injuries, complications and modality of treatment required in their management at our tertiary care centre.

Material and methods

This was a prospective observational study conducted in the Department of General Surgery, Anugrah Narayan Magadh Medical College & Hospital, Gaya, Bihar, India for 10 months. after taking the approval of the protocol review committee and institutional ethics committee.

Methodology

100 cases were immediately attended in the emergency department with history noted, clinical examination performed and initial management done as per ATLS guidelines. Radiological, blood investigations done and subsequent management done according to clinical and radiological findings. Additional workup like blood grouping and cross matching, arterial blood gas, ultrasonography of chest and abdomen, computed tomography or other radiological investigation as and when required were done and recorded. Both blunt and penetrating chest trauma were taken into consideration. Final outcome (death/discharge) was noted, with discharged patients were followed until normal activity were regained. Participants were selected based from the following selection criteria. Patients with road traffic accidents (RTAs) with trauma to chest, patients with assault with trauma to the chest, and patients with fall of heavy object over chest, accidental fall, animal attack with chest trauma were included in this study. Patients with severe head injury (having extradural haemorrhage, subdural haemorrhage,

sub arachnoid haemorrhage, intraparenchymal haemorrhage, skull bone fracture, or requiring any prior neurosurgical intervention) and patients with severe abdominal injury (patients having bowel, solid organ injury or requiring surgical intervention like laparotomy) were excluded from this study.

Statistical Analysis

Data was collected in case record form and analysed in Microsoft excel worksheet version 2018. Descriptive statistics for quantitative variables was represented as average and mean. Qualitative variables were represented as frequency and percentages.

Results

A total of 472 trauma patients were admitted, of these 100 patients were selected for the study as per our selection criteria and primarily had chest injury. The incidence of chest trauma in this study was 21.19%.

Out of a total of 100 patients, 24 patients were in the age group of 30-40 years constituting maximum number of cases i.e. 24%. The next common decade was the 3rd i.e., age group of 20-30 years with 22 patients. The mean average age was 36.25 years. Majority were males comprising of 78% (78 cases) whereas females comprised of 22%. The male to female ratio in this study was M:F=3.54:1.

The commonest mode of injury was RTA comprising of 63%. Next common cause was assault followed by accidental fall accounting for 15 cases (15%) and 13 cases (13%) respectively. Animal attack consisted of 7 patients of which 6 were males and 1 female which accounted for 7% of total. Of the cases of animal attack, pig attack was common with total of 4 cases followed by bull attack (2 cases) and Goat attack (1 cases). We encountered 2 case of fire arm injury (Table 1).

Considering the nature of injury as accidental or homicidal, it was observed that patients with accidental injury were the major group. Accidental injuries were the major group comprising of 91% whereas rest were homicidal cases 9%. Blunt force was the most common mechanism of injury comprising of 93% of cases whereas penetrating force contributed to 7% of cases. Blunt force was commonly associated with road traffic accidents. Right side of chest was injured in 55% cases, whereas left side in 44%. Bilateral injury was encountered in only 1 case.

Table 1: Mode of injury in chest trauma patients

Mode of injury	No. of cases		Total	Percentage
	Male	Female		
Road traffic accidents	47	16	63	63
Assault	13	2	15	15
Accidental fall	10	3	13	13
Animal attack	6	1	7	7
Fire arm injury	2	0	2	2
Total	78	22	100	100

Abrasion was the commonest external injury over chest which was present 35%. Contusion over chest wall was seen over chest in 7%. Other external injury seen were stab wound in 5%, laceration in 2%, penetrating wound in 1% and gunshot wound in 1 case (1%). However, there were no external injuries in 24 cases despite having some form of injuries internally.

Thoracic injuries observed in our study of patients with chest trauma were categorized as skeletal injury and pleural and visceral injury. Rib fracture was the commonest skeletal injury in 25% cases. Clavicle fracture was the next common in 13% patients. Lung contusion was the most common organ with visceral injury in 8% cases. Haemothorax in 7%, followed by

hemopneumothorax (6%) and pneumothorax (3%), lung laceration 2%, tension pneumothorax and tracheobronchial injury (1%), thoracic vascularinjury (internal thoracic artery) in 1 case (Table 2).

Associated injuries were present in 41% patients. The most common associated injury present was head injury in 25%. Other associated injuries were limb injuries (abrasion, laceration, contusion) in 7%, abdominal injury in 6% and blunt trauma to pelvis in 2%.

In this study most of the patients (82%) were treated by the conservative line of management. The conservative management includes treatment in the form of relief of pain by analgesics (oral/ intravenous/intramuscular), intercostal nerve block, epidural analgesia, chest physiotherapy, oxygen supplementation and intravenous fluids, antibiotics and mechanical ventilation if required. 1 patient among these required positive pressure ventilation as he was having flail chest. Management with tube thoracostomy was required in 15% for the patients with significant haemothorax, pneumothorax, hemopneumothorax, tension pneumothorax. Of these 15 cases 1 patients required mechanical ventilation.

Thoracotomy was required in 3 cases (3%) of which 1 required ventilatory support. Among the three thoracotomies performed, 1 case had penetrating chest injury with haemothorax for which wedge resection of lung was done, other had lung laceration with diaphragm injury for which wedge resection with diaphragm repair was done and in third case, there was massive haemothorax with internal thoracic artery injury for which vessel ligation and evacuation of haemothorax was done (Table 3).

Table 2: Different injuries encountered in chest trauma patients.

Chest injuries	No. of cases	Percentage
Skeletal injuries		
Rib fracture (all)	25	25
Rib fracture (1-3)	18	18
Rib fracture (>3)	7	7
Rib fracture (bilateral)	1	1
Flail chest	1	1
Clavicle fracture	13	13
Scapula fracture	1	1
Thoracic spine fracture	2	2
Diaphragm	1	1
Sternum fracture	1	1
Pleural and visceral injuries		
Pneumothorax	3	3
Haemothorax	7	7
Hemopneumothorax	6	6
Tension pneumothorax	1	1
Lung contusion	8	8
Lung laceration	2	2
Tracheobronchial injury	1	1
Thoracic vascularinjury	1	1
Cardiac injury	0	0
Pericardial collection	1	1
Oesophageal injury	0	0

Pain management is an important aspect in management of chest trauma. The severity of pain in our study patients was evaluated with the help of visual analogue scale (VAS). In this study 89% were managed with intravenous or intramuscular analgesia alone (nonsteroidal anti-inflammatory drugs, opioids).

Intercostal nerve block was required in 8% of cases, while epidural analgesia was required in 3% of cases for satisfactory pain management (Table 4). The common complications associated with chest trauma patients in our study was pneumonia and atelectasis in 3% each.

Table 3: Modality of treatment in chest trauma

Modality of treatment	No. of cases managed without mechanical ventilation	No. of cases managed with mechanical ventilation	Total	Percentage
Conservative	81	1	82	82
Tube thoracostomy only	14	1	15	15
Thoracotomy with tube thoracostomy	2	1	3	3
Total	97	3	100	100

Table 4: Pain management in chest trauma.

VAS score	No. of cases	Pain management with IM/IV analgesic alone	No. of cases requiring ICNB	No. of cases requiring epidural analgesia	Percentage of patient with particular VAS score	Percentage of patients requiring additional ICNB/EA with particular VAS score
0	0	0	0	0	0	0
2	4	4	0	0	4	0
4	44	44	0	0	44	0
6	46	41	5	0	46	6
8	5	0	3	2	5	100
10	1	0	0	1	1	100
Total	100	89	8	3	100	-
%	-	89	8	3	-	-

Table 5: Complications of chest trauma

Complications of chest injuries	No. of cases	Percentage
Pneumonia	3	3
Empyema	1	1
Atelectasis	3	3
Acute respiratory distress syndrome	1	1
Pericardial effusion	1	1
Bronchopleural fistula	1	1
Haemorrhagic shock	1	1
Death	2	2

Other complications were acute respiratory distress syndrome (ARDS) in 1%, empyema in 1%, pericardial collection in 1%, bronchopleural fistula (1%) and haemorrhagic shock (1%). The mortality rate was 2% (Table 5).

In this study the average length of hospital stay was 4.7 days. Majority of cases required hospital admission for 1-4 days (65%), 4-7 days in 20%, 1-2 weeks in 6%. Hospital admission for more than two weeks was required in 9% cases.

Discussion

The incidence of chest trauma in this study was 21.19%. Similar incidence of 20% were found in study of Kumar et al.⁶ This increasing incidence can be due to improper planning and development which results in the hazards of the modern civilization.

The mean average age was 36.25 years. Similar observations of mean age were recorded by Shorr et al (36.9 years), Shah et al (35 years) and Kulshrestha et al (34.5 years).⁷⁻⁹ Out of a total of 100 patients, 24 patients were in the age group of 30-40 years constituting maximum number of cases i.e. 24%. The next common decade was the 3rd i.e., age group of 20-30 years with 22 patients. The most commonly affected age group with blunt trauma chest belongs to young generation who often indulge in vehicular experimental activity (like over speeding etc) at the same time they comprise the important pillars of economy of country, thus increase in incidences will have great bearing in financial loss to the country.

Majority were males comprising of 78% (78 cases) whereas females comprised of 22%. The male to female ratio in this study was M:F=3.54:1. Dalal et al had a similar finding with male: female ratio of 5.48:1.¹⁰ This preponderance of male can be explained by the fact that males have greater exposure to outdoor activities like driving, industrial work, labour work as they constitute working and earning member in most of the families, whereas females take the responsibility of household work in our region. Other reason being male are usually more involved in quarrels and fights. With the recent changing trends, this ratio may decrease in future.

The commonest mode of injury was RTA comprising of 63%. RTA was the most common cause in many other studies as well like Shah et al (76%), Dangi et al (80.9%), Dalal et al (66.67%).⁹⁻¹¹ This may be explained by the fact that rise in number of RTA due to noncompliance to traffic rules by both driver as well as pedestrians, fatigue of the drivers, alcohol consumption during driving, lack of street lights, poor quality of roads, urbanization, population explosion, and tremendous growth in road transport sector. Next common cause was assault contributing to 15%, comparable to study of Dangi et al (9.52%), followed by accidental fall accounting 13%, comparable with study of Shah et al (16%).^{9,11} Animal attack, firearm injury contributed to minority of cases in our study with 7% and 2% cases respectively, whereas in study of Dalal et al it was reported in 2% and 1.49% respectively.⁷ Dangi et al reported firearm injury in 4.76% cases.¹¹

Accidental injuries were the major group comprising of 91% whereas rest were homicidal cases 9%. In the study of Dalal et al accidental nature of injury was present in 73.63% and homicidal in 26.37%.¹⁰ Blunt force was the most common mechanism of injury comprising of 93% of cases whereas penetrating force contributed to 7% of cases. In study of Shah et al penetrating chest trauma accounted for 5% and blunt chest trauma in 95% of cases.⁹ Right side of chest was injured in 55% cases, whereas left side in 44%. Bilateral injury was encountered in only 1 cases. Shah et al also had similar finding with right, left, and bilateral cases consisting of 52%, 44% and 4% respectively.⁹ Due to its clinical relevance in considering underlying organ affected and or planning of site of tube thoracostomy or thoracotomy, site of injury is of great importance.

In present study it was observed that rib fracture is the most common skeletal injury in the chest region i.e. 25%. This could be due to the fact that ribs are most exposed bone to trauma as they are spread over large area. Kumar et al, Shah et al, and Sharma et al mentioned in their study that the commonest skeletal injury of thoracic region was fracture of ribs.^{6,9,12} Other common skeletal injury was clavicle fracture in 13% of cases, similar to the study of Kulshrestha et al (14.1%).⁷

Lung contusion was the most common visceral injury encountered in 8% of cases whereas in study of Sharma et al it was 4%.¹² Haemothorax was present in 7%, pneumothorax in 3%, while in study of Sharma et al it was 1.6% and 1.8% respectively.¹² In our study

hemopneumothorax was present in 6% and in study of Shah et al similar incidence of hemopneumothorax was present i.e. 5%.⁹ Lung is the most common organ involved due to its larger size and occupying major portion of thorax which make it is an easy target in chest injuries. This factor along with the higher incidence of ribs fracture causes increased risk of lung contusion, haemothorax, pneumothorax and hemopneumothorax. Difference in injuries sustained can be attributed to the mode of Injury and amount of energy transferred during injury.

Trauma does not respect any anatomical boundaries, thus associated injuries in chest trauma are common accompaniments (35%). Head injury was the most common associated injury in our study (25%), in accordance to that seen in study of Kulshrestha et al(33%) and Shorr et al (43%).^{7,8} Common association of head injury in chest trauma patients in our study could be attributed to fact that majority of patients were victim of road traffic accidents sustaining multiple injuries. It also implies that both the injuries should be suspected RTA's.

In this study most of the patients i.e. 82% were treated by the conservative line of management. Tube thoracostomy was required in 15% whereas thoracotomy was required in 3%. Sharma et al in his study of 500 cases of chest trauma also encountered similar observations with conservative management done in 93.6% cases while tube thoracostomy in 6.1% cases.¹²

In this study, 89% patients were managed with intravenous or intramuscular analgesia alone (non-steroidal anti-inflammatory drugs, opioids). 6 out of 46 cases with VAS score of 6 required intercostal nerve block (ICNB) for pain relief while most of patients with higher VAS score required epidural analgesia (EA) or ICNB along with intravenous agents for pain relief. Sharma et al in his study had patients with VAS score of 6 where 68.2% required ICNB as compared to our study where 6.03% required nerve block.¹²

The common complications associated with chest trauma patients in our study was pneumonia and atelectasis in 3% each in our study as well in the study of Shah et al (pneumonia in 2% and atelectasis in 3% cases).⁹ Other complications were acute respiratory distress syndrome (ARDS) in 1%, empyema in 1%, pericardial collection in 1%, bronchopleural fistula (1%) and haemorrhagic shock (1%). The mortality rate was 2%. In this study the average length of hospital stay was 4.7 days. Kulshrestha et al in his study had an average length of stay of 6.9 days.⁷

Conclusion

We concluded that the chest injury occurs most common in RTA patients and commonly affected are males in their 3rd decade of life. Public awareness regarding road safety measures and educating about the first aid measures for trauma patients is needed. Most common mode of presentation was chest pain and most common clinical sign was positive chest compression. Most of the patients of chest injury had soft tissue trauma over chest in the form of abrasions.

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