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Original Research Article

Clinical study of patients with trauma to the chest in a tertiary care centre

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ABSTRACT

Background: Chest trauma is one of the serious injuries and also one of the leading causes of death from physical trauma. Current study is designed to study clinical profile, pattern of injuries, complications and treatment modality required in chest trauma management.
Methods: A prospective observational study was conducted in Shri Vasantrao Naik Government Medical College, a tertiary care hospital in Yavatmal, Maharashtra, India in 246 patients primarily admitted for chest trauma from 1st March 2018 to 31st August 2019. All cases were managed in emergency department with history noted, clinical examination performed and initial management done as per ATLS guidelines. Definitive management done according to clinical and radiological investigations. Final outcome (death/discharge) was noted with discharged patients were followed until normal activity regained.
Results: Male of 3rd-4th decade constituted most vulnerable group, with mean age of 38.56 years and male:female ratio of 5.31:1. Road traffic accident (RTA) was the commonest cause (71.14%), followed by assault (11.79%) and accidental fall (11.38%). Blunt force was the most common mechanism (93.09%). Rib fracture was present in 26.83%, lung contusion in 8.13% patients, followed by haemothorax (7.32%), hemopneumothorax (5.70%) and pneumothorax (3.25%). Conservative management suffices in most cases (86.59%), tube thoracostomy in 12.19%, thoracotomy in 1.22% cases. Patients with VAS score of 6 and above required intercostal nerve block (5.31%) or epidural analgesia (2.45%) for satisfactory pain relief. Pneumonia and atelectasis were common complications 2.03% each. Mortality rate was 1.22%. Average length of hospital stay was 4.6 days.
Conclusions: 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

Chest trauma is one of the major injuries encountered in trauma victims and also the leading cause of death from physical trauma after head injury. Chest injuries are found to be the primary or a contributing cause of about a quarter of all trauma related deaths.[1]

Injuries to the chest are common, with up to 20% of trauma patient's presenting with thoracic injuries. Chest trauma contributes to major accidental injuries in India, due to increased incidence of vehicular accidents (6% of global vehicular accidents) due to increased availability of new high-speed vehicles and ignorance or unawareness of traffic rules.[2,3] Only few studies have been conducted to analyse its magnitude and management in Indian scenario.

Injury to the chest can affect the chest wall and viscera of the thoracic cavity. These includes the bony skeleton

(ribs, clavicles, scapulae, sternum), trachea bronchial tree, lungs and pleurae, oesophagus, heart, great vessels and the diaphragm. Often a combination of these injuries is present. Thoracic trauma is often associated with injuries to other organs, especially the abdominal Solid organs as the abdomen is overlapped by the thoracic cage.

Chest injury is potentially the most dangerous of all and its management should be a matter of the most extreme urgency. Blood transfusions, artificial ventilators, antibiotics, X-rays, ultrasonography, computed tomography, lung scan, tube thoracostomy, tracheostomy, arterial blood gas analysis, spirometry, esophagoscopy and bronchoscopy have remarkably improved the management of critically ill-patients. Physiotherapy, rehabilitation has also added to the improvement in management of chest injuries.

Optimal care of trauma patients requires a coordinated management from the point of injury, through a hospital facility established to cope with the demands of tackling this multisystemic problems, to a rehabilitation structure that can return the patient to a maximum working potential within society. Sophisticated prehospital and trauma care systems have been shown to reduce the number of preventable deaths after trauma, maximum impact in reducing the burden of trauma must come from their prevention strategies.[4]

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.

METHODS

The present study was a prospective observational study conducted in Shri Vasantrao Naik Government Medical College, a tertiary care hospital in Yavatmal, India. The study was initiated after obtaining approval from the institutional ethics committee and department of surgery. The study included 246 patients primarily admitted for chest trauma from 1st March 2018 to 31st August 2019. All 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.

Inclusion criteria

Inclusion criteria were 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.

Exclusion criteria

Exclusion criteria were patients with severe head injury (having extradural haemorrhage, subdural haemorrhage, sub arachnoid haemorrhage, intraparenchymal haemorrhage, skull bone fracture, or requiring any prior neurosurgical intervention). Patients with severe abdominal injury (patients having bowel, solid organ injury or requiring surgical intervention like laparotomy).

Data was collected in case record form and analysed in Microsoft excel worksheet version 2016. Descriptive statistics for quantitative variables was represented as average and mean. Qualitative variables were represented as frequency and percentages.

RESULTS

A total of 1219 trauma patients were admitted, of these 246 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 20.18%.

Out of a total of 246 patients, 61 patients were in the age group of 31-40 years constituting maximum number of cases i.e. 24.80%. The next common decade was the 3rd i.e., age group of 21-30 years with 57 patients. The mean average age was 38.56 years. Majority were males comprising of 84.15% (207 cases) whereas females comprised of 15.85%. The male to female ratio in this study was M:F=5.31:1.

The commonest mode of injury was RTA comprising of 71.14%. Next common cause was assault followed by accidental fall accounting for 29 cases (11.79%) and 28 cases (11.38%) respectively. Animal attack consisted of 13 patients of which 12 were males and 1 female which accounted for 5.28% of total. Of the cases of animal attack, pig attack was common with total of 7 cases followed by bull attack (4 cases) and tiger attack (2 cases). We encountered one 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, comprising of 87.80% of cases with 182 males and 34 females. The most common mechanism of injury was blunt injury comprising of 93.09%. Blunt force was commonly associated with road traffic accidents. Right side of chest was injured in 54.06% cases, whereas left side in 44.72%. Bilateral injury was encountered in only three cases.

Table 1: Mode of injury in chest trauma patients.

Mode of injury	No. of cases		Total	Percentage
	Male	Female		
Road traffic accidents	149	26	175	71.14
Assault	24	5	29	11.79
Accidental fall	21	7	28	11.38
Animal attack	12	2	13	5.28
Fire arm injury	1	0	1	0.41
Total	207	39	246	100

Abrasion was the commonest external injury over chest which was present 37.80%. Contusion over chest wall was seen over chest in 7.32%. Other external injury seen were stab wound in 4.47%, laceration in 1.63%, penetrating wound in 0.81% and gunshot wound in 1 case (0.41%). However, there were no external injuries in 111 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 26.83% cases. Clavicle fracture was the next common in 13.82% patients. Lung contusion was the most common organ with visceral injury in 28.13% cases. Haemothorax in 7.32%, followed by hemopneumothorax (5.70%) and pneumothorax (3.25%), lung laceration 1.63%, tension pneumothorax and tracheobronchial injury (0.41%), thoracic vascular injury (internal thoracic artery) in 1 case (Table 2).

Associated injuries were present in 40.25% patients. The most common associated injury present was head injury in 25.20%. Other associated injuries were limb injuries (abrasion, laceration, contusion) in 7.32%, abdominal injury in 6.10% and blunt trauma to pelvis in 1.63%.

In this study most of the patients (86.59%) 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. One patient among these required positive pressure ventilation as he was having flail chest. Management with tube thoracostomy was required in 12.19% for the patients with significant haemothorax, pneumothorax, hemopneumothorax, tension pneumothorax. Of these 30 cases two patients required mechanical ventilation.

Thoracotomy was required in 3 cases (1.22%) of which 1 required ventilatory support. Among the three thoracotomies performed, one 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)	66	26.83
Rib fracture (1-3)	46	18.70
Rib fracture (>3)	17	6.91
Rib fracture (bilateral)	2	0.81
Flail chest	2	0.41
Clavicle fracture	34	13.82
Scapula fracture	2	0.41
Thoracic spine fracture	3	1.22
Diaphragm	2	0.41
Sternum fracture	2	0.41
Pleural and visceral injuries		
Pneumothorax	8	3.25
Haemothorax	18	7.32
Hemopneumothorax	14	5.70
Tension pneumothorax	2	0.41
Lung contusion	20	8.13
Lung laceration	4	1.63
Tracheobronchial injury	2	0.41
Thoracic vascular injury	2	0.41
Cardiac injury	0	0
Pericardial collection	2	0.41
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 92.24% were managed with intravenous or intramuscular analgesia alone (nonsteroidal anti-inflammatory drugs, opioids).

Intercostal nerve block was required in 5.31% of cases, while epidural analgesia was required in 2.45% of cases for satisfactory pain management (Table 4). The common complications associated with chest trauma patients in our study was pneumonia and atelectasis in 2.03% 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	212	1	213	86.59
Tube thoracostomy only	28	2	30	12.19
Thoracotomy with tube thoracostomy	2	1	3	1.22
Total	243	3	246	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	9	9	0	0	3.67	0
4	108	108	0	0	44.08	0
6	116	109	7	0	47.35	6.03
8	11	0	6	5	4.49	100
10	1	0	0	1	0.41	100
Total	245	226	13	6	100	-
Percentage	-	92.24	5.31	2.45	-	-

Table 5: Complications of chest trauma.

Complications of chest injuries	No. of cases	Percentage
Pneumonia	5	2.03
Empyema	1	0.41
Atelectasis	5	2.03
Acute respiratory distress syndrome	2	0.81
Pericardial effusion	1	0.41
Bronchopleural fistula	1	0.41
Haemorrhagic shock	1	0.41
Death	3	1.22

Other complications were acute respiratory distress syndrome (ARDS) in 0.81%, empyema in 0.41%, pericardial collection in 0.41%, bronchopleural fistula (0.41%) and haemorrhagic shock (0.41%). The mortality rate was 1.22% (Table 5).

In this study the average length of hospital stay was 4.6 days. Majority of cases required hospital admission for 1-3 days (66.26%), 4-7 days in 20.16%, 1-2 weeks in 5.35%. Hospital admission for more than two weeks was required in 8.23% cases.

DISCUSSION

Chest trauma are one of the common causes of hospital admissions, disabilities, deaths and socioeconomic losses. Modern civilization has led to its rapidly increasing incidence all over the world. The incidence of chest trauma in this study was 20.18%. Similar incidence of 20% were found in study of Kumar et al.[5] This increasing incidence can be due to improper planning and development which results in the hazards of the modern civilization.

The mean average age is 38.56 years ranging from 8 years to 74 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).[2,3,6] The higher incidence (48%) in the age group of 21-40 years can be attributed to the fact that this is the most active period of life with more outdoor activities. 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.

Males outnumbered females by a huge margin with male comprising of 84.15% and male to female ratio of 5.31:1. Dalal et al had a similar finding with male: female ratio of 5.48:1.[7] 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.

RTA was the common cause of chest injury comprising of 71.14% of all other modes of injury. 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%).[6-8] 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 11.79%, comparable to study of Dangi et al (9.52%), followed by accidental fall accounting 11.38%, comparable with study of Shah et al (16%).[6,8] Animal attack, firearm injury contributed to minority of cases in our study with 5.28% and 0.41% 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.[8]

Accidental injuries were the major group comprising of 87.80% whereas rest were homicidal cases 12.20%. In the study of Dalal et al accidental nature of injury was present in 73.63% and homicidal in 26.37%.[7] Blunt force was the most common mechanism of injury comprising of 93.09% of cases whereas penetrating force contributed to 6.91% of cases. In study of Shah et al penetrating chest trauma accounted for 5% and blunt chest trauma in 95% of cases.[6] Right side of chest was affected in 54.06%, whereas left sided injury was present in 44.72%. Bilateral injuries were present in 1.22% of cases. Shah et al also had similar finding with right, left, and bilateral cases consisting of 52%, 44% and 4% respectively.[6] 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. 26.83%. 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.[5,6,9] Other common skeletal injury was clavicle fracture in 13.82% of cases, similar to the study of Kulshrestha et al (14.1%).[2]

Lung contusion was the most common visceral injury encountered in 8.13% of cases whereas in study of Sharma et al it was 4%.[9] Haemothorax was present in 7.32%, pneumothorax in 3.25%, while in study of Sharma et al it was 1.6% and 1.8% respectively.[9] In our study hemopneumothorax was present in 5.70% and in study of Shah et al similar incidence of hemopneumothorax was present i.e. 5%.[6] 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 (40.25%). Head injury was the most common associated injury in our study (25.20%), in accordance to that seen in study of Kulshrestha et al (33%) and Shorr et al (43%).[2,3] 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. 86.59% were treated by the conservative line of management. Tube thoracostomy was required in 12.19% whereas thoracotomy was required in 1.22%. 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.[9]

In this study, 92.24% patients were managed with intravenous or intramuscular analgesia alone (non-steroidal anti-inflammatory drugs, opioids). Seven out of 116 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.[9]

Pneumonia and atelectasis were the common complications associated with chest trauma in our study as well in the study of Shah et al (pneumonia in 2% and atelectasis in 3% cases).[6] Other complications were ARDS which was present in two of the cases and bronchopleural fistula in one case. The mortality rate of our study was 1.22% (3 cases). Average length of hospital stay was 4.6 days in our study. Kulshrestha et al in his study had an average length of stay of 6.9 days.[2]

CONCLUSION

Chest trauma contribute significant to both morbidity and mortality especially in adult male victims of the road traffic accidents. Thus, early diagnosis and rapid management is of paramount importance in chest injuries. The majority of these cases can be managed conservatively. Tube thoracostomy or thoracotomy may be required in the management of life-threatening injuries. Pain management is most important aspect in management of chest trauma which allows patient for early mobilization and reducing complications of chest injury. Use of intercostal nerve block or epidural analgesia should be done if required for pain relief.

Recommendations

Morbidity and mortality especially in adults following chest injuries will result heavy loss of manpower and human resources. A multidisciplinary approach should be

undertaken to curtail these effects with following measures. Prevention measures like, strict enforcement of traffic rules and regulations, issue of driving licence only after thorough medical fitness, proper education to both driver as well as pedestrians to avoid alcohol intake and avoiding use of mobile phone or ear phone during driving or crossing streets. Also providing speed breakers, proper road sign boards, good quality of streets with street lights, use of helmets and seatbelts, protective jackets especially for two wheelers riders, which has to be designed appropriately which can blunt the force of impact and prevent much of the severe thoracoabdominal injuries. Strict laws and punishments for the culprits of assault and licence for carrying firearm weapons. Safety gadgets for construction workers.

Immediate primary treatment and transport measures. Public education regarding first aid and management of haemorrhage. 24×7 well equipped ambulance service with medical personnel adequately trained in trauma management. Trauma centre at places especially at accident prone areas.

Definitive management, trauma centres with special training of doctors for managing trauma patients. Readily available diagnostic modalities in emergency room like portable X-ray machine, ultrasound machine, arterial blood gas machine. Availability of ventilators, a comparatively cheap portable model should be constructed as there is scarcity in most of the hospital due to its cost. 24×7 blood bank with availability of all blood groups is must.

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