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CHEST INJURY DUE TO BLUNT TRAUMA

General Surgery

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ABSTRACT

Injuries to the thorax are common, occurring in more than 20% of patients in the National Trauma Data Bank. The chest contains vital cardiopulmonary structures, and therefore, these injuries can be life-threatening. Chest injuries result from blunt and penetrating mechanisms, with an overall mortality of 9.9%. Falls and motor vehicle crashes cause the majority of blunt chest injuries by the transmission of energy to the chest wall and underlying structures. It is a significant problem for India, where there is a very high incidence of vehicular accidents. So, this study was done to determine the magnitude and management of patients with chest trauma. A study of 157 cases of chest trauma admitted in tertiary care Hospital, Kurnool from September 2017 to June 2019 was carried out. The data collected included the mode, type and severity of chest injuries, management and outcome. Of 157 patients who sustain chest trauma, 80% of cases were due to a vehicular accident, 95% had rib fractures, 4% had flail chest, 9% had a pneumothorax, 16% had hemothorax, and 46% had hemopneumothorax, and 20% had an extra-thoracic injury. The mortality rate was 7.6%. The outcome and prognosis for the majority of patients of blunt chest trauma are excellent. Most require intercostal chest drainage tube insertion. The risk of mortality was associated with the presence of more than two rib fractures, with patients over the age of 60 years and with both side chest injury.

KEYWORDS

chest injury, rib fractures, blunt trauma

INTRODUCTION

Injuries to the thorax are common, occurring in more than 20% of patients in the National Trauma Data Bank. The chest contains vital cardiopulmonary structures, and therefore, these injuries can be life-threatening. Chest injuries resulting from blunt and penetrating mechanisms, with an overall mortality of 9.9%.[1] It is a significant problem for India, where there is a very high incidence of vehicular accidents. The present research focuses on blunt chest injuries, especially rib fractures and associated injuries, presenting our experience in approaching these patients.

PATIENTS AND METHODS

A study of 157 cases of chest trauma admitted in tertiary care Hospital, Kurnool, Andhrapradesh, India from September 2017 to June 2019 was carried out. The data collected included symptoms and signs at the presentation time, history of pulmonary diseases, the type and severity of chest injuries, management and outcome. Fractures of the ribs and also injuries other than bony thorax studied. Patient's physical condition, number of ribs fractured, patient's age, and the patient's previous history of chest disease (especially chronic obstructive pulmonary disease) were among the factors affecting our decision for hospitalization. The pain was managed effectively using analgesics as first-line treatment. If inadequate pain relief, intercostals blockage or epidural analgesia used.

Vigorous pulmonary hygiene provided with aggressive pulmonary physiotherapy, incentive spirometry, humidification of inspired air, encouraged coughing deeply. Nasotracheal suctioning was used if necessary to remove retained secretions. Patients divided into two major groups based on the presence of rib fractures. Group, I consisted of patients with one or two rib fractures; Group II consisted of patients with more than two rib fractures. The relationship between the number of rib fractures and mortality compared between these groups. A second analysis performed within different age groups for patients with rib fractures and mortality. The Patients divided into four age groups, namely 10–19 years, 20–39 years,40-59 and more than 60 years(Table 3).

RESULTS

95% of patients had rib fractures, 4% had flail chest, 9% had a pneumothorax, 16% had hemothorax, and 46% had hemopneumothorax. The mortality rate was 7.6%. Road traffic accidents were the most common cause of blunt chest injuries (80.25%) (Table 1). There were 145 male (92.3%), and 12 female (7.6%) patients. Mean age was Forty-six years, ranging from 11 to 78 years.

The most common symptoms were chest pain and dyspnea, whereas bone crepitation and subcutaneous emphysema were the most common findings on physical examination. Rib fractures are most common in blunt thoracic injury, occurring in 39% of patients admitted to major trauma centres.[2,3] Rib fractures were detected in 150 patients(95%) in our study. Extremity fractures were found to be the most commonly associated extrathoracic injuries in patients with rib fractures (Table 2). Rib fractures were associated with subcutaneous emphysema in 127 patients (80.1%). Throughout their follow-up period, 9% had a

Table 3: Patients distribution according to age and mortality

AGE(years)	GROUP I			GROUP II			TOTAL		
	Patients	Mortality	%	Patients	Mortality	%	Patients	Mortality	%
10-19	6	-	-	-	-	-	6	-	-
20-39	43	-	-	6	-	-	49	-	-
40-59	59	1	1.7	18	4	22.2	77	5	6.5
≥60	14	1	7.1	11	6	54.5	25	7	28
Total	122	2	1.6	35	10	28.5	157	12	7.6

pneumothorax, 16% had hemothorax, and 46% had hemopneu mothorax, and 20% had an extra-thoracic injury. The mortality rate was 7.6%. Chest tube drainage performed in 144 patients(92%) with pneumothorax, hemothorax or hemopneu mothorax.

Patients with minimal (4.4%) pneumothorax followed without chest tube drainage. Tube thoracostomy was performed successfully in all. Six patients (4%) presented with flail chest. All patients with flail chest treated in the Intensive Care Unit.

Table 1: Causes of blunt injury chest

CAUSE	TOTAL	%
Road traffic accidents	126	80.25
Falls	15	9.5
Assault	8	5.1
Occupational	5	3.2
Miscellaneous	3	1.9

Table 2: Associated injuries

	TOTAL	%
Extremity/pelvis	12	7.6
Abdominal	7	4.4
Facial	16	10.2
Cranial	8	5.1
Spinal/vertebral	9	5.7
Clavicular	14	8.9
Scapular	4	2.5

Pneumothorax	14	8.9
Hemothorax	26	16.5
Pneumohemothorax	73	46.5

DISCUSSION

Blunt chest injuries are seen very frequently in civil populations. The primary cause for blunt injury chest is road traffic accidents with an incidence of 70–80% [4]. In 80.25% of our patients, traffic accidents were the cause of injuries(Table 4).

Table 4: Comparison of the aetiology of chest injury

Study	Traffic accidents(%)	Others(%)
Shorr *et al.*[4]	50	50
Ramussen and Brynitz.[5]	60	40
S.T.Liman *et al.*[6]	68	32
Jigar *et al.*[7]	76	24
Kulshrestha *et al.*[8]	67.3	32.7
Our study	80.25	19.75

The median age in chest trauma patients was 36.9 years.[4] In our study; it was 46 years. Males are more frequently affected than females as reflected as per the data(Table 5).

Table 5: Comparison of median age in chest trauma patients

Study	Median age(years)	Male (%)	Female (%)
Shorr *et al.*[4]	36.9	374 (72.6)	141 (27.3)
Kulshrestha *et al.*[8]	34.5	150 (63.5)	86 (36.4)
Ramussen and Brynitz.[5]	50	70 (75.2)	23 (24.7)
Jigar *et al.*[7]	35	90 (90)	10 (10)
S.T.Liman *et al.*[6]	45	1053 (70.6)	437(29.3)
Our study	46	145 (92.3)	12 (7.6)

Rib fractures are the most common pathologies associated with chest trauma (35–40%).[9] In our study, the incidence of rib fractures was 95.5%, and all of these patients hospitalised. In our study, 52% of cases had an injury to the right side of the chest, 44% had an injury on the left side, and 4% had an injury on both sides of the chest(Table 6).

Table 6: Comparison of the side of injury in chest trauma

Study	Right (%)	Left (%)	Both (%)
Kulshrestha *et al.*[8]	42.28	39.59	18.13
Jigar *et al.*[7]	52	44	4
Our study	61.1	30.6	8.3

Some authors suggested that patients with rib fractures require hospitalization not only for their associated injuries but also for pain control and pulmonary complications [10].

A chest radiograph can be obtained rapidly in casualty during the initial assessment. Most important, the chest evaluated for the presence of a pneumothorax or hemothorax that would require immediate tube thoracostomy. Computed tomography (CT) of the chest is more sensitive to detect thoracic injuries such as pulmonary contusions, hemothorax, and pneumothorax.[11] The addition of CT chest to the trauma evaluation improves the sensitivity of the diagnosis of rib fractures.[12] Furthermore, chest CT angiography will identify injury of the aortic wall.

Ultrasonography has become routine in the early evaluation of the abdomen and pericardium.[13] *The Focused assessment for the sonographic evaluation of the trauma* (FAST) examination and the E-FAST, or extended- FAST can aid in the diagnosis of hemothorax or pneumothorax.[14,15]

However, all rib fractures should be re-evaluated at 48 to 72 h after injury because of the frequent late appearance of pulmonary complications.[16]

The fracture of more than two ribs is a marker of severe injury. The mortality rate is 1.6% in patients with 0ne to two rib fractures versus 28.5% with more than two rib fractures. Lee reported that mortality doubles (1.8 versus 3.9%) for patients with three or more rib fractures and those with no rib fractures.[17] The number of rib fractures has a significant correlation with the presence of hemothorax or pneumothorax, with 81% of patients having either condition if two or more ribs were fractured.[18] The presence of fractures of the first or second ribs has also been reported to be indicative of severe trauma. Poole reviewed all series of fractures of first and second ribs and found a 3% risk for aortic injury and a 4.5% risk for injury to a brachiocephalic vessel.[19]

Subcutaneous emphysema is a clear indication of injury to the respiratory tract. 71.9 % of cases were associated with hemothorax or pneumothorax in this study. Kalyanaraman et al. reported that lung injury seems to be associated with rib fractures in 74% of cases with subcutaneous emphysema.[20] In most of the cases, subcutaneous emphysema is self-limited, and it is essential to identify and treat the underlying cause. Some authors have reported that acute respiratory failure caused by massive subcutaneous emphysema requires decompression of the anterior mediastinum.[21-23]

Patients with flail chest are distinct from those with multiple rib fractures since they are at a higher risk of respiratory compromise and often require early intubation.[38] In fact, in the presence of multiple injuries, intubation of the patient with a flail chest is almost unavoidable, to obviate sudden respiratory decompensation and its subsequent morbidity.[38] Flail chest is highly associated with pulmonary contusion, which occurs in approximately 45% of patients.[39] Although recently, surgical procedures have been mentioned to decrease the mortality and morbidity rate by some authors [24,25], operative fixation has not widely accepted.[16] We prefer mechanical ventilation only in case of respiratory insufficiency. In flail chest, the mortality rate reported between 11 and 40% .[26-29] Our mortality rate for flail chest was 16.6%, closer to the lower level of this range.

The maintenance of pulmonary and tracheal hygiene, effective eradication of pleural fluid and air played a significant role in minimizing pulmonary complications. If the conservative treatment is not sufficient, early or late thoracotomy should be performed. In the literature, there has been a significant decline in the number of operations over recent years.[30] Richardson states that less than 5% of patients sustaining blunt chest trauma has indications for a thoracotomy.[31]

Hospital mortality rates for isolated chest injuries were reported to range from 4 to 8%, and increased to 13–15% when another organ system was involved and to 30–35% when more than one organ system was involved.[32] Lee et al.reported the mortality rate as 1.8% in all patients with blunt chest trauma.[17] This rate was 1% in our series. Most traumas occur between 20 and 60 years of age. Mortality rate significantly increased in overall patients with more than two rib fractures. However, we found a correlation between the mortality rate and the number of rib fractures for elderly patients. Ziegler et al. have reported that in the elderly, mortality increases compared with younger patients.[10] Osteopenic changes and co-existent underlying disease play a significant role in the elderly.[17]

Associated injuries in patients with rib fractures can be the head injury, abdominal injury, injury to extremities, spinal injury or pelvis injury. (Table 7,8)

Table 7: Comparison of associated injury in chest trauma patients

Study	Head injury (%)	Extra thoracic fracture (%)	Abdominal trauma (%)	Spinal injury (%)
Shorr *et al.*[4]	43	40	28.5	35
Kulshrestha *et al.*[8]	33	-	16.4	2.7
Ramussen *et al.*[5]	18.3	18.3	5.4	3.2
Jigar *et al.*[7]	10	22	12	7
S.T.Liman *et al.*[6]	0.8	4.1	0.7	0.4
Our study	5.1	7.4	4.45	5.73

Table 8: Comparison of different injuries in chest trauma patients

Study	Sternalfracture (%)	Fracture clavicle (%)	Flail chest(%)	Fracturescapula (%)	Haemopnumothorax (%)
Kulshrestha *et al.*[8]	2.10	14.1	-	6.7	-
Ramussen *et al.*[5]	2.15	-	10.7	30	22
Shorr *et al.*[4]	4.95	8.3	10.3	4.85	31.9

S.T.Liman *et al.*[6]	1.87	2.4	1.14	0.47	81
Jigar *et al.*[7]	1	8	17	9	25
Our study	-	8.9	3.8	2.54	72

Most of the patients with blunt injury chest can be treated with conservatively. In our study, most of the patients (97%) managed conservatively. The conservative management is with analgesics, nerve block, epidural analgesia, sedation, and strapping. Adequate analgesia should be provided to allow optimal pulmonary toilet and to promote comfort. Pain control with IV narcotics is often adequate in mild and moderate cases, but in severe cases, patients benefit from epidural analgesia. Bulger and coworkers demonstrated fewer pulmonary infections and decreased the duration of mechanical ventilation with the use of epidural analgesia in patients with three or more rib fractures.[33]

The aggressive pulmonary toilet, including deep breathing, frequent coughing, and incentive spirometry, should be encouraged. In addition, chest physical therapy and positive expiratory pressure exercises may also be beneficial The importance of adequate analgesia to proper pulmonary toilet is evident by studies showing decreased mortality among patients with rib fractures who received epidural anesthesia.[34] Interventions favoured for short-term pain relief include epidural analgesia, intercostal rib blocks, intrapleural instillation of anaesthesia, and intravenously giving opiates and oral nonsteroidal anti-inflammatory drugs.[2,35-37]

Respiratory resuscitation is an essential aspect of a chest injury, so airway must be patent, and if required, endotracheal intubation should be done. Underwater seal Intercostal tube drainage is also a part of conservative management (Table 9). It effectively decompresses the pneumothorax, hemothorax and helps in the expansion of lungs.

Table 9: Comparison of ICD in chest trauma patients

Study	Intercostal drainage
Kulshrestha *et al.*[8]	57% (85/149)
Ramussen *et al.*[5]	60% (56/93
Shorr *et al.*[4]	55.72% (287/515)
S.T.Liman *et al.*[6]	17.4(260/1490)
Jigar *et al.*[7]	33% (33/100)
Our study	91.7%(144/157)

The mortality rate in this study was 7.64%, representing Twelve patients. The causes of death included ARDS, sepsis, heart failure, and multiple organ failure(Table 10). while acute respiratory distress syndrome occurs in as many as one-third of patients, resulting in mortality rates as high as 33%.[39]

Table 10: Comparison of complications of chest trauma

Complication	Shorr *et al.*[4] (%)	Ramussen *et al.*[5] (%)	Jigar *et al.*[7] (%)	Our study (%)
Empyema	-	2	1	3.8
Pneumonia	6.7	5	2	4.4
Atelectasis	7.3	8	3	1.3
ARDS	6.4	5	2	2.5
Pericardial effusion	-	-	1	0.6
Emphysema	3.8	12	-	1.3
Mortality	8	9.7	4	7.64

CONCLUSION

Blunt injury chest is one of the significant and severe injuries following road traffic accidents. The outcome and prognosis for the majority of patients of blunt chest trauma are excellent. Most require intercostal chest drainage tube insertion. Intercostal tube drainage with under water seal is an acceptable and safe procedure for the management of pneumothorax, hemothorax, or hemopneumothorax. The mortality is high with the presence of more than two rib fractures, with patients over the age of 60.

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