

Correlation of the Clinical and Radiological Profile in Outcomes of Patients with Chest Trauma

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Abstract

Introduction: Trauma is one of the leading causes of morbidity and mortality Worldwide. According to the national trauma database (NTDB) of India, chest injuries are present in 13.8% of all blunt trauma patients. The overall mortality rate of the chest trauma patient is 8.4%. Most chest injuries can be treated non-surgically with relatively simple methods including tube thoracostomy, adequate analgesic management, and good pulmonary toilet. For the best patient outcome, aggressive management of the chest trauma, as well as timely care of related injuries, is needed. Hence, the present study was carried out to study the correlation between the clinical features and radiological findings in the outcomes of patients with chest trauma.

Methods: The present Prospective observational study was conducted in Government Medical College amongst 377 patients diagnosed with chest trauma, admitted, and managed during May. 2018 – Nov. 2020. All patients received in the Emergency Room (ER/Casualty) were immediately attended and history, primary survey and resuscitation were done simultaneously. A chest X-ray in the erect position and an NCCT chest with USG was taken, followed by operative or non-operative management based on the clinic-radiological findings.

Results: Vehicular accident was the commonest 257(68.2%) cause of injury followed by fall from height 69(18.3%). The commonest clinical and radiological finding was rib fracture seen clinically in 51.45%, on x-ray in 63.66% and on CT scan in 80.63% of patients, which was followed by pneumothorax clinically in 50.92 %, on x-ray in 60.47% and in 76.9% on the CT scan. CT Scan was the best modality which effectively predicted chest injury. Out of 377 patients, 86 (22.81%) needed only conservative management whereas in 291(77 %) patients' operative treatment was needed.

Conclusion: For patients with pneumothorax, haemothorax, and hemopneumothorax Intercostal tube drainage with under seal is an acceptable and safe method. Analgesics and, in some cases, strapping and intercostal nerve block are the best remedies for basic rib fractures. CT scan thorax is superior to traditional chest radiographs in our research, with a positive predictive value of <0.001. In chest trauma patients, prompt diagnosis and care, judicious use of radiological investigations, and effective surgical intervention increase the final outcome.

Keywords: Chest Trauma, Chest X-Ray, Rib Fracture, Pneumothorax, Intercostal Tube.

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Introduction

Trauma is one of the leading causes of morbidity and mortality Worldwide. Chest trauma constitutes about 10-15% of all causes and is responsible for 25% of deaths due to trauma.[1] According to the national trauma database (NTDB) of India, chest injuries are present in 13.8% of all blunt trauma patients. The overall mortality rate of chest trauma patients is 8.4%. [2] With the rising incidence of penetrating chest injuries and enhanced pre-hospital and intra-operative treatment, the number of seriously wounded but potentially salvageable patients presenting to trauma centres is on the rise. Most chest injuries can be treated non-surgically with relatively simple methods including tube thoracostomy, adequate analgesic management, and good pulmonary toilet. It is important to accurately identify a patient who is at high risk of severe chest injuries to prevent delays that could result in serious morbidity and mortality.[3] For the best patient outcome, aggressive management of the chest trauma, as well as timely care of related injuries, is needed.

Aim: The present study was carried out to study the correlation of the clinical features and radiological findings in the outcomes of patients with chest trauma.

Material and Methods

The present Prospective observational study was conducted in Government Medical College after the approval from the Institute's Ethics Committee amongst 377 patients diagnosed with chest trauma, admitted, and managed during May. 2018 – Nov. 2020 those who gave informed and written consent. Each participant has explained the need and importance of the study prior to filling out the study documents.

Inclusion criteria:

Patients having:

1. single or multiple rib fractures with or without other associated injury.
2. Associated with pneumothorax and haemothorax with or without another injury.
3. Penetrating chest injury with pleural breach with or without fracture ribs.
4. Fracture of the sternum with or without associated injury.

Exclusion criteria: Patients who are not willing to give consent to the study.

All patients received in the Emergency Room (ER/Casualty) were immediately attended and history, primary survey and resuscitation were done simultaneously. A chest X-ray in the erect position and an NCCT chest with USG was taken, followed by operative or non-operative management based on the clinic-radiological findings. Patients were categorized on the extent of damage to the chest wall. Upto involvement of soft tissue above the rib cage is considered "upto chest wall" and involvement of rib cage, lung parenchyma, and pleural space is considered as beyond the chest wall.

On detection of the possible clinical condition, appropriate therapy was given in the operative room for patients who require operative intervention such as ICD insertion, exploratory laparotomy, and thoracotomy. After stabilization, the patient was shifted to the ward for further management.

Pain management of 1st 24 hrs. was met by injectable/oral analgesics, with local anaesthetics (intercostal blocks) and the patient was observed for local anaesthetic toxicity if any and other side effects. Subsequently, analgesics or intercostal blocks were given as per the need of the

patient by using a numerical pain scale. These patients were monitored closely till they are hemodynamically stable and respiration settled and then either discharged uneventfully or transferred to respective departments according to associated injuries for further management if needed.

Statistical Analysis:

Statistical analysis method- All Data was collected in paper-based case report forms and then it was entered in Microsoft Excel 2013 format. Frequency tables and measures of central tendency (mean) and

measures of dispersion (Standard deviation) were obtained by using the software IBM SPSS version 20. Proportions were compared using the Chi-square test and continuous variables were compared using the student t-test.

Results:

The present study " correlation of clinical, radiological profile with outcomes of chest trauma victims" was carried out in the Department of Surgery, during the period May 2018 - Nov 2020. Total no. of cases studied were 377.

Table 1: Distribution of patients according to their age and gender.

Age group (years)	Male	Female	Total	(%)
0-15	06	0	06	1.6
16-25	57	2	59	15.6
26-35	94	07	101	26.8
36-45	83	09	92	24.4
46-55	52	02	54	14.3
56-65	32	04	36	9.5
66-75	22	04	26	6.9
76-85	2	1	3	08
Total	321	179	500	100

Table no.1 shows that the majority of the patients 101(26.8%) were from 26 to 35 years of age group followed by 92(24.4%) 36-45 years. Present study showed that chest injuries are common in males because they are commonly exposed to trauma. The mean age of presentation is 37.97 years with standard deviation 14.96.

Table 2: Distribution of patients according to the mode of injury.

Mode of Injury	No. of Cases			(%)		
	M	F	Total	M	F	Total
Vehicular accidents	238	19	257	63.39	4.81	68.2
Fall from height	65	4	69	17.77	0.53	18.3
Blunt object (Assault)	44	6	50	11.67	1.59	13.3
Bull horn injury	1	0	01	0.26	0.00	0.2
Total	348	29	377	93.07	6.93	100

Table no.2 shows that the Vehicular accident was the commonest 257(68.2%) cause of injury followed by fall from height 69(18.3%). Vehicular accidents were responsible for chest injury in 63.39% males and 4.81% females.

Table 3: Distribution of patients according to the Signs and Symptoms.

Signs / Symptom	No. of cases	(%)
Chest pain	377	100
Tachypnoea	283	75.06
Breathlessness	283	75.06
Decreased Air Entry	253	67.10
Restricted chest movements (tenderness)	190	50.39
Bony crepitations	124	32.89
Involvement of accessory muscles of respiration	60	15.91
Subcutaneous emphysema	56	14.85
Paradoxical movement	6	1.59
Bleeding	4	1.06
Bleeding through the wound	4	1.06

Table no.3 shows that the chest pain was the most common 377(100 %) presenting symptom followed by breathlessness 283 (75.06%). The commonest sign of presentation was tachypnoea 283 (75.06%) followed by decreased air entry on auscultation 253 (67.10%).

Table 4: Distribution of patients according to the radiological and clinical findings.

Finding	X-ray Chest	CT Scan	Clinical
Fracture rib	240 (63.66%)	304 (80.63%)	194 (51.45%)
Pneumothorax	229 (60.74%)	290 (76.9%)	192 (50.92%)
Contusion	78 (20.68)	168 (44.56%)	48 (12.73%)
Flail chest	06 (1.59%)	06 (1.59%)	6 (1.59%)
Sternal injury	02 (0.53%)	04 (1.06%)	3 (0.79%)
Haemothorax	07 (1.86%)	07 (1.86%)	4 (1.06%)
Diaphragmatic injury	2 (0.5%)	4 (1%)	2 (0.5)
Cardiac injury	0 (0%)	2 (0.5%)	0 (0%)

Table no.4 shows that the commonest clinical and radiological finding was rib fracture seen clinically in 51.45%, on x-ray in 63.66% and on CT scan in 80.63% patients, which was followed by pneumothorax clinically in 50.92 %, on x-ray in 60.47% and in 76.9% on the CT scan. CT Scan was the best modality which effectively predicted chest injury.

Table 5: Distribution of patients according to the associated injury other than chest trauma.

Other Associated Injury	No. of Cases	Percentage
Head Injury	186	(49.33%)
Clavicle Fracture	120	(31.83%)
Long Bone Fracture	55	(14.59%)
Facial Bone Fracture	51	(13.52%)
Abdominal Organ Injury	26	(6.89%)
Scapular Fracture	11	(2.92%)
Spine Injury	11	(2.92%)
Pelvic Bone Fracture	09	(2.39%)
Sternal Fracture	06	(01.59%)

Table no.5 shows that the head injury 186 (49.33%) was the most common associated injury along with chest trauma (49.33%) which was followed by clavicular fracture 120 (31.83 %) and long bone fractures 55 (14.59%).

Table 6: Distribution of patients according to the treatment given.

Treatment	Number of patients	Percentage
Intercostal drainage	290	76.90
Conservative	86	22.81
Laparotomy for diaphragmatic injury	02	0.53

Table no.6 shows that the type of treatment given to the patients.86 (22.81%) out of 377 needed only conservative management whereas in 291 77 % patients' operative treatment was needed. The most common procedure in the management of chest injuries was intercostal drainage290(76.90%).

Table 7: Distribution of patients according to the outcome of chest trauma.

Outcome	Number of patients	Percentage
Discharged after operative treatment	173	45.88
Death due to injury	118	31.29
Discharged after conservative treatment	86	22.81

Table no.7 Depicts the outcome of chest trauma in this study of 377 patients. 86(22.81%) cases were discharged in a satisfactory condition with conservative management, 173 (45.88%) requires an operative management in the form of intercostal drainage mainly and 118(31.29%) were died due to injury.

Discussion

We have observed that road traffic accidents formed the most common cause of rib fractures, followed by assaults, falls from height, animal-related, stab injuries etc. Increased automobile traffic and ever-increasing population together with intentional or unintentional ignorance of traffic rules account for the predominance of road traffic accidents resulting in chest trauma.

Trauma is the leading cause of death, morbidity, and disability, particularly in the working-age population, and it is also the third most common cause of death. More than half of the patients with rib fractures in the sample were of all ages. Because of their exposure to outdoor activities such as driving, factory work, and labourers, males outnumbered females by a wide margin. These results were similar to those of other research. The most common cause of rib fractures was

blunt trauma, which included car crashes, falls from heights, attacks, animal-related injuries, and so on. Increased automobile traffic and ever-increasing population together with intention or unintentional ignorance of traffic rules account for the predominance of road traffic accidents resulting in chest trauma. These findings were in accordance with the studies of Helling et al (1989) [4] and Mattox et al (1989) [5], in which road traffic accidents constituted the maximum number of cases.

In this study, the rate of isolated rib fractures was found to be (51.6%). The majority of patients had fractures of three or four ribs, and a significant number had fractures of one or two ribs; the majority of them were treated with analgesics and observation, with serial chest X-rays. Pneumothorax/haemothorax is less common with single or two rib fractures, but as the number of broken ribs increases, the risk of this complication increases. Middle ribs (4-9th) were the most commonly involved. Pulmonary complications such as pneumothorax (50.92%), haemothorax (1.86%), pulmonary contusion (44.56%), flail chest (00%), surgical emphysema (1.6%) were noted in this study.

The most common age group affected was 31 to 40 years which is also the working age group in our geographic area. Our observation of age incidence was comparable with observations made by Atri M et al (2006) [6], (n=2571) 34.4 years and Lema et al (2011) [7], (n=150) 32.17 years.

In the present study, males 12:1 were more commonly affected than females as more commonly involved in outdoor activities as compared to females. It is comparable with studies by Lema et al (2011) [7], (n=150) 3.8:1 and Dehghan et al (2014) [8], (n=3467) 3.34:1.

In our study blunt trauma, 92.3% is more common than penetrating trauma 7.7%. Similar to studies by Lema et al (2011) [7], (n=150) blunt trauma 72.7%, penetrating trauma 27.3% and Mohan Atri M et al (2006) [6], (n=2571) blunt trauma 81.7% penetrating trauma 18.7%. A road traffic accident was the commonest mode of chest injury noted in our study which is in accordance with various other studies. The present study showed that RTA 70% was the reason for injury. Similarly, Liman et al (2003) [9] (n=1490) RTA 67.79% and Dehghan et al (2014) [8] (n=3467) RTA 79%.

The present study shows that Head injuries 49.33%, Abdominal injuries 6.89% and other injuries 18.69%

While studies by Shorr et al (1987) [10] showed Head injuries 43 Abdominal injuries 28.5 Other injuries 40. Rasmussen OV et al (1986) [11] head injury 8.3, Abdominal injury 5.4 and other injuries 18.3

In the present study, we found that various associated injuries were Sternal fracture 1.59%, Clavicular fracture 31.83%, Scapular fracture 2.95%, and Flail chest 1.59%. Similarly, results were observed by Kulshrestha et al (1988) [12] Sternal fracture at 2.1%, Clavicular fracture at 14.1 %, and Scapular fracture at 6.7%. Rasmussen OV et al (1986) [11]

found Sternal fracture at 2.15% and Flail chest at 10.7%.

In the present study, we observed on the patient's X-Ray chest the following findings, Fracture rib 240

(63.66%), Flail chest 06 (1.59%), Sternal injury 02 (0.53%), Pneumothorax 229 (60.74%), Contusion 78 (20.68), Haemothorax 03 (0.79%) and Diaphragmatic injury 2 (0.5%).

In a study by Matthias Traub et al (2007) [13] they observed on X-Ray chest following findings, Fracture rib 47 (33.3%), Flail chest 5 (3.5%), Pneumothorax 9 (6.4%), Contusion 23(16.3%), Haemothorax 10 (7.1%) and Diaphragmatic injury 2(1.4%). These findings are comparable to our study.

In the present study, we observed on the CT scan chest the following findings, Fracture rib 304 (80.63%), Flail chest 06 (1.59%), Sternal injury 04 (1.06%), Pneumothorax 290 (76.9%), Contusion 168 (44.56%), Haemothorax 07 (1.86%), Diaphragmatic injury 4 (1%) and Cardiac injury 2 (0.5%)

In the present study, the average duration of hospital stay in our study was 8.47 days. A study by Liman et al (2003) [9], (n=1490) found that the average duration of hospital stay was 4.5 days and in a study by Iv. Novakov et al (2004) [14], (n=212) found that the average duration of hospital stay was 8.7 days similar to our study. While, in a study by Lema et al (2011) [7], (n=150) found that the average duration of hospital stay was 13.7 days, which was more than our study.

In our study conservative line of management was observed in 51.66 % of patients and operative management was done in 48.33% of patients. The majority of the patients required operative treatment i.e. ICD insertion, while thoracotomy was not required in any patient during our study.

Similarly, a study by Khan ZLM et al (2009) [15] (n=103 patients) found that 29% of patients were managed by the conservative line of treatment and 62% of patients were managed by tube thoracostomy and 9% of patients were managed by thoracotomy. [16]

While in a study by Atri M et al (2006) [6], (n=2571 patients) found that 42.6% of patients were managed by the conservative line of treatment and 48.4% of patients were managed by tube thoracostomy and 9% of patients were managed by thoracotomy.

Conclusion

In our study, blunt trauma is more common than penetrating trauma when it comes to chest injuries.

The most common mechanism of injury in the blunt trauma group is a road traffic accident, while the most common mechanism of injury in the penetrating trauma group is a stab injury. Bull horn injury was also one of the modes of penetrating injury in our research. In our research, broken ribs were the most common form of chest injury, followed by pneumothorax. Our patient spent an average of 8.47 days in the hospital. In our sample, the mortality rate was 31.29%, which was mostly due to other injuries. As compared to polytrauma, isolated chest trauma patients have a lower mortality rate. In chest trauma patients, age at the time of diagnosis, type of chest injury (blunt/penetrating), the occurrence of other related injuries and Chronic illnesses all increase morbidity and mortality. CT scan thorax, among the numerous radiological investigations (chest radiograph, USG thorax, CT-scan thorax), plays an important role in the diagnosis and treatment of chest trauma patients who are sustaining saturation with all supportive therapy. The most common mechanism of injury in our research was RTA. In chest trauma patients, prompt diagnosis and care, judicious use of radiological

investigations, and effective surgical intervention increase the final outcome.

Limitation of the Study:

Our study also included other associated injuries to isolated chest trauma i.e. polytrauma.

Abbreviations:

CT scan - computed tomography scan

USG - ultrasound sonography test

ICD - Intercostal drainage

NCCT -Non-contrast computerized tomography

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