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Research Article

Clinical profile of chest injury a prospective observational study

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ABSTRACT

Background: Chest trauma is one of the most serious injuries leading to significant disability and mortality. Chest injury directly accounts to 20%-25% of all traumas related deaths in developed countries.
Methods: This was a prospective observational study involving chest injury patients admitted in civil hospital, Solapur over the period of September 2013 to June 2015.
Results: A total of 150 chest injury patients were studied out of 864 patients of chest injury during the said period. Males outnumbered females by a ratio of 5:1. Their ages ranged from 10 to 80 years (mean = 37.27 years). Majority of the patients (94.67%) sustained blunt injuries. RTA was the common mechanism of blunt injury affecting 59.86% of patients. Rib fracture was the commonest type of chest injury followed by pneumothorax, 88% and 62% respectively. Head injury was the commonest associated injury seen in 56% of patients. Majority of patients 66.67% were treated successfully with tube thoracostomy. The mean hospital stay was 8.97days with SD of 4.89 days. Mortality rate was 11.97%.
Conclusions: Chest injury resulting from RTA remains a major mechanism of chest injury. A preventive measure, educating people about traffic rules and regulations and strictly implementing them is necessary to reduce incidence of chest injuries.

Keywords: Chest injury, Clinical profile, Rib fracture

INTRODUCTION

Trauma continues to be an enormous public health problem worldwide and it is associated with significant morbidity and mortality both in developed and developing countries.[1] Globally 10% of all trauma admissions results from chest injury and 25% of trauma-related deaths are attributed to chest injuries.[2,3] In India approximately 16000 deaths per year alone are a result of chest trauma.

The causes and pattern of chest injuries have been reported in literature to vary from one part of the world to another partly because of variations in infrastructure, civil violence, wars and crime. Road traffic accidents (RTAs) are the commonest cause of chest injuries in civilian practice accounting for up to 70% in some series with increasing use of firearms, arrows and spears the incidence of penetrating chest injuries increased in civil society.[4,5]

Studies have shown that most chest injuries can be treated by non-surgical approach with relatively simple methods, such as tube thoracostomy, appropriate analgesics management and good pulmonary toilet.[6,7] The accurate identification of a patient at high risk for major chest injuries is necessary to avoid delays that may lead to significant morbidity and mortality.[8] Aggressive management of the chest trauma along with prompt treatment of associated injuries is essential for optimal patient outcome.[9]

This study was conducted in our setting to study incidence of chest trauma in trauma related patients in our hospital, different modalities of investigations and management of chest trauma and to study the morbidity and mortality related to chest trauma.

METHODS

The design of this study was a prospective observational study which was conducted at a tertiary care centre, department and surgical wards government medical college and civil hospital, Solapur over period of September 2013 to June 2015.

Trauma patients were first seen at the OPD or emergency department. When patients of chest trauma arrived in casualty thorough clinical examination was done. All the vital parameters were recorded, history about the type of injury, site of injury were obtained from the patient himself, when patient was not in condition to give proper history it was obtained from the relatives, accompanying person or police. Enquiry was made about the pre-existing chronic illness and documented. If the patient was found in hypotension then resuscitative measures were undertaken. When the patient became hemodynamically stable then shifted for necessary radiological investigations and then in the ward or surgical ICU. On admission if it was found that the patient is having apnoea, tachypnoea, stridor, prompt tracheal intubations was done. If endotracheal intubation cannot be achieved, airway was secured surgically by performing either cricothyroidotomy or tracheostomy. Once the condition of the patient becomes stable then further necessary investigations were carried out.

Inclusion criteria

All the patients of chest injury irrespective of their age and sex requiring admission were included in study.

Exclusion criteria

Severely traumatized patients who expired before investigation for chest trauma, and patients not requiring admission were excluded from the study.

Recruitment of patient to participate in the study was done at the A and E department after primary and secondary surveys done by the admitting surgical team. Patients were screened for inclusion criteria and those who met the inclusion criteria were offered explanations about the study and requested to consent before being enrolled into the study.

Data collection and analysis

Data collected was entered into a computer and analyzed using Excel-2013 with the help of a medical statistician. Data was summarized in form of proportions and frequency tables for categorical variables. Means, median, mode, standard deviation and histograms were used to summarize continuous variables. Appropriate statistical test of significance like Chi-square test and Z-test were used wherever necessary. Significance was defined as a p-value of less than 0.05.

RESULTS

Overall trauma related admissions in our hospital during the period of study were 5040 out of which 864 were of thoracic trauma, therefore the overall incidence of chest trauma in our hospital is 17.14.

Table 1: Age wise distribution of patients of chest injury.

Age group (years)	Number of patients	Percentage
0-10	1	0.67%
11-20	12	8.00%
21-30	40	26.67%
31-40	42	28.00%
41-50	35	23.33%
51-60	12	8.00%
61-70	7	4.67%
>71	1	0.67%
Total	**150**	**100%**

Table 2: Sex wise distribution of patients of chest injury.

Present study			Male : Female ratio
Sex	No. of patients	Percentage	
Male	125	83.33%	5:1
Female	25	16.67%	
Total	**150**	**100%**	

(χ2 test, p<0.001, DF=1, highly significant).

Table 3: Age wise and sex wise distribution of patients of chest injury.

Age	Sex				Total	
	Male		Female			
	No.	%	No.	%	No.	%
0-10	0	0.00	1	4	1	0.67%
11-20	9	7.20	3	12	12	8.00%
21-30	37	29.60	3	12	40	26.67%
31-40	37	29.60	5	20	42	28.00%
41-50	28	22.40	7	28	35	23.33%
51-60	9	7.20	3	12	12	8.00%
61-70	4	3.20	3	12	7	4.67%
≥71	1	0.80	0	0	1	0.67%
	125	100	25	100	150	100%

From above table it is evident that 31-40 years is the most vulnerable age group in our study. The Youngest patient observed in our study was 10 year old and the oldest patient was 85 years old. The average age of the patient is

37.27 years with standard deviation of 13.6 years. Male to Female ratio observed in our study is 5:1.

Table 4: Type of chest injury.

Type of injury	Number of patients	Percentage
Blunt	142	94.67%
Penetrating	8	5.33%
Total	**150**	**100%**

($\chi 2$ test, $p<0.001$, DF=1, highly significant).

From above table it is clearly evident that blunt trauma to the chest is more common than penetrating chest injury.

Table 5: Sex wise and injury wise distribution of patients of chest trauma.

Sex	Type of chest trauma		Total number of patients	Percentage
	Blunt	Penetrating		
Male	117	8	125	83.33%
Female	25	0	25	16.66%

Table 6: Occupation wise distribution of chest trauma patients.

Occupation	Number of patients	Percentage
Driver	32	21.33
Farmer	25	16.67
Worker	23	15.33
House wife	20	13.33
Student	19	12.67
Shop owner/ keeper	9	6.00
Teacher	8	5.33
Salesman	5	3.33
Labourer	3	2.00
Engineer	2	1.33
Tailor	2	1.33
Retired	1	0.67
Shephard	1	0.67
Total	**150**	**100.00**

From above table it is evident that maximum incidence of chest injury is seen in drivers, this may be because of majority of our patients sustained Road traffic accidents.

Table 7: Mechanism of blunt chest injury.

CAUSE	Blunt	
	Number	Percentage
Road traffic accidents (RTA)	85	59.86%
Assault	31	21.83%
Fall from height	18	12.00%
Hit by bull	4	2.82%
Fall of object on chest	4	2.82%

From above table it is evident that RTA is the commonest mechanism of blunt chest trauma followed by assault.

Table 8: Mechanism of Penetrating chest injury.

Mechanism of injury	Number of patients
Stab	6
Bull horn injury	2
Gunshot injury	0

From above table it is evident that stab injury is the commonest mechanism of penetrating chest injury.

Table 9: Types of chest injuries detected in our study.

Types of chest injuries	Number of patients	Percentage (n=150)
Pneumothorax	93	62.00
Hemothorax	86	57.33
Hemopneumothorax	70	46.67
Rib fracture	132	88.00
Lung contusion	64	42.67
Flail chest	23	15.33
Subcutaneous emphysema	35	23.33
Fracture sternum	13	8.67

From above table it is evident rib fracture is the most common type of injury seen in our study which is followed by pneumothorax.

Table 10: Chest trauma and the associated injuries.

Associated injuries	Number of patients	Percentage
Head injury	84	56%
Abdominal injury	20	13.33%
Spine injury	13	8.67%
Extremity injury(skeletal injury)	55	36.67%

Head injury is the commonest associated injury detected in our patients of chest trauma followed by skeletal injury.

Table 11: Modality of treatment.

Treatment	Number	Percentage
Conservative	50	33.33
Operative	100	66.67
Total	**150**	**100**

In our present prospective study majority of patients treated operatively, (66.67%), while conservative line of treatment was observed in 33.33% of patients.

Table 12: Operative procedures done.

Operative procedures done	Number of patients	Percentage
Tube thoracostomy	100	100%
Thoracotomy	0	0%

From above table it is evident that tube thoracostomy is the commonest procedure performed in our chest trauma patients, not a single patient needed thoracotomy.

Table 13: Duration of ICD.

Duration of ICD (days)	Number of patients	Percentage	Average duration
<4	1	1%	8.74 Days (SD=3.36 days)
4-6	31	31%	
7-9	34	34%	
10-12	21	21%	
13-15	9	9%	
16-18	4	4%	
Total	**100**	**100%**	

In our study maximum number of patients (34%) had ICD kept for 7-9 days. Average duration of ICD was 8.74 days in our study with standard deviation of 3.36 days.

Table 14: Various investigations done in chest trauma patients.

Various investigations	Number of patients	Percentage (n=150)
Chest radiograph	150	100.00
USG thorax	45	30.00
CT-scan thorax	118	78.67

From above table it is evident that chest radiograph is the most commonly done investigation in our study. USG thorax was done in 45 patients and CT-scan thorax was done in 118 patients.

Table 15: Comparison of X-ray and CT in diagnosing rib fracture.

Investigation	Ribs fracture(n=132)		
	Total cases	Seen (%)	Not seen (%)
X-ray	132	98 (74.24)	34 (25.76)
CT-scan	108	108 (100)	0 (0)

Out of 150 patients 132 patients had rib fracture, out of them all patients were subjected to X-ray and out of them rib fracture was detected in 98 (74.24%) patients and 34 out of 132 patients who had rib fracture couldn't diagnosed on X-ray. Those 34 patients who weren't diagnosed on x-ray were diagnosed on CT-scan. Out of those 132 patients who had Rib fracture 108 patients were subjected to CT-scan. No patient out of 108 patients remained undiagnosed on CT-scan. CT-scan is the best modality of investigation to detect Rib fracture.

Table 16: Comparison among X-ray, USG and CT in diagnosing hemothorax.

Investigation	Hemothorax (n=86)		
	Total cases	Seen (%)	Not seen (%)
X-ray	86	54 (62.79)	32 (37.21)
CT	84	84 (100)	0 (0)

Out of 150 patients 86 patients had hemothorax, out of them 86 patients were subjected to X-ray and out of them hemothorax was detected in 54 (62.79%) patients and not detected in 32 (37.21%) patients. 32 patients who remained undiagnosed on X-ray were confirmed on CT-scan. 8 patients out of 86 patients who had hemothorax were subjected to USG out of that 7 (87.5%) patients were diagnosed and 1 (12.5%) patient remained undiagnosed, who was diagnosed on CT-scan. 84 patients out of 86 patient underwent CT-scan and none of them were remained undiagnosed. CT-scan can detect even minor collection in thoracic cavity which cannot be seen on USG or X-ray.

Table 17: Comparison between X-ray and CT in diagnosing Pneumothorax.

Investigation	Pneumothorax(n=93)		
	Total cases	Seen (%)	Not seen (%)
X-ray	93	53 (56.99)	40 (43.01)
CT-scan	88	88 (100)	0 (0)

In our study 93 patients were detected for pneumothorax out of 150 patients. Out of 93 patients all patients were subjected to X-ray, out of them 53 (56.99%) were diagnosed for pneumothorax on X-ray and 40 (43.01%) remained undetected. Those 40 patients were diagnosed on CT-scan. Out of 93 patients who had pneumothorax 88 patients were subjected to CT-scan and none of them remained undiagnosed of pneumothorax.

Table 18: Co-morbid conditions detected in patients with chest trauma.

Co-morbid conditions	Number of patients	Percentage
COPD	29	19.33%
Hypertension	55	36.67%
Diabetes mellitus	40	26.67%
Pulmonary tuberculosis	7	4.67%
Ischaemic heart disease	3	2%

Certain morbidities like sternal fracture, pneumo-mediastinum were seen only on CT-scan, and pulmonary contusions were best visualised on CT-scan, though it can

be seen on X-ray. It was noticed that even minor contusion can be seen on CT-scan and not on X-ray.

It was also noted that fracture to the lower ribs i.e. below 5th/6th rib are masked due to domes of diaphragm, but are visualized in CT-scan.

Table 19: Duration of hospital stay for chest injury.

Duration of hospital stay for chest injury (days)	Number of patients	Average hospital stay
1-5	43	8.97 days (SD = 4.89 days)
6-10	53	
11-15	39	
16-20	12	
21-25	2	
Total	**149**	

(1 patient out of 150 patients was died within 2 hours of admission, hence not included in the above table.)

Average duration of hospital stay was 8.97 days with standard deviation of 4.89 days.

Table 20: Mortality in chest trauma patients.

Type of chest trauma	Total patients	Death	Percentage
Blunt	142	17	11.97%
Penetrating	8	0	0%

Out of 142 patients of blunt chest injuries 17 patients succumbed to death, there was not a single death detected in penetrating chest injury group in our study.

Table 21: Analysis of death is given as follows.

Parameters	Numbers
Multiple ribs fracture	15
Flail chest	5
Pulmonary contusion	9
Asso.co-morbidities	10
Associated injury	17
GCS <8 in case of head injury	9
Operative intervention for asso.injury	4

DISCUSSION

Out 5040 trauma related patients who were admitted in hospital 864 patients were cases of chest trauma giving incidence of 17.14% in a trauma related conditions.

Age incidence

Most common age groups affected were 30 to 39 years which is most productive age group. Our observations of age incidence is compared and found consistent with observations of other series as shown in the table.

Table 22: Comparison of age incidence in various studies.

Age group (years)	Atri M et al[13], (n=2571)	Lema et al[11], (n=150)	Present study, (n=150)
0-10	5%	8.0%	0.67%
11-20	12.5%	8.0%	8.00%
21-30	30%	36.0%	26.67%
31-40	30.8%	25.3%	28.00%
41-50	10.8%	12.6%	23.33%
51-60	6.7%	6.0%	8.00%
61-70	3.3%	2.0%	4.67%
>71	0.8%	2.0%	0.67%

In our present prospective study the most commonly affected age group is 31-40 years; similar findings are observed in Atri M et al.[13]

Table 23: Comparison of average age in various studies.

Studies	Average age
Atri M et al[13], (n=2571)	34.4 years
Lema et al[11], (n=150)	32.17years
Present study, (n=150)	37.27years

As compared to other studies the average age in our study is statistically not significant.

Table 24: Comparison of male : female ratio in various studies.

Studies	Incidence male : female
Lema et al[11], (n=150)	3.8:1
Dehgan et al[10], (n=3467)	3.34:1
Present study, (n=150)	5:1

In all the above studies males are more commonly affected than female as more commonly involved in outdoor activities as compared to females.

Table 25: Comparison of type of chest injury in various studies.

Studies	Incidence	
	Blunt trauma	Penetrating injury
Lema et al[11], (n=150)	72.7%	27.3%
Mohan Atri et al[13], (n=2571)	81.7%	18.7%
Present study, (n=150)	94.67%	4.33%

In our study blunt trauma is more common than penetrating trauma. Similar findings are also observed in Lema et al, Atri M et al.[11,13]

Table 26: Comparison of mechanism of injury in various studies.

Studies	Commonest mechanism of chest injury
Liman et al[12] (n=1490)	RTA 67.79%
Lema et al[11] (n=150)	RTA 50.7%
Dehgan et al[10] (n=3467)	RTA 79%
Present study, (n=150)	RTA 58%

It has been observed that the mechanism of chest injuries varies from one country to country, also varies within the same country. RTA is the commonest mechanism of chest injury noted in our study which is in accordance with various other studies.

Table 27: Comparison of associated injuries in various studies.

Name of study	Associated injuries with chest injury		
	Head injury	Skeletal injury	Abdominal injury
Lema et al[11] (n=150)	33.33%	26.7%	5.3%
Ibrahim Al-Koudmani et al[15] (n=888)	8%	19%	13%
Anupam Choudhary et al[16], (n=52)	38.46%	15.4%	15.4%
Mehboob Alam Pasha et al[17], (n=504)	39.6%	54.4%%	11.5%
Present study, (n=150)	56%	36.67%	13.33%

In our study head injury is the commonest associated injury detected. Similar findings are also note in Choudhary A et al study and Lema et al study.[11,16]

Table 28: Average duration of hospital stay in various studies.

Study	Average duration of hospitalization (days)
S.T.Liman et al[12], (n=1490)	4.5
Lema et al[11], (n=150)	13.7
Iv. Novakov et al[18], (n=212)	8.7
Present study, (n=150)	8.97

The average duration of hospital stay in our study is 8.97 days. As per the statistical test of significance, 'Z' test for mean, 'p'-value is more than 0.05 i.e. not significant.

In our study conservative line of management was observed in 33.33% of patients and operative management was done in 66.67% patients. Majority of the patients required operative treatment, while thoracotomy was not required in any patient during our study, this may be because of small sample size.

Table 29: Treatment of chest injury.

Name of study	Modality of treatment		
	Conservative	Operative	
		Tube thoracostomy	Thoracotomy
Khan ZLM et al[14] (n=103 patients)	29%	62%	9%
Atri M et al[13], (n=2571 patients)	42.6%	48.4%	9%
Present study (n=150)	33.33%	66.67%	0%

Table 30: Comparison of mortality in various studies.

Name of study	Mortality
Atri M et al[13], (n=2571 patients)	12.1%
Khan MLZ et al[14] (n=103 patients)	8%
Present study, (n=150)	11.33%

If mortality rate is compared with other studies the mortality rate in our study is statistically not significant. (As per statistical test of significance, 'Z'-test, 'p'-value is more than 0.05 i.e. not significant).

CONCLUSION

In our present prospective study 150 Patients of chest injury were studied. The most commonly affected age group in our study is 31-40 years. The average age of patients in our study is 37.27 years. The male to female ratio detected in our study is 5:1. Blunt trauma is more common than penetrating trauma leading to chest injury in our study. Road traffic accident is the commonest mechanism of injury in blunt trauma group, while stab injury is the commonest mechanism of injury in penetrating trauma group. Fracture ribs are the most common type of chest injury detected in our study followed by pneumothorax. The average duration of hospital stay in our patient is 8.97 days. The mortality rate in our study is 11.33%.

Age at the time of presentation, type of chest injury (blunt/penetrating), presence of other associated injuries increases morbidity and mortality in chest trauma patients. Presence of chronic illnesses like HTN, diabetes, COPD, ischemic heart disease etc. are the independent risk factors which increases the morbidity and mortality.

Among the various radiological investigations (chest radiograph, USG thorax, CT-scan thorax) CT scan thorax has a definite role in the diagnosis and management of chest trauma patients.

In our study RTA is the commonest mechanism of injury. So, strictly following traffic rules, education of the people about the traffic rules may decrease the incidence of RTA and consequently the incidence of chest trauma. Now days due to urbanization and industrialization there is a rise in urban violence and assault leading to increased incidence of chest injuries.

Prompt diagnosis and treatment, judicious use of radiological investigations and timely surgical intervention improves the final outcome in chest trauma patients.

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