EVALUATION OF OUTCOMES IN CHEST TRAUMA PATIENTS USING CHEST TRAUMA SCORING SYSTEM

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ABSTRACT

INTRODUCTION

Chest trauma is a common surgical incidence all over the world. Chest Trauma scoring system (CTS) is found in many studies to be an effective tool to predict outcomes in chest trauma patients. The need for a universal system for thoracic trauma is justified to identify critical factors, to predict patient outcomes, urgent need for intervention, and requirement of intensive care and to communicate with the family. Therefore there is a need of study and scoring system which can predict possible outcome.

MATERIAL AND METHODS

This is a prospective, longitudinal, observational study conducted at Universal College of Medical Sciences, Bhairahawa from October 2019 to March 2021. The chest trauma score was used to evaluate the outcome in patient admitted with blunt trauma chest. Duration of hospital stay, respiratory complications, need of ICU and Ventilators and mortality were noted as outcomes.

RESULTS

In this study, 79 cases with blunt trauma chest were admitted with road traffic accident being major factor for admission. Most patients were in age group 45-65 years of age with male predominance (84.8%). The results showed that patient with high CTS ≥5 was associated with higher incidence of pneumonia and need of ICU. The ROC curve showed that CTS predict significantly mortality with sensitivity of 100% and specificity of 92.2% with cutoff value of 7.5. Similarly, mean duration of hospital stay of patients having CTS ≥5 was 6.57 days more than patients having CTS <5.

CONCLUSION

Chest Trauma Score is a good predictor of outcome in patient with blunt chest trauma.

KEYWORDS

Chest trauma score, Morbidity, Mortality.

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INTRODUCTION

Trauma is a serious public health concern in many parts of the world, and it is a leading cause of morbidity and mortality among those who are affected. In the first four decades of life, trauma is also believed to be the primary cause of mortality, hospitalization, and long-term impairments.[1] Thoracic trauma accounts for 10-15% of all injuries.[2] According to study conducted by Pant et al. at the Department of Emergency Medicine of Civil Service Hospital, a tertiary care hospital in Kathmandu, Nepal in 2018 the head injury, thoracic injury and abdominal injuries were 12.4%, 10.8% and 1.7% respectively.[3]

Three of the most essential life-sustaining systems converge in the chest: the airway, the respiratory system, and the cardiovascular system. Trauma has a significant likelihood of causing damage to any of the structures within the chest. Chest trauma is responsible for 25% of deaths in highly traumatized individuals.[4] Thoracic trauma are open (penetrating) and closed (blunt), with the latter accounting for 90% of occurrences. In general, they have a low likelihood of requiring surgical intervention; however, degree of the damage will be determined by its severity.[5]

Many research have been conducted to determine the variables that predict morbidity and mortality in thoracic trauma, but only a few have resulted in scoring systems. By allocating resources, a prognostic score system makes it easier to manage. It has been observed that trauma patients who follows score and protocol-based therapies have better results and spend less time in the hospital.[6,7]

Studies done on scoring systems for thoracic trauma recognized the most important factors affecting prognosis of chest trauma patients are age, number of rib fractures, pulmonary contusions and bilateral injury to the chest.[8,9] Number of above factors were used to derive The Chest Trauma Score (CTS), devised by Pressley et al and validated by Chen as shown in table number 1.[6,9]

Table 1. Chest trauma score [6,9]

Age Score	<45	1
	45-65	2
	>65	3
Pulmonary Contusion Score	None	0
	Unilateral Minor	1
	Bilateral Minor	2
	Unilateral Major	3
	Bilateral Major	4
Rib Score		
	<3 Rib Fracture	1
	3-5 Rib Fracture	2
	>5 Rib Fracture	3
Bilateral Rib Fracture	Yes	2
	No	0

Chest trauma scoring system is an important scoring system that can aid in diagnosis of high risk patient and necessitate the need of intensive care and predict the course of disease progression in affected individual.

MATERIAL AND METHODS

This is a prospective, longitudinal, observational study conducted at Universal College of Medical Sciences, after the approval was taken from Institutional Review Board. Registration number: UCMS/IRC/200/19. The total duration of study was from October 2019 to March 2021 and purposive non-probability sampling technique was used. The sample size was calculated by using the formula $n=z2pq/d^2$ and was found to be approximately 79.[10]

Cases included in the present study were all patients with chest trauma, chest trauma with length of stay >24 hours and those who agreed to participate in study. Written consent was taken from patients who participated in the study. Patients less than 18 years, patients in whom chest CT was not performed within 24 hours of trauma, those who were discharged within 24 hours of presentation to the emergency department and patients with significant injury to body parts other than chest along with penetrating chest injury were excluded.

The schematic represenatation of patient selection in the present study is given in figure 1.

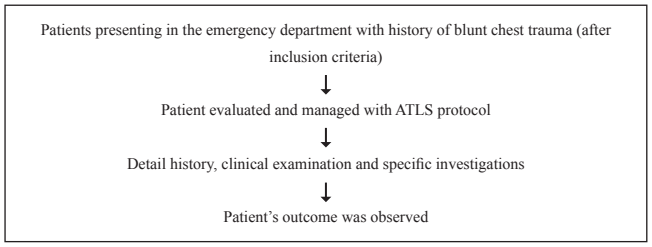


Figure 1. Schematic representation of patient selection

All the data collected were checked, compiled, organized and analyzed by the investigator himself. All the data were analyzed using SPSS (Statistical package for social science) software version 25.0. Chi-square test was used to analyze the two categorical variables. Parametric data was expressed in mean± standard deviation (SD) by using independent sample t-test. ROC curve was used to predict the mortality using chest trauma scoring system. Level of significance for all the analytical tests was set at 0.05 and p value <0.05 is considered statistically significant.

RESULTS

The demographic profile of 79 patients were recorded and characterized into different section. Out of 79 cases studied, road traffic accident (51.9%) was the most common mode of injury, followed by fall from height (41.8%) and blunt trauma chest due to physical assault (6.3%). Out of 79 patients, 67 patients were male (84.8%) and 12 patients were female (15.2%). Out of 79 patients, 35 patients were < 45 years of age (44.3%), 36 patients were 45-65 years age group

(45.6%) and 8 patients were >65 years of age (10.1%). Out of 79 patients, 43 patients did not had any pulmonary contusion following blunt chest trauma (54.4%), 21 patients had unilateral minor contusion (26.6%), 7 patients had bilateral minor contusion (8.9%), 6 patients had unilateral major contusion (7.6%) and 2 patients had bilateral major contusion (2.5%) respectively. Out of 79 patients admitted, 36 patients had < 3 ribs fracture (45.6%), 22 patients had 3-5 ribs fracture (27.8%) and 21 patients had > 5 ribs fracture (26.6%) respectively. Out of 79 patients, 69 patients had unilateral sided ribs fracture (87.3%) and 10 patients had bilateral sided ribs fracture (12.7%) respectively. Out of 79 patients admitted with blunt trauma to chest, 8 patients developed pneumonia (10.1%) and 2 patients developed acute respiratory failure (2.5%). Out of 8 patients who developed pneumonia, streptococcus pneumonia (75%) was isolated in sputum culture of six patients and acinetobacter (25%) was isolated in remaining two patients. Out of 79 patients admitted with blunt chest trauma, 33 patients required monitoring in ICU (41.8%) and two patients among them required assistance with ventilator (2.5%). Out of 79 patients admitted following blunt chest trauma, two patients died (2.5%) and remaining 77 patients were discharged (97.5%).

Table 2. Descriptive statistics of baseline parameters of patient

Variables	Mean	Standard deviation	Range	Minumum	Maximum
Age	44.96	15.62	60.00	18.00	78.00
Pulse rate	94.91	14.66	62.00	60.00	122.00
Respiratory rate	17.37	3.06	16.00	12.00	28.00
Systolic blood Pressure	113.42	17.16	90.00	60.00	150.00
Diastolic blood pressure	72.41	12.63	70.00	30.00	100.00
Saturation	94.58	6.95	49.00	50.00	99.00
Temperature	98.21	0.53	2.80	96.20	99.00
Haemoglobin	12.20	2.18	10.30	8.40	18.70
Total count	11625.32	4261.23	24100.00	2800.00	26900.00
Neutrophil	73.42	12.20	53.00	40.00	93.00
Duration of hospital stay	6.49	4.27	21.00	2.00	23.00
Total chest trauma score	4.49	2.20	9.00	2.00	11.00

The baseline parameters of patients included in study are shown in Table 2.

Table 3. Relation between different parameters with CTS

Parameters	CTS	N	Mean	Std. Deviation	Mean Difference	*p* value
Age	<5	48	42.10	13.76	7.28	.042
	≥5	31	49.39	17.44		
Pulse	<5	48	88.42	13.65	16.55	<0.001
	≥5	31	104.97	9.76		
RR	<5	48	16.00	1.89	3.48	<0.001
	≥5	31	19.48	3.35		
SBP	<5	48	115.42	13.98	5.09	.200
	≥5	31	110.32	21.05		
DBP	<5	48	75.00	8.99	6.61	.022
	≥5	31	68.39	16.14		
Saturation	<5	48	97.02	1.21	6.21	<0.001
	≥5	31	90.81	9.95		
Temperature	<5	48	98.21	0.51	0.01	.936
	≥5	31	98.22	0.57		
Haemoglobin	<5	48	12.58	1.98	0.95	.059
	≥5	31	11.63	2.38		
Total leucocyte count	<5	48	10950.00	4552.72	1720.97	.080
	≥5	31	12670.97	3588.70		
Neutrophil	<5	48	71.02	11.77	6.11	.029
	≥5	31	77.13	12.09		
Duration of hospital stay	<5	48	3.92	1.33	6.57	<0.001
	≥5	31	10.48	4.18		

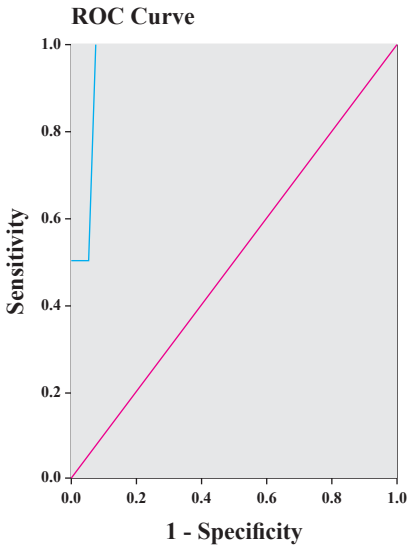
The above results showed that the mean age of patients, mean difference in pulse rate, mean difference in respiratory rate, mean diastolic blood pressure, mean saturation level, mean neutrophil level and mean duration of hospital stay was statistically significant in patient having CTS ≥5.

Table 4. Association between complications and CTS

Variables		CTS <5	CTS≥5	*p* value
Need of ventilator	Yes	0(0)	2(100)	0.15
	No	48(62.3)	29(37.7)	
Need of ICU	Yes	3(9.1)	30(90.9)	<0.001
	No	45(97.8)	1(2.2)	
Pneumonia	Yes	0(0)	8(100)	<0.001
	No	48(67.6)	23(32.4)	
ARF	Yes	0(0)	2(100)	0.15
	No	48(62.3)	29(37.7)	
Mortality	Yes	0(0)	2(100)	0.15
	No	48(62.3)	29(37.7)	

The above results showed that about 90.9% need ICU and all cent percent had pneumonia with CTS ≥5. There was significant association between need of ICU and pneumonia and CTS. This can be concluded that the patient with CTS ≥5 is more likely to need ICU and have pneumonia (p<0.001).

Table 5. ROC curve to predict mortality



Area	*P* value	95% Confidence Interval	
		Lower Bound	Upper Bound
.968	.025	.911	1.000

The ROC curve shows that CTS predict significantly mortality with sensitivity of 100% and specificity of 92.2% with cutoff value of 7.5.

DISCUSSION

Our study had shown male dominance with male to female ratio of 5.57:1. Similar observation of male dominance with ratio of 7:1 was made by Okugbo Su et al.[11] The present

study showed that blunt trauma chest following RTA was the most common mode of injury (52%) followed by fall from height (41.8%) and blunt trauma due to physical assault (6.3%). Similar observation was made by Hanafi et al with main cause of blunt chest trauma was due to motor vehicle accident which occurred in 452 (93%) patients followed by fall from height 22 (4.5%) followed by direct blow to chest 12 (2.5%).[12] The present study showed that 45.6% patients had age group 45-65 years followed by age group <45 years (44.3%) and >65 years (10.1%). According to study by Harde et al out of 30 patients 23 (76.7%) patients were younger than 45 years, 5 (14.7%) were between 45 and 65 years and remaining 2 (6.7%) patients were older than 65 years.[13] In this study mean length of hospital stay of patients having CTS ≥5 was 6.57 days more than patients having CTS <5. Severe chest injury with high CTS hinders with deep breathing and coughing out of secretions, leading to secondary respiratory complications, development of pneumonia and requirement of mechanical ventilation. This was proved in our study as high CTS ≥5 was significantly associated with high incidence of pneumonia (p<0.001) and increased requirement of mechanical ventilation (p= 0.15). In a study by Pressley et al[14] patients with total scores <7 were less likely to require intubation and mechanical ventilation (20.6%) compared with those with scores ≥7 (40.0%) (p<.0001). This study showed that about 90.9% need ICU whose CTS ≥5. The result was similar with study by Chen et al with the need of ICU admission in 69.5% with CTS ≥5.[6] In the current study high total CTS ≥5 was associated with mortality (p = 0.15) which was not statistically significant. Early mortality was seen in patients with bilateral multiple rib fractures, deranged renal function test and respiratory failure was the commonest cause for mortality. Studies by both Pressley et al[14] and Chen et al.[6] show that high CTS scores have a greater prevalence of mortality. This scoring system will help in triage of the patients with blunt chest trauma in emergency and also in patients with high CTS on admission, the earlier implementation of treatment strategies in ICU setting. In patient with high CTS, aggressive support with adequate analgesics and appropriate intervention will help in reducing morbidity and mortality and predicting the outcome of patients.

CONCLUSION

Chest trauma score is a good predictor of outcome in patient with blunt chest trauma. High Chest Trauma Score (CTS ≥5) is associated with increased incidence of pneumonia, requirement of intensive care and increased duration of hospital stay. High Chest Trauma Score (CTS ≥5) is also associated with development of acute respiratory failure, need of ventilator and mortality though they were not statistically significant. Thus patient with risk of complication may be identified earlier and management can be done accordingly.

LIMITATIONS

Single centre study.

CONFLICT OF INTERESTS

None

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