

## **Prediction of outcome by chest trauma score in blunt chest trauma patients**

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**Conflicts of Interest:** Nil

### **Abstract**

**Introduction:** Chest trauma is one of the most serious injuries and also a common cause of significant disability and mortality. Chest trauma is the leading cause of death from physical trauma after head and spinal cord injury. Many scoring systems have been developed in recent years to define injury severity in cases of thoracic trauma and pulmonary contusion [1]. Some of these scores are global, such as the Abbreviated Injury Scale (AIS) and the Injury Severity Score (ISS), but they do not provide detailed analysis of injuries over chest.

**Methodology:** This was a Time bound study from approval of SRC(January 2022) to November 2022. Data was collected from patients admitted in SSG hospital from January 2022 to November 2022 for blunt chest trauma satisfying all inclusion criteria mentioned above. Demographic Parameters, history, vital parameters, and necessary investigations including chest X-ray were recorded. Each individual underwent chest trauma score in format. Number of rib fractures and pulmonary contusion were noted from chest X-ray. Grading of pulmonary contusion was done on the basis of area of lung involved. Mild contusion was < one third area of

lung involved. Severe contusion was >one third area of lung involved. CT thorax was done on clinical basis in cases where it required. Outcome observed were Duration of hospital stay, Requirement and duration of ICU/ventilator support, Requirement and duration of ICD insertion and mortalit

**Conclusion:** The study for evaluation of CTS score in predicting outcome in blunt chest trauma patients was carried out from January 2020 to November 2020 at SSG hospital Vadodara which concludes. In CTS there is statistically significant difference in predicting length of hospital stay, Requirement of ICU, Requirement of ventilatory support( $P=<0.0001$ ), Requirement of ICD insertion ( $P=<0.0475$ ) in both the groups. CTS is 79.17% sensitive and 77.78% specific in predicting requirement of ICD insertion. CTS is 100% sensitive and 98.21% specific in predicting mortality in patients with blunt chest trauma.

**Keyword:** Chest Trauma, ICD, CTS Score.

## Introduction

Chest trauma is one of the most serious injuries and also a common cause of significant disability and mortality. Chest trauma is the leading cause of death from physical trauma after head and spinal cord injury. Thoracic injuries are primary or a contributing cause of about one fourth of all trauma-related deaths. The mortality rate in these cases is about 10%. In India majority of chest trauma are due to non automobile injuries such as falls, falling of the roof, fall in well, injury by cattle, violence etc. Chest injury is potentially the most dangerous of all and its management should be a matter of the most extreme urgency. The particular danger of the chest injury is that it threatens the vital transport of oxygen to the tissue by two ways: by hypovolemia from severe bleeding and from interference with the respiratory

system itself. Even when this hypoxia is danger to life. It can adversely influence the outcome of associated brain trauma. Many scoring systems have been developed in recent years to define injury severity in cases of thoracic trauma and pulmonary contusion [1]. Some of these scores are global, such as the Abbreviated Injury Scale (AIS) and the Injury Severity Score (ISS), but they do not provide detailed analysis of injuries over chest [2, 3]. The Chest Trauma Score (CTS) was derived from number of factors, devised by Pressley et al[4]and validated by Chen. Chen et al. found that this simple score can predict the possibility of poor outcome like complications and mortality in thoracic trauma patients if CTS is >5. However, it was not studied on Indian patients. In developing nations in limited resource setting, national guidelines and a standard scoring system will bring uniformity in assessment and management of chest trauma patients[5] Therefore, we decided to study CTS in Indian subpopulation in a public hospital. We evaluated CTS to predict mortality and morbidity.

## Aims and Objective

**Aims:** The aim of this study is to evaluate the efficacy of the Chest trauma score and its ability to predict mortality and morbidity in blunt chest trauma patients.

## Objectives

- The objective of my study is to predict morbidity in blunt chest trauma patients using CTS on parameters like.
- Duration of hospital stay
- Requirement and Duration of ICU / ventilator support.
- Requirement and duration of ICD insertion.
- To predict mortality.

Inclusion Criteria- the study included patients with,

- Age >18years,
- All blunt chest trauma cases,
- Radiological evidence compatible with chest trauma,
- Associated Head injury with GCS>8/15
- Associated Blunt abdominal trauma with normal USG

#### Exclusion Criteria

- Pre-existing respiratory disease that affects pulmonary functions,
- Pregnancy,
- Associated head injury with GCS<8/15
- Associated blunt abdominal trauma with USG finding suggestive of Visceral injury

#### Patients and Methodology

**Source of Data:** All cases of blunt chest trauma admitted in SSG hospital, Baroda included in the study.

**Type of Study:** This was the Prospective observational study

**Place of Study:** The study was conducted under Department of General Surgery, Medical College Baroda and SSG hospital from January 2022 to November 2022.

#### Sample Size Calculation

A total sample size of 60 patients were needed in this study to achieve 80% power with 5% risk calculated using open epi software. A total of 60 patients with blunt chest trauma were included in study.

#### Methodology

This was a Time bound study from approval of SRC (January 2022) to November 2022.

Data was collected from patients admitted in SSG hospital from January 2022 to November 2022 for blunt chest trauma satisfying all inclusion criteria mentioned above.

60 patients were included in the study. Type of study was Prospective observational study.

Written and informed consent was taken from patients/relatives.

Demographic Parameters, history, vital parameters, and necessary investigations including chest X-ray were recorded.

Each individual underwent chest trauma score in format. Number of rib fractures and pulmonary contusion were noted from chest X-ray.

Grading of pulmonary contusion was done on the basis of area of lung involved.

Mild contusion was < one third area of lung involved.

Severe contusion was >one third area of lung involved.

CT thorax was done on clinical basis in cases where it required.

Outcome observed were Duration of hospital stay, Requirement and duration of ICU/ventilator support, Requirement and duration of ICD insertion and mortality

#### Results and Analysis

A study of 60 cases of blunt chest trauma which were admitted in the General surgical units at Shree Sayaji General Hospital, Baroda, January 2022 to November 2022 was carried out.

Table 1: Age distribution of cases

Age(Year)	Total	Percentage (%)
<45	35	58.33%
45-65	22	36.66%
>65	03	5%

The age of patients in present study was 18 years and above. The majority of patients were below 45 years. The youngest patient in my study was of 18 years and eldest patient was of 72 years. 58.33% of patients were in age group <45 years and in age group 45-65 years

there were 36.66% of patients and in age group of >65 years there were 5% of patients.

Table 2: Gender distribution of cases

Sex	No. of Patients	% of Patients
Male	52	86.66
Female	08	13.33
Total	60	100

In our series out of 60 cases, 52(86.66%) were males and 8(13.33%) females. Male to female ratio was 6:1.

Table 3: Mode of Trauma

Mode of Trauma	Male (%)	Female (%)	Total No of Patients (%)
Road traffic accident	39 (75%)	7(87.5%)	46(76.67%)
Fall down	11(21.15%)	01(12.5%)	12(20%)
Assault	02(3.85%)	00	02(33.33%)
Total	52	08	60

In our series out of 60 patients majority of patients had road traffic accident and account for 46(76.67%) cases out of which 7(15.23%) were female and in female also majority of patients had road traffic accident i.e.7 (76.67%)

Table 4: Mean duration of hospital stay according to CTS score:

CTS Score	Number of Patients	Mean Duration of Hospital Stay
<=5	40	8.37
>5	20	15.5

In present study 40 patients (66.67%) having CT score of <=5 had mean duration of hospital stay of 8.37 days and 20 patients (33.33%) having CT score of >5 had mean duration of hospital stay of 15.5 days

Table 5: Number of patients requiring ICU admission and mean duration of ICU admission

CTS Score	Number of Patients Require ICU Admission	Mean Duration (Days)
<=5	00	-----
>5	16	5.25

In this study none of the patient having CT score of <=5 required ICU admission while 16 patients having CT score of >5 required ICU admission with mean duration of 5.25 days of ICU admission.

Table 6: Number of patients requiring ventilatory support and mean duration of ventilatory support

CTS score	Number of patients requiring ventilatory support (IPPV)	Mean duration (days)
<=5	0	0
>5	08	5.37

In this study none of the patients having CT score of <=5 required ventilatory support while 8 patients having CT score of >5 required ventilatory support with mean duration of 5.37 days.

Table 7: Number of patients requiring ICD placement and mean duration of ICD placement

CTS Score	Number of patients requiring ICD insertion	Mean duration (days)
<=5	06	6.16
>5	18	7.83

In this study 6 patients having CT score of <=5 required ICD insertion with mean duration of 6.16 days while 18 patients having CT score of >5 required ICD insertion with mean duration of 7.83 days.

Table 8: No of mortality in each CTS score group

CTS Score	Mortality (No. Of Patient)
<=5	0
>5	04

As shown in above table in this study out of 60 patients 4 patients expired and all of them were having CT score of >5.

**Discussion**

CTS combines the patient’s age, number of rib fractures, pulmonary contusion and Presence or absence of B/L rib fractures. In present study all 60 cases admitted in the department of general surgery were evaluated as described earlier in the patients and methodology. All the patients were appropriately assessed and outcome was recorded.

Age: The age of patients in present study was >18 years. Mean age was 40.02 years. Maximum number of patients belonged to the age group of <45 years old (58.33%). Only 5 % belonged to >65 years age group

Table 9: Comparison of age wise distribution of patients in various studies

Study	Year	CTS score and duration of Hospital stay(median)		P=0.713
		<=5	>5	
Chen et al [27] (n=1361)	2014	4	7	
Present study (n=60)	2020	7.5	12	

Mean age in the present study and in the study by Harde et al<sup>[5]</sup> is 40.02 and 34.50 respectively where as it is 55.48 and 48.20 in studies conducted by Chen et al and Chapman et al. Present study results matched with a study performed in 2019, in India<sup>[8]</sup>, where the mean age was 34.50 years.

Table 10: Comparison of gender wise distribution of patients in various studies

Study	Year	Male patients (%)	Female patients (%)
Harde et al (n=30) <sup>[8]</sup>	2019	86.7	13.3
Chapman et al <sup>[30]</sup> (n=385)	2014	71	29
Present study (n=60)	2022	86.66	13.33

Present study results matched those of study performed in 2019 by Harde et al<sup>[5]</sup> in which 86.7% patients were male. In 2014, in a study conducted by Chapman et al<sup>[30]</sup>, 71% patients were males.

Table 11: Comparison of duration of hospital stay of patients in various studies according to CTS score

Study	Year	CTS Score And Duration Of Hospital Stay(Median)		P=0.713
		<=5	>5	
Chen et al [27] (n=1361)	2014	4	7	
Present study (n=60)	2020	7.5	12	

In present study patients with CTS score of <=5 had median hospital stay of 7.5 days compared to the study done by Chen et al where patients having CTS score <=5 had median hospital stay of 4 days. In present study CTS score group of >5 had median hospital stay of 12 days as compared to Chen et al CTS score group of >5 where median hospital stay was 7 days, which was statistically insignificant (P value = 0.713).

Table 12: Comparison of ICU admission of patients in various studies according to CTS score.

		Percentage of ICU Admission According To CTS Score	
Study	Year	<=5	>5
Chen et al [27](n=1361)	2014	46.4	69.5
Present study (n=60)	2022	0.0	80
P Value		<0.0001	0.0446

In present study none of the patients having score of <=5 required ICU admission which is significantly different compared to study by Chen et al. where 46.4% patients having CTS score <=5 required ICU admission. On the other hand, 80% of patients having CTS score of >5 in present study required ICU admission which is statistically significant compared to 69.5% ICU admission of Chen et al.

Table 13: Comparison of median duration of ICU stay of patients in various study according to CTS score

		Duration of ICU Admission According To CTS Score(Median)		P=0.310
Study	Year	<=5	>5	
Chen et al [27] (n=1361)	2014	03	04	P=0.310
Present study(n=60)	2022	00	4.5	

In present study none of the patient in <=5 group required ICU admission whereas all 16 patients which required ICU admission belong to >5 score group with median stay of 4.5 days which is comparable to study done by Chen et al where median duration of ICU stay is 4 days(P=0.310)

Table 14: Comparison of requirement of ventilatory support of patients in various studies according to CTS score

Study	Year	CTS score and requirement of ventilatory support (%)		P<0.0001
		<=5	>5	
Harde et al (n=30)[8]	2019	40	60	P<0.0001
Present study (n=60)	2022	00	100	

In present study 8 patients required ventilatory support, all belonged to >5 score group (100%) which in comparison to study by Harde et al was significantly different, where out of all patients who required ventilatory support, 40% had score of <=5 and 60% patients had score of >5.

In present study sensitivity and specificity of CTS score in predicting ventilatory support was also calculated which was 87.5% and 100% respectively.

Table 15: Comparison of mortality of patients in various studies according to CTS score

Study	Year	CTS score and mortality (%)		P=0.1945
		<=5	>5	
Harde et al <sup>[8]</sup> (n=30)	2019	6.7	46.7	P=0.1945
Pressley et al <sup>[7]</sup> (n=649)	2012	4.2	14.3	
Chen et al <sup>[27]</sup> (n=1361)	2014	2.2	09	
Present study (n=60)	2022	00	20	

In present study 4 patients died from chest trauma all of whom belong to >5 score group whereas none of the patient in score group <=5 died. Our outcome is comparable to different studies also, where the mortality was significantly higher in patients having CT Score of >5 (p=0.1945).

In present study requirement of ICD insertion based on CTS score was observed where 6 patients who had CT score of <=5 required ICD insertion with mean duration of 6.16 days while 18 patients who had CT score of >5 required ICD insertion with mean duration of 7.83 days, on ROC analysis of those patient CTS score was found to be 79.17% sensitive and 77.78% specific at CTS score

of 4 this type of analysis was not done in any of the previous studies.

### Summary

The aim of this study is to assess the validity of the Chest Trauma Score and its ability to predict mortality and morbidity in blunt chest trauma patients on the parameters like duration of hospital stay, duration of ICU stay, duration of ventilatory support and requirement of ICD.

After permission from scientific review committee study was carried out in the Department of general surgery, SSG Hospital. After applying inclusion and exclusion criteria 60 cases were studied from January 2022 to November 2022.

At the time of admission CTS score was calculated using the five parameters including age, no of rib fracture, lung contusion and Bilateral rib Fracture.

With the help of various statistical tests comparison was done between patients CTS  $\leq 5$  and  $> 5$  groups on the basis of outcome like duration of hospital stay, ICU stay, ICD requirement, ventilatory support and mortality. In the study 52(86.67%) patients were male and 8(13.33%) patients were female with skewed gender distribution. No association was observed between gender, the CTS score and the outcome of the patient.

Mean age was 40.02 years. Minimum age of the patient in my study was 18 years and maximum age was 72 years. Maximum number of patients belonged to the age group of  $< 45$  years old i.e. 35 (58.33%) patients.

The patients were divided on the basis of CTS scoring. Out of the 60 patients 40 patients (66.67%) belonged to  $\leq 5$  CTS score category and 20 (33.33%) belonged to  $> 5$  CTS score category. Patients of the  $\leq 5$  score group had a mean hospital stay of 8.37 days while patients of the other group stayed for an average of 15.5 days. The

difference in between the 2 groups with respect to the duration of stay came out to be statistically significant ( $p < 0.0001$ )

Patients with CTS  $> 5$  group, 16(80%) patients required ICU stay with an average of 5.25 days and 8(40%) patients required ventilatory support with an average of 5.37 days and 18(90%) patients required ICD insertion while Patients with CTS  $\leq 5$  group 6(15%) patients required ICD insertion. Four patients (20%) in CTS  $> 5$  group died.

### Conclusion

The study for evaluation of CTS score in predicting outcome in blunt chest trauma patients was carried out from January 2020 to November 2020 at SSG hospital Vadodara which concludes

In CTS there is statistically significant difference in predicting length of hospital stay, Requirement of ICU, Requirement of ventilatory support ( $P < 0.0001$ ), Requirement of ICD insertion ( $P < 0.0475$ ) in both the groups.

CTS is 79.17% sensitive and 77.78% specific in predicting requirement of ICD insertion

CTS is 100% sensitive and 98.21% specific in predicting mortality in patients with blunt chest trauma.

The study for evaluation of CTS score in predicting outcome in blunt chest trauma patients was carried out from January 2020 to November 2020 at SSG hospital Vadodara which concludes

1. The patients were divided on the basis of CTS scoring. Out of the 60 patients 40 patients (66.67%) belonged to  $\leq 5$  CTS score category and 20 (33.33%) belonged to  $> 5$  CTS score category. Patients of the CTS  $\leq 5$  group had a mean hospital stay of 8.34 days while patients of the other group stayed for an average of 15.5 days. The difference in

between the 2 groups with respect to the duration of stay came out to be statistically significant with a p value of <0.0001, Thus CTS score is statistically significant in predicting

2. Patients with CTS >5 group, 16(80%) patients required ICU stay with an average of 5.25 days.
3. Patients with CTS >5 group, 8(40%) patients required ventilatory support with an average of 5.37 days.
4. Patients with CTS >5 group, 18(90%) patients required ICD insertion while Patients with CTS ≤5 group 6(15%) patients required ICD insertion.
5. Patients with CTS >5 group, 4(20%) patients died. Patient belonging to CTS ≤5 group, no one required ICU stay, ventilatory support and no mortality was observed. This suggests that as CTS score increases, prognosis worsens and average hospital stay, ICU stay, ventilatory support and mortality increases which is statistically significant.

#### Limitations

According to Present study younger populations are more susceptible this may be due to small sample size or because they are more prone to road traffic accident Limitations of this study is in case of CTS score group >5 required ICU admission and because mortality was also from same group, duration of ICU stay can not be predicted as people who required Ventilatory support died within week.

#### Abbreviation

CTS - CHEST TRAUMA SCORE  
RTA - ROAD TRAFIC ACCIDENT  
GCS – GLASGOW COMA SCALE  
TTSS - THORACIC TRAUMA SEVERITY SCORE  
AIS - ABBREVIATED INJURY SCALE  
ISS - INJURY SEVERITY SCORE

TRISS - TRAUMA AND INJURY SEVERITY SCORE  
RTS - REVISED TRAUMA SCORE  
PCS - PULMONARY CONTUSION SCORE  
MODS - MULTI ORGAN DISFUNCTION SYNDROME  
ARDS – ACUTE RESPIRATORY DISTRESS SYNDROME  
B/L - BILATERAL

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