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A STUDY OF ROLE OF CHEST TRAUMA SCORING SYSTEM IN BLUNT TRAUMA CHEST

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ABSTRACT

INTRODUCTION

Thoracic trauma is the third leading cause of death, after head and spinal cord injury. The incidence is increasingdue to many factors. Trauma to thoracic region has a wide spectrum from chest wall injury to vital organs within the thoracic cavity. Management varies from non-invasive to invasive. A prognostic scoring system makes it easier to manage by directing resources, improved outcomes and decreased hospital stay was reported following scores and protocol based intervention in trauma victims. The available thoracic trauma scores are Wagner Score, Abbreviated Injury Scale Chest, Lung Injury Scale, Pulmonary contusion score, Ribs Score, Thoracic Trauma Severity Score, Modified Early Warning Signs. Due to difficult applicability of some scores, lack of significance for predicting outcome or resource limitation, there is no universal scoring system. The Chest Trauma Score (CTS) is derived from number of above factors, found that this simple score can predict the possibility of poor outcome like complications and mortality in thoracic trauma patients.

AIMS:

To Study the Role of Chest Trauma Scoring System in Predicting Morbidity and Mortality in Blunt Trauma Chest.

METHOD OF STUDY:

Hospital based Prospective Study in 200 patients attending to Emergency department and Surgery OPD from 2020 to 2021 after obtaining Ethical Committee Approval. A detailed history was taken which includes Mode of Onset, Duration between onset and presentation, Clinical Examination, Routine Laboratory Investigations, Relevant Specific Investigations and Follow up investigations were noted and recorded. Chest trauma score was calculated with a point system assigned as shown in the table. Based on data collected the result will be analyzed using SPSS 2.1 software and MS EXCEL

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Calculation of Chest trauma score

AGE SCORE	SCORE	RIB SCORE	SCORE
>45	1	<3 RIBFX	1
45-65	2	3-5 RIBFX	2
65	3	>5 RIBFX	3
PULMONARY CONTUSIONSCORE		BILATERAL RIB FRACTURES	
NONE	0	NO	0
UNILATERAL MINOR	1	YES	2
BILATERAL MINOR	2		
UNILATERAL MAJOR	3		
BILATERAL MAJOR	4		

Results & Conclusion: CTS is a good predictor of prognosis in patients with chest injuries, according to the findings of this study. An higher risk of mortality, pneumonia, and the necessity for mechanical ventilation is associated to a high chest trauma score (CTS 5). This rating method might be used to identify individuals who are at risk of problems and immediately begin intensive targeted treatment.

Key words: Chest Trauma, Trauma Scores, Flial chest,

INTRODUCTION

In India, the leading cause of death is trauma. After head and spinal cord injury, thoracic trauma is the third leading cause of death. Many factors are contributing to the rise in incidence.

Trauma to the thoracic region can range from injury to the chest wall to vital organs within the thoracic cavity. Management methods range from non-invasive to invasive.

A prognostic scoring system simplifies management by directing resources. Following scores and protocol-based intervention in trauma victims, improved outcomes and decreased hospital stay were reported.

The need for a universal system for thoracic trauma is

- To identify critical factors

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- To predict patients outcome
- Urgent need for intervention
- Requirement of Intensive care
- To communicate with the family.

The available thoracic trauma scores are

- Chest Trauma Score,
- Wagner Score,
- Abbreviated Injury Scale Chest (AIS)
- Lung Injury Scale
- Pulmonary contusion score (PCS)
- Ribs Score
- Thoracic Trauma Severity Score
- Modified Early Warning Signs scoring system.

There is no universal scoring system due to the difficulty of applying some scores, the lack of significance for predicting outcome, or resource constraints. Thoracic trauma scoring systems have been studied in detail.

- Age
- Rib fractures
- Pulmonary contusion
- Bilateral injury as the most important factors affecting prognosis of chest trauma patients.

These factors individually or combined may help in predicting outcome. The Chest Trauma Score (CTS) is derived from these factors, found that this simple score can predict the possibility of poor outcome like complications and mortality in thoracic trauma patients if CTS >/= 5.

The present study was conducted to Study the Role of Chest Trauma Scoring System in Predicting Morbidity and Mortality in Blunt Trauma Chest.

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AIM AND OBJECTIVES OF THE STUDY

1. To study the Role of Chest Trauma Scoring System in predicting Morbidity.

2. To study the Role of Chest Trauma Scoring System in predicting Mortality.

MATERIALS AND METHODS

Study of Design : Hospital based Prospective Study.

Study subjects : All patients presenting to Emergency department and Surgery OPD.

Study setting : Department of General Surgery.

Study period : One year duration from time of institutional scientific and ethical committee approval date.

Study sample : 200

INCLUSION CRITERIA

- Chest trauma patients presenting with one or more ribs fractures.
- Age 18 to 70 years.
- Patient presenting within 1 week of trauma.
- Patients willing to participate in the study.

EXCLUSION CRITERIA

- Patients presenting with associated injuries [abdominal viscera and headinjuries].
- Patients with COPD/Pulmonary TB.
- Patients on anti platelet drugs/ bleeding diathesis.
- Patients with pathological fractures.

A DETAILED HISTORY WAS TAKEN WHICH INCLUDES

- Mode of Onset,
- Duration between onset and presentation.

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- Clinical Examination.
- Routine Laboratory Investigations.
- Relevant Specific Investigations.
- Follow up.

CHEST TRAUMA SCORING (CTS)

AGE SCORE	SCORE	RIB SCORE	SCORE
>45	1	<3 RIBFX	1
45-65	2	3-5 RIBFX	2
65	3	>5 RIBFX	3
PULMONARY CONTUSION SCORE			
NONE	0	BILATERAL RIB FRACTURES	0
UNILATERAL MINOR	1	NO	2
BILATERAL MINOR	2	YES	
UNILATERAL MAJOR	3		
BILATERAL MAJOR	4		

Final CTS was then calculated which ranges from 2-12.

on the basis of final CTS, patients were divided into two groups with CTS <5 andCTS >/= 5

STATISTICAL ANALYSIS

Data Entry was done using Microsoft excel 2013 and analysis done using SPSS V 16. Qualitative data was expressed in frequencies and percentages and Quantitative data in mean and standard deviation. Non parametric statistics i.e. Chi square test/ Fishers exact test was used to find the significant association between the two qualitative variables. ROC analysis was done to predict the outcome based on CTS score. Bar diagrams and pie chart were used to represent the data. p value

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of <0.05was considered statistically significant.

RESULTS

Table 1: Age distribution

	Frequency	Percentage
<45	100	50%
45 – 65	76	38%
>65	24	12%
Total	200	100%
Mean ± SD	46.44 ± 16.14	

Table 2: Gender distribution

	Frequency	Percentage
Male	102	51%
Female	98	49%
Total	200	100%

Table 3: Mode of injury

	Frequency	Percentage
RTA	144	72%
Fall	56	28%
Total	200	100%

Table 4: Pulmonary contusion score

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	Frequency	Percentage
None	38	19.0%
Unilateral minor	44	22.0%
Bilateral minor	42	21.0%
Unilateral major	47	23.5%
Bilateral major	29	14.5%
Total	200	100%

Table 5: Rib score

	Frequency	Percentage
<3 Rib fractures	81	40.5%
3 – 5 Rib fractures	69	34.5%
>5 Rib fractures	50	25%
Total	200	100%

Table 6: Bilateral rib fracture

	Frequency	Percentage
Yes	37	18.5%
No	163	81.5%
Total	200	100%

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Table 7: Chest trauma score

	Frequency	Percentage
<5	92	46%
>5	108	54%
Total	200	100%

Table 8: Mortality

	Frequency	Percentage
Survived	109	54.5%
Dead	91	45.5%
Total	200	100%

Table 9: Incidence of Pneumonia

	Frequency	Percentage
Yes	83	41.5%
No	117	58.5%
Total	200	100%

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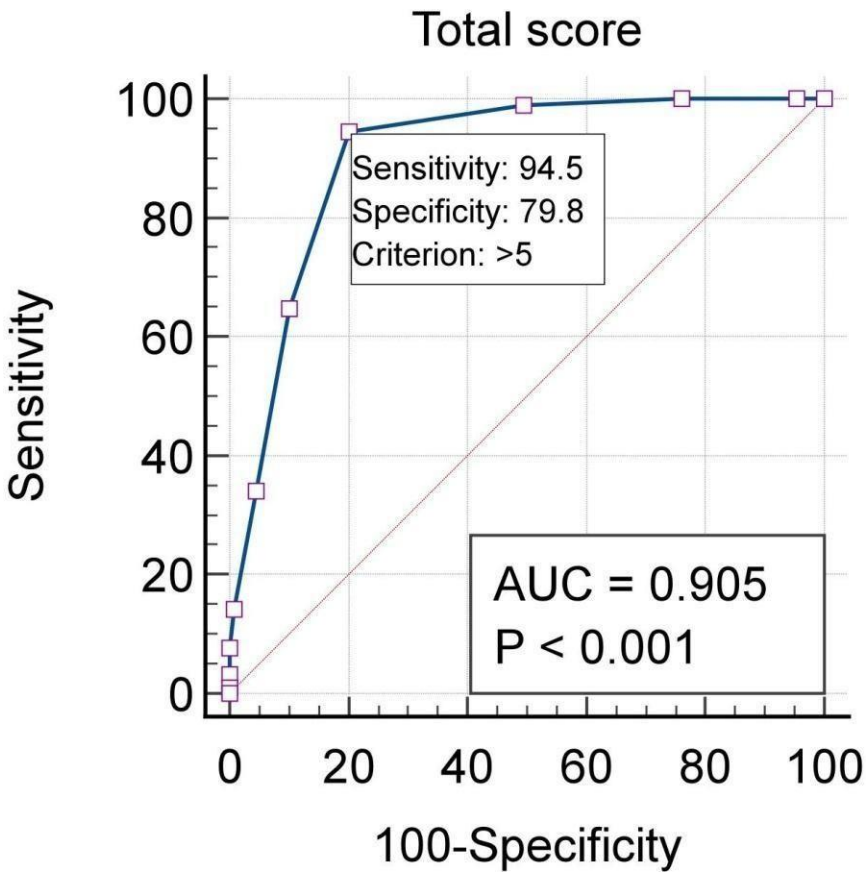
Table 10: Mechanical ventilation

	Frequency	Percentage
Yes	42	21%
No	158	79%
Total	200	100%

Table 11: ROC Analysis of CTS score to predict mortality



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AREA UNDER THE ROC CURVE (AUC)

Area under the ROC curve (AUC)	0.905
Standard Error [a]	0.0213
95% Confidence interval [b]	0.855 to 0.941
z statistic	19.026
Significance level P (Area=0.5)	<0.0001

[a] DeLong et al., 1988[b]

Binomial exact

YOUDEN INDEX

Youden index J	0.7432
Associated criterion	>5
Sensitivity	94.51
Specificity	79.82

There was a highly significant association between CTS score and mortality.(AUC-0.905, p-<0.0001)

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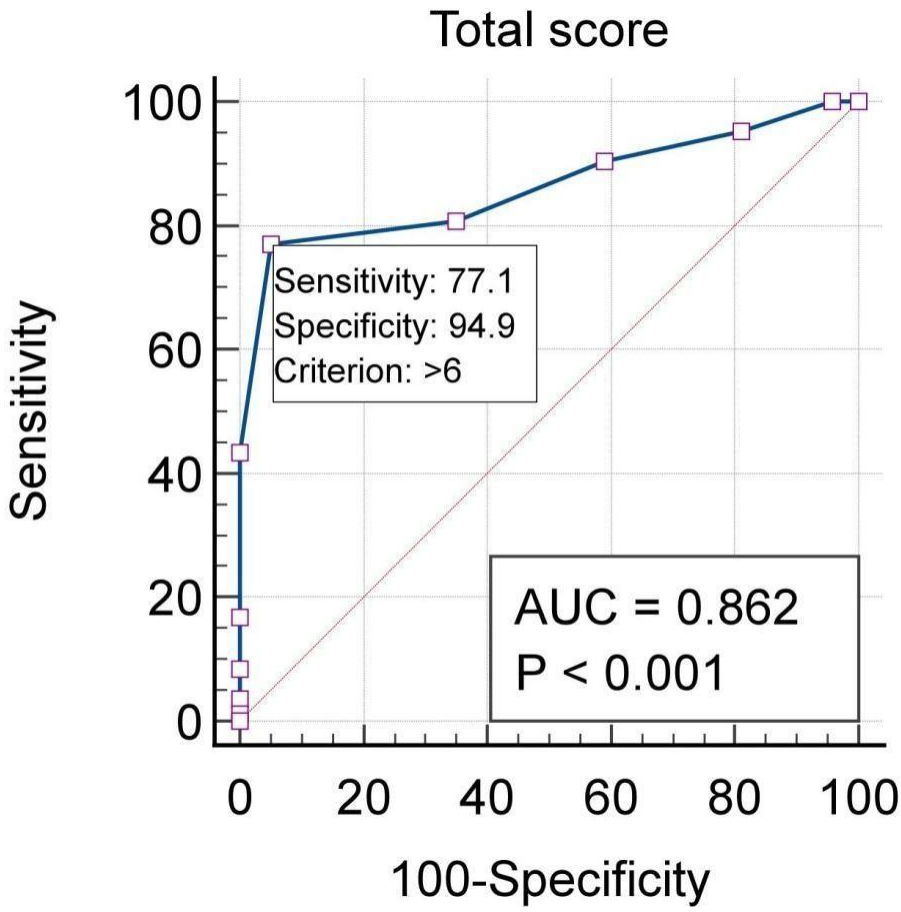
Table 12: ROC analysis to predict pneumonia



AREA UNDER THE ROC CURVE (AUC)

Area under the ROC curve (AUC)	0.862
Standard Error [a]	0.0295
95% Confidence interval [b]	0.807 to 0.907
z statistic	12.265
Significance level P (Area=0.5)	<0.0001

[a] DeLong et al., 1988

[b] Binomial exact

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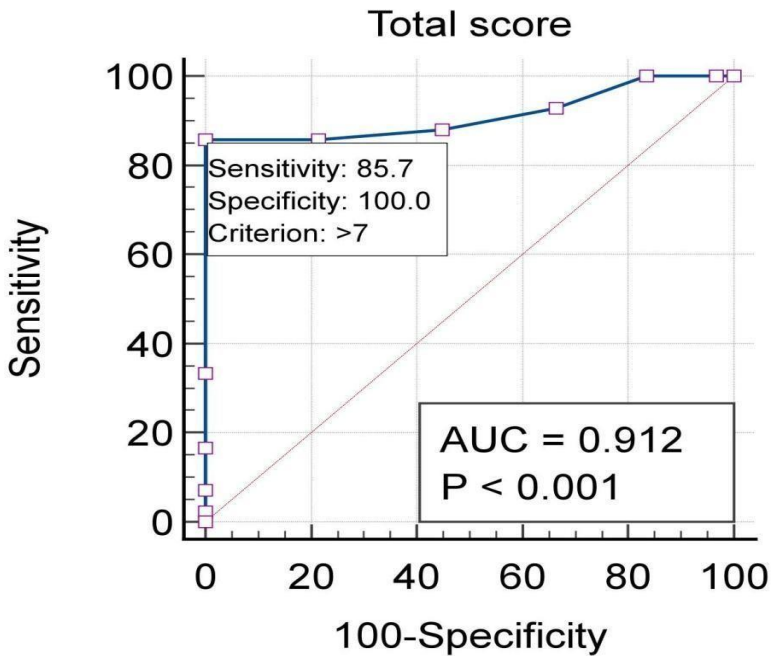
YOUDEN INDEX

Youden index J	0.7198
Associated criterion	>6
Sensitivity	77.11
Specificity	94.87

Upon ROC analysis, at a CTS score of >6 predicts pneumonia with a sensitivity was 77.1 and specificity was 94.9, AUC was 0.862 and p value was <0.0001

Table 13: ROC analysis to predict need for mechanical ventilation



Upon ROC analysis at a CTS score of >7 predicts the need for mechanicalventilation with a sensitivity of 85.7 and with a specificity of 100, AUC 0.912 and p

<0.001

AREA UNDER THE ROC CURVE (AUC)

Area under the ROC curve (AUC)	0.912
Standard Error [a]	0.0351
95% Confidence interval [b]	0.864 to 0.947
z statistic	11.731
Significance level P (Area=0.5)	<0.0001

[a] DeLong et al., 1988[b]

Binomial exact

YOUDEN INDEX

Youden index J	0.8571
Associated criterion	>7
Sensitivity	85.71
Specificity	100.00

Table 14: Chest Trauma score and Incidence of Pnumonia

Chest Trauma score	Yes	No
<5	16	76
>5	67	41
Total	83	117
Chi square test = 40.58, p=<0.0001*, Statistically signficiant		

Table 15: Chest trauma score and Mechanical ventilation

DISCUSSION

Trauma is the leading cause for death in India. After spinal cord injury and head trauma, thoracic trauma is the third leading cause of death from trauma. Chest trauma accounts for 10% of all trauma admissions. The mortality rate can vary from 10% to 60%.[1]

Trauma to the thoracic area can range from injury to the chest wall to damageto vital organs in the thoracic cavity. Management of thoracic injuries can be either aggressive or penetrating[2]

Although many studies have been conducted to determine factors that predict mortality and morbidity in thoracic trauma patients, very few of these have been converted into scoring systems. It is easier to direct resources and manage a prognostic scoring system. Score and protocol-based interventions for trauma victims led to improved outcomes and shorter hospital stays. A universal system for treating thoracic trauma is needed to identify and predict critical factors, provide information to the family, communicate with them, and allow for prompt intervention ifnecessary[3,4]

Global poly-trauma scores, such as the Injury Severity Score or Trauma Injury Severity Score(TRISS), can be used to predict the outcome of poly-trauma. However,the score might not accurately predict isolated thoracic injuries. There are afew thoracic trauma scores that you can use: Wagner score, Abbreviated Injury Scale chest, Lung Injury Scale (AIS), Pulmonary Contusion Score

(PCS), RibScore and Thoracic Trauma Severity Scores (TTSS)[5] There is no universal scoring system due to the difficulty of some scores and their inability to predict outcome, or lack of significance, Study of scoring systems for thoracic injury have shown that age, rib fractures and pulmonary contusions are the most important factors in determining prognosis for chest trauma patients. [6] These factors can be used together or individually to predict the outcome. Pressley and colleagues developed the Chest Trauma Score (CTS). Chen validated the results.[7]

Chen and colleagues If CTS >=5, this simple measure can indicate poor outcomes in thoracic injury patients, such as complications and fatality. It was not tested on patients in India. In underdeveloped nations with inadequate resources, national standards and a common scoring system for chest trauma patients will be beneficial.[8]

In this pretext the present study titled "A study of role of chest trauma scoring systemin blunt trauma chest" was carried out with an aim to study the role of chest trauma scoring system in predicting morbidity and mortality in blunt trauma chest andthe objectives being

- To study the role of chest trauma scoring system in predicting morbidity.
- To study the role of chest trauma scoring system in predicting mortality.

SOCIO DEMOGRAPHIC CHARACTERISTICS

In the present study the mean age of the participants was 46.44 ± 16.14 years, 50% of the participants were aged <45 years, 38% were aged 45-65
years, 2% wereaged >65.

In the present study 51%were male and 49% were female.

In the study conducted by **Elbaiah et al.,**[9] the socio demographic profile was similar to the present study.

In 2012, in Hannover Germany, a study was conducted on patients with multiple injuries (mean age 42.7±17.0 y) were included; (73%) were males and (27%) were females.[10]

MODE OF INJURY

In the present study, 72% of the participants had RTA, 28% had falls.

In the study conducted by **Elbaiah A et al [9].,** the most common mode of injurywas RTA which was in consonance with the present study and the these similar findings were made even in the studies done by Global et al. in 2012, in KSA where road traffic accidents accused of injury in (81.25%), and other mechanisms accounted for(18.75%).[11]

PULMONARY CONTUSION SCORE:

Lung contusions typically involved less than two lobes ipsilateral, with bilateralinvolvement being associated with higher mortality. Tension pneumothorax was the most common cause of pneumothorax. There was statistically significant variation between good and poor outcomes in the majority of cases.

The present study found that 19% of participants had no pulmonary contusions, 22%had unilateral minor contusions, 21% had bilateral minor contusions, 23.5% had unilateral large contusions, and 14.5% had bilateral

We found that lung contusions were associated with mortality, particularly when they involved bilaterally. Retrospective study in Baltimore, Maryland of blunt chest trauma showed that severe thoracic parenchymal injury could be present in the absence or presence of thoracic bony fragments.[12]

Again regarding pleural involvement among the studied cases; the results quite match what implicated by Shahzad et al., where they documented that (33.3%) presented with unilateral while (9.1%) with bilateral pneumothorax, one- sidedhemotho- rax in (55.5%) while bilateral was in (21%) of cases.[13]

RIB SCORE:

In the present study, 40.5% had < 3 rib fractures, 34.5% had 3-5 rib fractures, 25% had >5 rib fractures.

In the present study, 18.5% had bilateral rib fractures.

This similar sort of chest injury profile was seen in the studies conducted by Elibah A et

al[9]., and Shahzad et al[13]; who found that on chest radiograph of all blunt chest trauma patients; (37.8%) had 3–6 rib fractures, (23.8%) of patients werehaving 1-<3 rib fractures, flail chest in (21%) and >3 bilateral rib fractures in (17.4%).[14]

CHEST TRAUMA SCORE

Chest trauma is a significant cause of death and morbidity, especially in the younger population.[15] Injuries to the thorax are the third most common injuries in trauma patients, next to injuries to the head and extremities. Thoracic trauma has an overall fatality rate of 15–25%. Furthermore, the presence of thoracic injuries in the setting of multi-systemic trauma can significantly increase patient mortality. [16,17] Chest trauma may be due to penetrating or blunt trauma.[18]

Road traffic crashes are the commonest cause of blunt chest injuries in private practice accounting for up to 70% in some series. Blunt trauma is more common than penetrating chest injury, accounting for more than 90% of thoracic injuries.[19]

Outcome and prognosis for a vast majority of patients with chest trauma are excellent. Most (>80%) require either non-invasive therapy or at most a thoracostomy tube. The most important determinant of outcome is the presence or absence of significant associated injuries.[20]

The present standards for assessing thoracic trauma vary widely. A scoring system that can predict complications in thoracic trauma patients needed. For this in 2000 Pape et al. developed the Thoracic Trauma Severity Score, the TTSS combines the patient’s age, resuscitation parameters, and radiological assessment ofthe thorax.[21]

In the present study, 46% had a chest trauma score of <5, 54% had a chest trauma score of >5.

In 2012, Philipp M et al. suggested a study regarding out- comes of chest trauma patients comparing different thoracic trauma scoring systems reviled that among the examined scoring systems, only the TTS was an independent predictor of mortality. Patients with a TTS > 9 had a 4-fold risk of death.[10]

MORTALITY:

In the present study there was a mortality rate of 45.5%

PNEUMONIA:

In the present study 41.5% pneumonia, where as 58.5% did not have pneumonia.

MECHANICAL VENTILATION:

Mechanical ventilation was needed in 21% of the cases and 79% did not need any.

CHEST TRAUMA SCORE AND PNEUMONIA:

There was a statistically significant association between chest trauma and pneumonia.

It was observed that the cases who had higher CTS had more chances of having pneumonia

CHEST TRAUMA AND MECHANICAL VENTILATION:

It was observed that there was a significant association between chest trauma and mechanical ventilation.

The need for mechanical ventilation was significantly higher in cases with severe chest trauma when comparted to those who had less severe disease.

CHEST TRAUMA AND MORTALITY:

There was a statistically significant association between chest trauma score and mortality, mortality was relatively higher in cases with severe chest trauma.

PREDICTORS OF MORTALITY:

There was a highly significant association between CTS score and mortality. (AUC-0.905, p-<0.0001)

Upon ROC analysis, at a CTS score of >6 predicts pneumonia with a sensitivity was 77.1 and specificity was 94.9, AUC was 0.862 and p value was <0.0001 Upon ROC analysis at a CTS score of >7 predicts the need for mechanical ventilation with

a sensitivity of 85.7 and with a specificity of 100, AUC 0.912 and p <0.001.

In the present study it was observed that there is a statistically significant association between various factors like CTS score, pneumonia, mechanical ventilation.

It is crucial to quickly and accurately assess the severity of thoracic trauma. This will enable for accurate and timely handling. The standard scoring system enables fast categorization and triage of the severity of chest damage. This will allowtreatment procedures to be implemented more quickly in the emergency room.

The lack of trauma treatment facilities, as well as the wide variation between them in different areas of India, were highlighted by Joshipura and colleagues.

72 A simple global scoring system, such as CTS, might aid in the standardisation of trauma care in India by assessing both the severity of the trauma and prognostication.

The final CTS score in this research was in the range of 2 to 12, with a mean score of 5 1.250. Respiratory problems, pneumonia, and the need for mechanical ventilation follow a severe chest injury with a high CTS. Even in this investigation, a high CTS 5 was shown to be related with a higher incidence of pneumonia (P = 0.046) and a higher need for mechanical ventilation (P = 0.025) in patients with chest injuries.

Patients with CTS 5 exhibited a higher rate of pneumonia and mechanical ventilation. This scoring system may assist in the triage, resource utilization like ICU bed and ventilator. Also in patients with high CTS on admission, earlier implementation of treatment strategies such as but not limited to epidural analgesia, supportive ventilation, and intercostal drainage (ICD) can be applied to reduce morbidity and mortality.[9,23,24]

Each score component was investigated independently for its relevance to the result in the current study. There was a significant correlation between increasingage and the requirement for mechanical ventilation (P = 0.640) and death (P = 0.007), but not with pneumonia. Battle et al. also observed that the likelihood of requiring mechanical ventilation increases with age.[24]

Bulger et al. also discovered an increase in the number of days spent on a ventilator in elderly patients who had had acute chest injuries.

According to Stitzel et al., a threshold of 55 years old increased the chance of death in patients with chest injuries. which are remarkably comparable to the findingsof the current investigation.[25]

Individually, pneumonia, mechanical ventilation, and mortality were all associated with an increasing number of rib fractures (RIBFX >3), severe pulmonary contusion, and bilateral injury, but these associations were not statistically significant. This indicates that while each of these components may not be suitable for predicting outcomes on its own, when combined into a total score, they may aidin prediction.

Thus, this CTS system may provide a more accurate prediction of outcome than any single parameter.

A retrospective study conducted at the cardiothoracic surgical unit of the University College Hospital, Ibadan. On all blunt chest injury patients over a 20 years period and concluded that majority of blunt chest trauma can be managed by simple procedures with minimal complications; that (72.9%) of cases had either closed thoracostomy drainage or clinical observation, (27.1%) had major thoracic surgical intervention,[26] that was also quite relevant to the results of the present study.

Also regarding management; we noticed after data analysis that the need for mechanical ventilation associated with mortality and high morbidity. In 2002 a study was conducted on patients with blunt chest trauma; endotracheal intubation was performed at the scene or in transit on (52%) of patients, and that associated with poor prognosis.[27]

The fate of the studied cases was close enough to what Shahzad et al. noticed in their study; where (50.3%) admitted to ICU, (40.6%) were admitted to Inpatient Ward,(6.1%) were discharged home and only (3%) died. [28]

When we used the studied score, we discovered that higher scores were associated with a higher risk of mortality. With a score of 0-5, two were released and eight were admitted to the inpatient ward; with a score of 6-10, four were admitted to the inpatient ward and another four to the intensive care unit. All patients with a score of 11-20 were brought to ICU, and those with a score of 21-25 had an early mortality rate of two patients, which was similar to what Shahzad et al. observed in their study.[13]

Using the receiver operating characteristic (ROC) curve analysis, it was determined that the TTSS score greater than 7 had 100% sensitivity and 100% specificity for predicting the outcome of thoracic trauma patients; keeping in mind that we are testing the score in patients with isolated thoracic trauma. This is consistent with what was discovered in 2014 in Pakistan, where researchers concluded that a significant relationship exists between outcome and TTSS. The results of the Chi-square test revealed a statistically significant association between the patient's outcome and the Thoracic trauma severity score (TTS). [28]

According to Battle CE's meta-analysis of risk factors for mortality in patients with blunt chest wall trauma, patients aged 65 years or older, had three or more rib fractures, had cardiopulmonary disease, and developed pneumonia post-injury were all significant risk factors for death.[24]

The elderly, pre-existing co-morbidities, rib fractures, flail chest, bilateral chest injury, lung parenchyma injury, and multiorgan involvement are all important risk factors for poor outcomes, according to several studies. Furthermore, studies have shown that scoring systems aid in the identification of high-risk patients who require intensive focused management, resulting in better patient outcomes. The majority of the previously mentioned factors are included in CTS.

With a significant area under the curve of 0.75, the area under the receiver operating characteristic curve for mortality indicates that the test is acceptable. At CTS score 5.5, the score is sensitive to outcome prediction, with a maximum sensitivity of 87.5 percent and a specificity of 68 percent. Thoracic trauma severity score (TTSS) is another commonly used chest trauma score that includes anatomical andphysiological parameters and has been found to be the most useful for

assessing severity and predicting outcome in blunt chest trauma.

Although studies reveal a substantial link between TTSS and the frequency of morbidity or death in patients with thoracic trauma, its application in low-resource settings like India should be proven, as blood gas analysis may not be accessible. Ekpe EE identified a relationship between a modified early warning signals (MEWS) score system for prognosis in chest trauma and mortality. To determine its application in the Indian population, more study is required. [29]

Inadequate treatment of blunt chest injuries with analgesia, physiotherapy, and respiratory support frequently leads to complications such as pneumonia, respiratory failure, and death.[23]

In an integrative review, Kourouchea et al. suggest that respiratoryintervention, multimodal analgesia, complication prevention, and surgical fixation are all examples of early interventions that improved Blunt Chest trauma outcomes. [30]

Early implementation of these chest care bundles would be possible following classification of chest trauma patients using standard scoring systems such as CTS and early involvement of multidisciplinary teams. CTS can be applied rapidly in the emergency room, allowing for prompt initiation of appropriate intervention.

As a result, CTS has shown promise in predicting outcomes after chesttrauma and may be useful in the Indian subpopulation. The inaccessibility of CT scans in rural areas, on the other hand, may limit their use. Although CT is considered the most sensitive method of diagnosing pulmonary contusion, in low-
resource settings, chest radiography may be used instead, and thus CTS may be used. [31,32]

CONCLUSION

CTS is a good predictor of prognosis in patients with chest injuries, according to the findings of this study. An higher risk of mortality, pneumonia, and the necessityfor mechanical ventilation is associated to a high chest trauma score (CTS 5). This rating method might be used to identify individuals who are at risk of problems and immediately begin intensive targeted treatment.

LIMITATIONS OF THE STUDY:

The current study had a small sample size and was carried out at a single public tertiary care teaching institution. A multi-centric comparative study would have provided a larger sample size and possibly more validation of CTS score.

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