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ORIGINAL RESEARCH

A GCS or TRISS in RTA? Which is best….

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ABSTRACT

Background: Trauma remains a significant cause of mortality and morbidity worldwide, with varying mortality rates depending on the severity and nature of injuries sustained. Efficient assessment of injury severity using appropriate scoring systems is crucial for guiding trauma management and predicting patient outcomes. Various scales, such as the Trauma and Injury Severity Score (TRISS) and Glasgow Coma Scale (GCS), are employed to assess physiological and anatomical aspects of trauma severity. **Aim:** This prospective cohort study aimed to compare and contrast the predictive efficacy of TRISS and GCS in determining mortality among trauma patients presenting at the casualty department of Shri B. M. Patil Medical College Hospital and Research Centre, Vijayapura, India. **Materials & Methods:** Over a period from August 2022 to July 2024, 50 trauma patients aged over 13 years were enrolled. Exclusion criteria included outpatients, patients treated for less than 6 hours, and those with pre-existing chronic conditions. Data collection involved assessing each patient using the aforementioned severity scales upon admission. **Results:** The study cohort had a mean age of 35 years, with females comprising 83% of patients. Head and Necktrauma was most prevalent, followed by Abdomen. Moreover, deceased patients exhibited significantly lower GCS, and along with higher TRISS scores, which showed AUC for ROC analysis of 0.83. **Conclusion:** The findings underscore the utility of GCS and TRISS in predicting mortality among trauma patients. Lower scores on physiological severity scales were associated with better survival outcomes, emphasising the importance of early and accurate assessment using these tools in trauma care. Further research should explore their applicability across diverse trauma.scenarios to enhance clinical decision-making and improve patient outcomes.

Keywords: Trauma, injury severity scales, mortality prediction, TRISS, GCS.

INTRODUCTION

Trauma is a major cause of death globally and one of the worst problems facing the healthcare system(1). It is the primary cause of mortality and disability in underdeveloped nations.

It is the fourth most common cause of death worldwide. According to assessments conducted in 2022, 4,61,312 road accidents have been reported by States and Union Territories (UTs), which claimed 1,68,491 lives and caused injuries to 4,43,366 persons.

The highest RTA cases were reported in Tamil Nadu, and Our state lies in 5th place. First of all, Either directly or indirectly, trauma imposes significant financial and social costs on society. Traumatic deaths account for a large percentage of all deaths in a society.

The most important single harm contributing to mortality and morbidity is trauma, which is also one of the main causes of both 50% of people pass away at the scene of the accident, 25% do so within the first four to six hours after trauma,25% may pass later.

At the most basic level, the primary goal of a trauma system is to get the right patient to the right place at the right time. Outcomes in trauma are highly dependent on the geography of injury, and regions that respond best have developed an organised approach to providing all the key elements to maximise meaningful recovery, called a trauma system. The ideal trauma system includes the entire care continuum, beginning with prevention and encompassing prehospital care, acute hospital services, postinjury rehabilitation, and research [(2)]The primary determinant of injury severity is the kind of scoring system being used, or injury severity grading, which is thought to be a crucial prerequisite for clinical testing and trauma treatment[2]. Put another way, having an appropriate tool or index for the assessment of traumatic patients is crucial for the proper therapy of these patients.Efficient and accurate assessment of injury severity is crucial for guiding

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clinical management and predicting patient outcomes. Various injury severity scales have been developed and utilised in clinical practice and research settings to aid in this assessment. However, the choice of scale can significantly impact prognostic accuracy, leading to variation in predictive capabilities across different scales.

The solution was the development of a trauma system that includes all hospitals to address the needs of injured patients, regardless of designation. Inclusive trauma systems identify roles for facilities as a continuum, from critical access hospitals to the large Level I and Level II trauma centres. Guided by triage protocols, injured patients are transported to facilities that are appropriate to the severity of the injuries[2]. Although this may require the transfer of patients from smaller hospitals to trauma centres, most can receive proper treatment within the local network. Lists the standard components of an inclusive trauma system that must be coordinated to maximise the effectiveness of care[2]. The benefits of this approach include a reduction in the wastefulness of medical resources and allowance of appropriate care within the community.There are several injury severity assessments available, but it's still unclear which one accurately predicts death in trauma patients. This lack of understanding makes it more difficult to establish standardised procedures for the assessment and treatment of injuries, which could jeopardise patient outcomes and care. Furthermore, a thorough assessment of the relative efficacy of various severity scales is required due to the diversity of trauma injuries and patient demographics. [(3)]

MATERIALS AND METHODS

Study Period: August 2022 – June 2024

Study Design: Prospective cohort study

- The study was conducted in the Department Of General Surgery, Bijapur Lingayat District Education (Deemed to be University) Shri B.M. Patil Medical College, Hospital and Research Centre, Vijayapura, Karnataka, India, which included Trauma patients who are over 13 years old and admitted more than 6 hours. Patients who were under treatment for less than 6 hours and previous history of the disease (cardiovascular, pulmonary, renal or cerebral)

Statistical Analysis

Descriptive indicators were expressed as means (± standard deviation) or percentages using the obtained data. Univariate analysis and Chi-square test were used to discover the individual relationships between each variable and mortality rate. Logistic regression with a backward method determined the independent variables predicting mortality. Finally, the area under the receiver operating characteristic (ROC) curve was used to assess the efficiency of the injury severity scale and to detect the sensitivity and specificity to predict the status of discharge “Death or Alive”. The results and data that were produced were analysed using SPSS Statistics software (Version 20). Also, $p<0.05$ was considered as a significance level in all tests.

Study Design

This study was a Prospective Cohort Study.

Data collection

A total of 50 trauma patients who came to casualty at Bijapur Lingayat District Education (Deemed to be University) Shri B. M. Patil Medical College, Hospital and Research Centre were screened for eligibility to participate in the study. The study included 50 trauma patients who fulfilled the inclusion criteria. All the participants provided written informed consent before they participated in the study. Patients were assigned to all trauma scores and calculated.

RESULTS

A total of 50 patients were assessed according to Trauma scores for the period of (August 2022 – June 2024) were considered.

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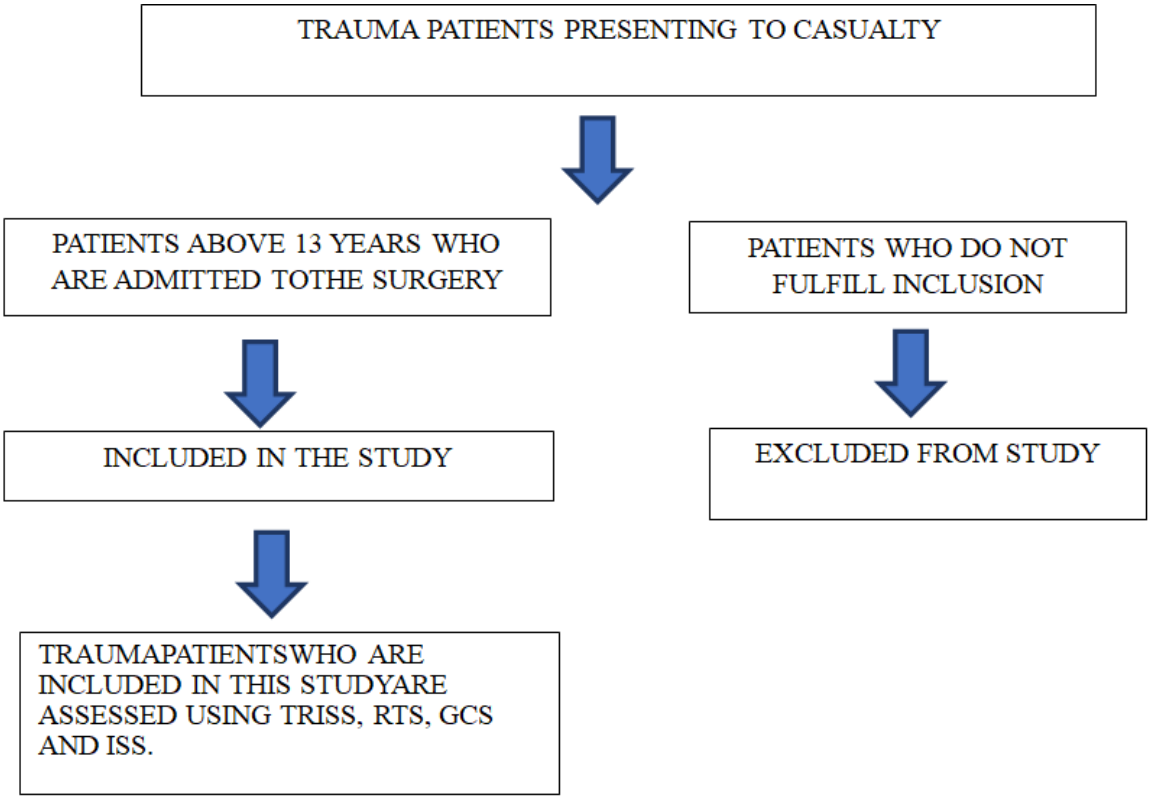

FIGURE 1: Flow Diagram

RESULTS

Table 1: Characteristics of study participants

Characteristic	D, N = 11	R, N = 39	p-value
Age	35 (28, 47)	26 (23, 38)	<0.001
Gender			
F	2 (18%)	7 (82%)	
M	9 (23%)	32 (77%)	
Mode of trauma			NA
RTA	11 (22%)	39 (78%)	
Body region			<0.001
Abdomen	6 (55%)	5 (45%)	
Abdomen and Chest	0 (0%)	1 (100%)	
Chest	1 (100%)	0 (0%)	
Extremities	0 (0%)	4 (100%)	
Face	0 (0%)	6 (100%)	
Head and neck	4 (18%)	18 (82%)	
Head, neck, and Extremities	0 (0%)	1 (100%)	
Thorax	0 (0%)	4 (100%)	
Diastolic BP			
Median (IQR)	60 (60, 70)	70 (70, 80)	
GCS score	8.00 (7.00, 10.00)	14.00 (11.00, 15.00)	<0.001
TRISS Score	48 (26, 72)	99 (96, 99)	<0.001

The data provided in Table 1 summarizes the background characteristics of study participants, divided into two groups, D (N=11) and R (N=39).

Summary of Characteristics

1. Age:
- Group D: Median age is 35 years (IQR 28–47).
- Group R: Median age is 26 years (IQR 23–38).
- p-value: <0.001, indicating a statistically significant difference in age between groups.

2. Gender:
- Female (F):
- Group D: 2 females (18%)
- Group R: 7 females (82%)
- Male (M):
- Group D: 9 males (23%)

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- Group R: 32 males (77%)

3. Mode of Trauma (specifically Road Traffic Accident, RTA):
- Group D: 11 (22%)
- Group R: 39 (78%)

4. Body Region Involved:
- Abdomen: Group D - 6 (55%), Group R - 5 (45%)
- Abdomen and Chest: Group D - 0 (0%), Group R - 1 (100%)
- Chest: Group D - 1 (100%), Group R - 0 (0%)
- Extremities: Group D - 0 (0%), Group R - 4 (100%)
- Face: Group D - 0 (0%), Group R - 6 (100%)
- Head and Neck: Group D - 4 (18%), Group R - 18 (82%)
- Head, Neck, and Extremities: Group D - 0 (0%), Group R - 1 (100%)
- Thorax: Group D - 0 (0%), Group R - 4 (100%)
- p-value: <0.001, indicating significant differences in the distribution of body regions affected.

5. GCS (Glasgow Coma Scale) Score:
- Group D: Median score is 8 (IQR 7–10)
- Group R: Median score is 14 (IQR 11–15)
- p-value: <0.001, indicating a significant difference in GCS scores.

6. TRISS (Trauma and Injury Severity Score):
- Group D: Median score is 48 (IQR 26–72)
- Group R: Median score is 99 (IQR 96–99)
- p-value: <0.001, indicating a significant difference in TRISS scores.
- Interpretation

Statistically significant differences between groups are noted in age, body region affected, GCS, and TRISS scores. This suggests potentially different demographic and injury severity profiles between the two groups.

Table 2: Outcomes Based on Scores

Outcome	GCS Score < 8 (N=4)	GCS Score > 8 (N=46)	TRISS Score < 90 (N=10)	TRISS Score > 90 (N=40)
Deaths (D)	4 (40%)	7 (60%)	8 (84%)	2 (16%)
Recoveries (R)	0 (0%)	39 (100%)	1 (2%)	39 (98%)
p-value	<0.001	<0.001	<0.001	<0.001

This table presents the outcomes (deaths and recoveries) based on GCS and TRISS scores among study participants, with statistical significance indicated by p-values.

Summary of Characteristics

1. GCS Score:
- GCS Score < 8:
- Deaths (D): 4 out of 4 (40%)
- Recoveries (R): 0 out of 4 (0%)
- GCS Score > 8:
- Deaths (D): 7 out of 46 (60%)
- Recoveries (R): 39 out of 46 (100%)
- p-value: <0.001, indicating a statistically significant difference in outcomes based on GCS scores.

2. TRISS Score:
- TRISS Score < 90:
- Deaths (D): 8 out of 10 (84%)
- Recoveries (R): 1 out of 10 (2%)
- TRISS Score > 90:
- Deaths (D): 2 out of 40 (16%)
- Recoveries (R): 39 out of 40 (98%)
- p-value: <0.001, showing a statistically significant difference in outcomes based on TRISS scores.
- Interpretation

These results indicate that lower GCS and TRISS scores are strongly associated with higher mortality rates. Conversely, higher scores (GCS > 8 and TRISS > 90) correlate with better recovery rates, underscoring the predictive value of these scores for patient outcomes in trauma cases.

Table 3: Diagnostic accuracy of the scores

Score Category	Sensitivity	Specificity	PPV	NPV
GCS score cat	97%	67%	50%	98%
TRISS categorization	99%	67%	93.70%	99%

The table presents performance metrics for two score categorization models, GCS and TRISS, based on sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV).

Summary of Characteristics

1. GCS Score Categorization:
- Sensitivity: 97% — High sensitivity, indicating that the GCS score categorization is very effective at identifying true positives.
- Specificity: 67% — Moderate specificity,there's a moderate rate of correctly identifying true negatives.
- Positive Predictive Value (PPV): 50% — Indicates that when the GCS score predicts a positive outcome.
- Negative Predictive Value (NPV): 98% — High NPV, showing that when GCS predicts a negative outcome.

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2. TRISS Score Categorization:
- Sensitivity: 99% — Extremely high sensitivity, making TRISS highly reliable for identifying true positives.
- Specificity: 67% — Same specificity as GCS, with moderate ability to identify true negatives.
- PPV: 93.7% — High PPV, indicating that TRISS is accurate in its positive predictions .
- NPV: 99% — Very high NPV, so TRISS almost always correctly predicts true negatives.

Interpretation
- Both GCS and TRISS categorizations have high sensitivity and NPV, making them strong tools for identifying true positives and negatives, respectively.
- TRISS categorization outperforms GCS in PPV (93.7% vs. 50%), meaning it's much better at predicting true positive outcomes.

Overall, TRISS categorization appears to be the more reliable model, particularly for positive predictions, due to its high PPV and slightly higher sensitivity.

DISCUSSION

In the field of trauma care, accurately predicting patient outcomes is paramount for optimising treatment strategies and allocating resources effectively. Several injury severity scales have been developed to assess and classify the severity of trauma and predict mortality risk with precision. Among these scales, the Trauma and Injury Severity Score (TRISS), and Glasgow Coma Scale (GCS), are widely employed in both clinical practice and research.

TRISS integrates anatomical and physiological parameters to estimate survival probabilities following trauma, incorporating variables such as patient age, GCS score, ISS, and vital signs like systolic blood pressure and respiratory rate. Validated across diverse trauma populations, TRISS facilitates outcome comparisons across different trauma centres.

GCS evaluates consciousness levels post-traumatic brain injury through assessments of eye-opening, verbal response, and motor response, assigning scores that range from 3 (deep coma) to 15 (fully alert). This scale is pivotal in predicting neurological outcomes and guiding decisions on interventions like intubation and neurosurgical procedures.

Together, these severity scales serve as indispensable tools in trauma care, assisting clinicians in triage, treatment planning, and predicting patient outcomes. Understanding their strengths and limitations is crucial for enhancing trauma patient management and improving survival rates. Ongoing research endeavours aim to further refine these scales and explore their applicability in diverse trauma settings to optimise patient care outcomes.

In the present study, a total of 50 patients were included, with a mean age of 35 years. Among them, 82% were female patients. Among the traumas inthe body region, Head and Neck followed byabdomen .

In a study by Srinidhi K et al.[40], the majority of trauma patients in the study exhibited blunt injuries (71.0%) rather than penetrating injuries (29.0%). External regions were the most common sites of major trauma (40.3%), followed by extremities (31.0%).

In another study by Javali R et al.[1], the average age of patients was 66.35 years, with road traffic accidents being the most frequent cause of injury (94.0%), resulting in a mortality rate of 17.0%.

In line with a study by Indurkar SK et al[15], documented with Receiver Operating Characteristic (ROC) curve analysis indicated comparable sensitivity between TRISS (94.7%) and RTS, while ISS exhibited lower sensitivity (36.8%) in predicting patient outcomes. Both RTS (79.2%) and TRISS (76.6%) scores demonstrated higher specificity than ISS (5.2%) for outcome analysis. In conclusion, the TRISS score proves valuable in managing trauma patients, offering satisfactory predictive capabilities for mortality. Trauma scores play a crucial role in determining the nature of injury, particularly in medicolegal cases.

From the above data, TRISS shows 94.4% accuracy in predicting mortality; the findings in a study by Srinidhi K et al[14], suggest that among trauma patients, the TRISS system proves to be a more accurate predictor of prognosis compared to other scoring systems evaluated in the study.

In a study done by Mahnaz Yadollahi et al[2], patients with GCS<8 had a higher odd ratio of mortality in comparison with the patients with GCS>8. This result is consistent with the results of our study, indicating that GCS<8 are the most significant mortality risk factors for trauma patients. Regarding the prediction of mortality in ROC curve analysis, the best cut-off point for the GCS in our study was97% sensitivity and 67% specificity.

In the study done by Kyoungwon Jung et al[16], when an AUC value from ROC analysis is 0.9 or higher, the method is considered highly accurate, suggesting that it is a very accurate method for predicting the mortality rate, and it was statistically better compared to the ISS and RTS. It has been consistently reported that the TRISS has superior results for predicting the mortality rate of trauma patients in developed countries compared to other scoring systems. In our study, the AUC for ROC analysis for TRISS was 0.83. Thus, the TRISS may play a very important role in predicting mortality in a developing country such as India where the trauma patient population is different from that of a developed country and no trauma system has yet been established.

CONCLUSION

The results of our study are based on the data from our institution and suggest that the TRISS is the best prediction model for trauma outcomes in the current Indian population in North Karnataka. TRISS has

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maximum prediction in outcome when compared with the other scores in our study with AUC of 0.83.

The severity of trauma seemed to have a direct correlation with ICU admission and mortality. Since RTAs are the most common cause of injury among admitted patients, prevention programs and safety strategies focusing on the use of helmets, seatbelts, and driving under a speed limit should be incorporated.

Furthermore, research including a large sample size is needed in the current situation for our population, where trauma is still the leading cause of death.

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