International Journal of Surgery and Surgical Research
www.surgeryjournals.net
Online ISSN: 2664-9179, Print ISSN: 2664-9160
Received: 15-08-2025, Accepted: 14-09-2025, Published: 29-09-2025
Volume 7, Issue 2, 2025, Page No. 12-15

To analyze the diagnostic ability of RTS in predicting trauma-related outcomes

Dr. Irshan Mohammad[1*], Dr. Heena Sharma[2], Dr. Nitin Verma[3]
[1] Department of Health and Family Welfare, CHC Jawali, Himachal Pradesh, India
[2] Department of Health and Family Welfare, CHC Nalagarh, Himachal Pradesh, India
[3] Department of Health and Family Welfare, RH Una, Himachal Pradesh, India

Abstract
Background: Trauma is a major cause of morbidity and mortality worldwide, especially in low- and middle-income countries like India. The Revised Trauma Score (RTS) is a widely used physiological scoring system designed to predict trauma outcomes and aid in patient triage. This study aimed to evaluate the diagnostic accuracy of RTS in predicting clinical outcomes among trauma patients in a tertiary care hospital in North India.
Methods: A prospective study was conducted on 50 trauma patients aged 16 years and above admitted to the Department of General Surgery at Dr. Rajendra Prasad Government Medical College, Kangra. Data on demographics, trauma mechanism, Glasgow Coma Scale (GCS), systolic blood pressure, respiratory rate, and outcomes were collected. RTS was calculated at admission, and its predictive performance was assessed using the Area Under the Receiver Operating Characteristic Curve (AUC).
Results: The study population predominantly consisted of young adult males (76%) with road traffic accidents (64%) as the most common trauma mechanism. Blunt trauma accounted for 84% of cases. Most patients (94%) had high GCS scores at admission. The RTS demonstrated limited discriminatory ability for predicting outcomes, with an AUC of 0.589 (95% CI: 0.282–0.872, p=0.565), indicating poor predictive performance in this cohort.
Conclusion: In this setting, the Revised Trauma Score showed limited accuracy in predicting trauma outcomes, possibly due to the predominance of mild injuries and preserved neurological status in patients. Reliance on RTS alone may be insufficient for outcome prediction, and alternative or complementary scoring systems should be considered to improve trauma patient management in similar healthcare contexts.

Keywords: Trauma, Revised Trauma Score (RTS), Trauma outcomes, Diagnostic accuracy, Triage

Introduction

Trauma is a significant global health concern, accounting for substantial morbidity, mortality, and long-term disability. According to the World Health Organization (WHO), trauma results in more than 5 million deaths annually, which is nearly 9% of all deaths worldwide. It is the leading cause of death among individuals aged 5 to 44 years [1]. The burden of trauma is particularly high in low- and middle-income countries (LMICs), including India, where the rapid pace of urbanization, increasing motor vehicle use, and occupational hazards have led to a rise in trauma-related cases [2]. In India, road traffic accidents (RTAs) alone account for approximately 11% of all deaths, and the rate continues to rise.

Timely identification of the severity of trauma is essential for triaging patients, prioritizing interventions, optimizing resource utilization, and predicting patient outcomes. In resource-constrained settings, where access to advanced diagnostic tools may be limited, clinical scoring systems play a vital role in decision-making [3]. Several scoring systems have been developed over the years to assess trauma severity and predict outcomes, including the Injury Severity Score (ISS), Trauma and Injury Severity Score (TRISS), and the Revised Trauma Score (RTS).

The Revised Trauma Score (RTS) is a physiological scoring system introduced by Champion *et al*. in 1989 [4], which is simple to apply and effective in prehospital and emergency department settings [4]. It comprises three parameters: the Glasgow Coma Scale (GCS), systolic blood pressure (SBP), and respiratory rate (RR), each weighted and combined to yield a score ranging from 0 to 7.8408. A lower RTS indicates more severe physiological derangement and has been associated with increased risk of mortality [5].

Numerous studies have validated RTS as a predictor of trauma outcomes, particularly mortality, intensive care unit (ICU) admission, and hospital length of stay. For instance, studies by Akinpelu *et al*. and Tohira *et al*. found that RTS had moderate to good predictive accuracy for in-hospital mortality, especially in blunt trauma patients [6, 7]. However, there is variability in its predictive power across populations and trauma mechanisms, with some studies suggesting limited accuracy in penetrating injuries or mixed-trauma cohorts [8]. Furthermore, few studies have comprehensively assessed the utility of RTS in Indian settings, where the trauma profile, prehospital care, and healthcare infrastructure differ significantly from Western contexts.

Given the need for rapid, cost-effective, and reliable prognostic tools in Indian emergency departments, this study was undertaken to evaluate the diagnostic ability of the RTS in predicting trauma-related outcomes, including mortality, ICU admission, and length of hospital stay. By analyzing the correlation between RTS values at admission and final clinical outcomes, this research aims to provide insights into the utility of RTS in triaging and managing trauma patients in a tertiary care hospital in North India.

Materials and Methods

This hospital-based, prospective, comparative study was conducted in the Department of General Surgery at Dr. Rajendra Prasad Government Medical College (Dr. RPGMC), Kangra at Tanda, Himachal Pradesh, over a period of one year starting from July 2021. The study aimed to assess the diagnostic ability of the Revised Trauma Score (RTS) in predicting trauma-related outcomes among patients presenting with various forms of trauma.

Study Population

Patients aged 16 years or older who presented with either blunt or penetrating trauma and required hospital admission for a minimum of 24 hours were included in the study. Exclusion criteria comprised patients who were discharged or transferred from the emergency department to other healthcare institutions, patients presenting exclusively with thermal injuries, and those who or whose legal guardians declined to give informed consent.

Clinical Assessment and Scoring

Eligible patients presenting to the casualty, outpatient department (OPD), or referred from other departments were enrolled after stabilization and informed consent. A detailed history regarding the mechanism and type of trauma was recorded. On presentation, clinical parameters including pulse rate, systolic blood pressure (SBP), respiratory rate (RR), oxygen saturation (SpO_2), and Glasgow Coma Scale (GCS) were assessed. Based on these parameters, both the Revised Trauma Score (RTS) and the New Trauma Score (NTS) were calculated for each patient.

The RTS was calculated using the formula:

RTS = (0.9368 × GCS coded value) + (0.7326 × SBP coded value) + (0.2908 × RR coded value)

The coded values were assigned based on standard RTS criteria for each parameter. Similarly, the NTS was calculated as:

NTS = (0.4006 × GCS) + (0.2983 × SBP_NTS coded value) + (0.8709 × SpO_2_NTS coded value)

Both scores were used to categorize trauma severity and assess their correlation with patient outcomes.

Investigations and Management

Once the patients were stabilized and trauma scores recorded, they underwent necessary investigations including complete blood count (CBC), renal function tests (RFT), liver function tests (LFT), serum electrolytes, serum lipase, arterial blood gas analysis (ABG), and prothrombin time with international normalized ratio (PT-INR). Radiological investigations included chest X-ray, cervical spine X-ray, Focused Assessment with Sonography in Trauma (FAST), and non-contrast CT (NCCT) head, as indicated clinically. Following evaluation, patients were managed either conservatively or surgically, depending on the nature and extent of injuries, in accordance with the standard trauma care protocols of the institution.

Data Collection and Analysis

All relevant data were recorded on a pre-designed case record form and subsequently entered into Microsoft® Excel for analysis. Descriptive and inferential statistics were applied to evaluate the diagnostic ability of RTS and NTS in predicting clinical outcomes such as mortality, ICU admission, and length of hospital stay.

Ethical Considerations

The study was conducted after obtaining approval from the Institutional Ethics Committee and Protocol Review Board (Registration No. ECR/490/Inst/HP/2013). Informed consent was obtained from all participants or their legal guardians after providing adequate information in a language they could understand. Confidentiality of patient information was strictly maintained, and participants were informed of their right to withdraw from the study at any point without affecting their medical care or legal rights. The study adhered to the ethical standards of the Declaration of Helsinki (1975) and its amendments (2008).

Results

Baseline characteristics

Table 1 outlines the baseline characteristics of the study population consisting of 50 individuals. The participants' ages ranged widely, with the most common age group being 20–29 years, accounting for 34% (n=17) of the sample. This was followed by those over 59 years (24%), 30–39 years (18%), 40–49 years (14%), and 50–59 years (10%). The mean age of the participants was 41.54 years, with a standard deviation of 18.14 years, indicating considerable variability in age distribution. In terms of gender, the majority of the participants were male (76%, n=38), while females comprised 24% (n=12) of the study population. These baseline characteristics suggest a predominantly male and relatively young adult population with a wide age distribution.

Table 1: Baseline characteristics

Baseline characteristics	Frequency (n=50)	Percentage (%)
Age group		
20-29 years	17	34%
30-39 years	9	18%
40-49 years	7	14%
50-59 years	5	10%
>59 years	12	24%
Mean age	41.54+18.14 years	
Gender		
Male	38	76%
Female	12	24%

Mode and type of trauma

Table 2 presents the mode and type of trauma among the 50 participants in the study. The most common mode of trauma was road traffic accidents, accounting for 64% (n=32) of cases. This was followed by falls from height (20%), physical assaults (10%), and other causes such as work-related injuries (6%). Regarding the type of trauma, the majority of cases involved blunt trauma, representing 84% (n=42) of the participants, while penetrating trauma was observed in 16% (n=8). These findings highlight that road traffic accidents and blunt trauma were the predominant causes and types of injury in this cohort.

Table 2: Mode and Type of Trauma

Mode and Type of Trauma	Frequency (n=50)	Percentage (%)
Mode of trauma		
Road Traffic Accident	32	64%
Fall from Height	10	20%
Physical Assault	5	10%
Others (e.g., work injury	3	6%
Type of Trauma		
Blunt Trauma	42	84%
Penetrating Trauma	8	16%

Distribution of Outcomes according to GCS Score of Revised Trauma score

Table 3 shows the distribution of patient outcomes based on the Glasgow Coma Scale (GCS) component of the Revised Trauma Score. The vast majority of patients, 94% (n=47), had a score of four, indicating a relatively high level of consciousness. In contrast, scores of one, two, and three were each recorded in only one patient (2% each), representing a small minority of the cohort. This distribution suggests that most patients in the study presented with relatively preserved neurological function, as reflected by the high GCS scores.

Table 3: Distribution of Outcomes according to GCS Score of Revised Trauma score

Revised trauma score	Frequency (n=50)	Percentage (%)
One	1	2%
Two	1	2%
Three	1	2%
Four	47	94%

Comparison of Area Under curve of revised Trauma score

Table 4 presents the comparison of the Area Under the Curve (AUC) for the Revised Trauma Score, which yielded an AUC of 0.589. This indicates a poor ability of the score to discriminate between outcomes, as an AUC value close to 0.5 suggests performance similar to random chance. The standard error associated with the AUC is 0.150, reflecting a high level of uncertainty around the estimate. Furthermore, the asymptotic significance (p-value) is 0.565, which is well above the conventional threshold of 0.05, indicating that the AUC is not statistically significantly different from 0.5. The 95% confidence interval ranges from 0.282 to 0.872, a wide interval that also includes 0.5, reinforcing the lack of statistical significance and precision in the score's predictive ability. Overall, these findings suggest that the Revised Trauma Score demonstrates limited and unreliable discriminative performance in this context.

Table 4: Comparison of Area Under curve of revised Trauma score

	Revised Trauma score
AUC	0.589
Std. Errora	0.150
Asymptotic Sig.	0.565
95% CI (lower bond-upper bound)	0.282-0.872

Discussion

This study aimed to assess the utility of the Revised Trauma Score (RTS) in predicting outcomes among trauma patients. The findings revealed that the majority of the study population were young adults, predominantly male, and that road traffic accidents and blunt trauma were the leading causes and types of injury. These demographic and etiological patterns are consistent with previous studies conducted in similar settings, where young males are more frequently exposed to high-risk activities such as driving and occupational hazards [9, 10].

In terms of neurological status, most patients presented with relatively high Glasgow Coma Scale (GCS) scores, indicating preserved consciousness. This may reflect the nature of injuries being largely blunt and possibly non-life-threatening in many cases. However, the key finding of the study was the poor performance of the RTS in predicting clinical outcomes, as demonstrated by an Area Under the Curve (AUC) of 0.589. This value indicates only a marginal discriminatory ability, and the wide confidence interval (0.282–0.872) along with a non-significant p-value (0.565) underscores the lack of reliability and precision of RTS in this specific cohort.

When compared with existing literature, the performance of the RTS in this study appears weaker. For example, Champion *et al*., in their foundational study on the RTS, reported much higher AUC values (above 0.90) in predicting trauma outcomes, particularly in more critically injured populations.[4] Similarly, studies by Husum *et al*. and Bergeron *et al*. demonstrated that RTS had good predictive validity when used in combination with other scoring systems or in settings with a higher incidence of severe trauma [11, 12]. The comparatively poor performance of the RTS in the present study may be attributed to the relatively mild injury profiles of the patients, as reflected by the high proportion with GCS scores of 4 and the predominance of blunt trauma. This could have limited the variability in RTS scores and reduced its sensitivity in distinguishing between different outcome groups.

Moreover, the RTS was originally designed for pre-hospital or emergency department triage, particularly in systems with rapid trauma team response and well-established trauma care protocols. Its performance may not be as robust in settings where definitive care is delayed or when patients present with less severe injuries. Alternative or complementary scoring systems such as the Injury Severity Score (ISS) or Trauma and Injury Severity Score (TRISS) may provide better prognostic accuracy in such contexts, as supported by several comparative studies [13].

Overall, while the RTS remains a simple and widely used tool in trauma assessment, its effectiveness in predicting outcomes in this particular setting appears limited. These findings highlight the need for context-specific validation of trauma scoring systems and suggest that reliance on RTS alone may not be adequate in all clinical environments.

Conclusion

In this study, the Revised Trauma Score demonstrated limited ability to accurately predict patient outcomes, as evidenced by its poor discriminatory performance and lack of statistical significance. The majority of patients sustained blunt trauma primarily due to road traffic accidents, and most presented with relatively preserved neurological function. Given the RTS's limited predictive value in this setting, reliance on it alone for trauma outcome assessment may be insufficient. Future research should explore alternative or complementary scoring systems better suited to the specific injury profiles and healthcare context to improve prognostication and patient management.

References

1. Injuries and violence. Accessed, 2025. https://www.who.int/news-room/fact-sheets/detail/injuries-and-violence
2. Hyder AA, Peden M. Inequality and road-traffic injuries: call for action. Lancet,2003:362(9401):2034-2035. doi:10.1016/S0140-6736(03)15145-8
3. Tien HCN, Jung V, Pinto R, Mainprize T, Scales DC, Rizoli SB. *et al*. Reducing time-to-treatment decreases mortality of trauma patients with acute subdural

hematoma. Ann Surg,2011:253(6):1178-1183. doi:10.1097/SLA.0b013e318217e339
4. Champion HR, Sacco WJ, Copes WS, Gann DS, Gennarelli TA, Flanagan ME. A revision of the Trauma Score. J Trauma,1989:29(5):623-629. doi:10.1097/00005373-198905000-00017
5. Kuhls DA, Malone DL, McCarter RJ, Napolitano LM. Predictors of mortality in adult trauma patients: the physiologic trauma score is equivalent to the Trauma and Injury Severity Score. J Am Coll Surg,2002:194(6):695-704. doi:10.1016/s1072-7515(02)01211-5
6. Kondo Y, Abe T, Kohshi K, Tokuda Y, Cook EF, Kukita I. *et al*. Revised trauma scoring system to predict in-hospital mortality in the emergency department, Glasgow Coma Scale, Age, and Systolic Blood Pressure score. Crit Care,2011:15(4):191. doi:10.1186/cc10348
7. Akinpelu OV, Oladele AO, Amusa YB, Ogundipe OK, Adeolu AA, Komolafe EO. *et al*. Review of road traffic accident admissions in a Nigerian tertiary hospital. East and Central African Journal of Surgery,2007:12(1):63-67.
8. Lavoie A, Moore L, LeSage N, Liberman M, Sampalis JS. The New Injury Severity Score. a more accurate predictor of in-hospital mortality than the Injury Severity Score. J Trauma,2004:56(6):1312-1320. doi:10.1097/01. ta.0000075342.36072.ef
9. Kobusingye O, Guwatudde D, Lett R. Injury patterns in rural and urban Uganda. Inj Prev,2001:7(1):46-50. doi:10.1136/ip.7.1.46
10. Mock C, Quansah R, Krishnan R, Arreola-Risa C, Rivara F. Strengthening the prevention and care of injuries worldwide. Lancet,2004:363(9427):2172-2179. doi:10.1016/S0140-6736(04)16510-0
11. Lavoie A, Emond M, Moore L, Camden S, Liberman M. Evaluation of the Prehospital Index, presence of high-velocity impact and judgment of emergency medical technicians as criteria for trauma triage. *CJEM*,2010:12(2):111-118. doi:10.1017/s1481803500012136
12. Husum H, Gilbert M, Wisborg T, Van Heng Y, Murad M. Rural prehospital trauma systems improve trauma outcome in low-income countries. a prospective study from North Iraq and Cambodia. J Trauma,2003:54(6):1188-1196. doi:10.1097/01.TA.0000073609.12530.19
13. Javali RH, Krishnamoorthy, Patil A, Srinivasarangan M, Suraj, Sriharsha, *et al*. Comparison of Injury Severity Score, New Injury Severity Score, Revised Trauma Score and Trauma and Injury Severity Score for Mortality Prediction in Elderly Trauma Patients. Indian J Crit Care Med,2019:23(2):73-77. doi:10.5005/jp-journals-10071-23120.