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Comparison of Trauma Scoring Systems for Mortality Prediction in Adult Blunt Trauma Patients: A Prospective Observational Study

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Abstract: ***Background**: Trauma severity scores are used to estimate mortality risk, but performance varies across settings. We compared trauma scoring systems and evaluated the Glasgow Coma Scale as a predictor of mortality. **Methods**: This prospective study included 113 adults with blunt trauma admitted to a tertiary centre. Injury Severity Score, New Injury Severity Score, Revised Trauma Score, Trauma and Injury Severity Score, and Glasgow Coma Scale were assessed. Discrimination was evaluated using area under the receiver operating characteristic curve. Pairwise comparisons used DeLong testing. Calibration was assessed using the calibration intercept, calibration slope, and Brier score, while clinical utility was evaluated using decision curve analysis. **Results**: Thirty-nine patients died. All measures demonstrated discrimination. The Revised Trauma Score had the highest area under the curve (0.948), followed by the Glasgow Coma Scale (0.945), Injury Severity Score and New Injury Severity Score (0.934 each), and Trauma and Injury Severity Score (0.913). However, pairwise comparisons showed no differences between the trauma scoring systems. The Revised Trauma Score showed favourable calibration. **Conclusion**: All scores provided mortality discrimination. The advantage of the Revised Trauma Score was not statistically definitive, supporting multicentre validation studies.***

Keywords: Trauma, Mortality, Injury Severity Score, Trauma Severity Indices

1. Introduction

Trauma remains a major global cause of death and disability, accounting for approximately 4.4 million deaths each year and placing a considerable burden on younger populations [1]. Polytrauma is associated with substantial mortality, particularly in patients with severe injuries and physiological deterioration [2, 3]. Identifying patients at high risk of death early in the course of care is therefore essential for timely triage, treatment prioritization, and appropriate use of healthcare resources [4].

Trauma severity scores help clinicians quantify the extent of injury and physiological compromise and provide standardized measures for prognostication, triage, and assessment of trauma outcomes [4]. The Injury Severity Score (ISS) is a widely used anatomical scoring system derived from the Abbreviated Injury Scale and summarizes the severity of injuries across different body regions [5]. However, because it considers only the most severe injury in each body region, the overall burden of multiple serious injuries within the same region may be underestimated. The New Injury Severity Score (NISS) was developed to overcome this limitation by considering the three most severe injuries regardless of their anatomical location. NISS has shown better mortality discrimination than ISS in some trauma populations, although its performance is not consistently superior across all settings [6]. The Revised Trauma Score (RTS), in contrast, focuses on physiological status using the Glasgow Coma Scale, systolic blood pressure, and respiratory rate [7]. The Trauma and Injury Severity Score (TRISS) combines anatomical injury severity, physiological status, and age with injury mechanism to estimate the probability of survival [8].

Despite their widespread use, studies comparing these scoring systems have reported differences in mortality prediction across trauma populations and clinical settings [9, 10]. This variation highlights the importance of evaluating their performance within individual healthcare settings. The Glasgow Coma Scale (GCS) is an important component of physiological trauma assessment and the Revised Trauma Score (RTS), and has also been evaluated as an individual predictor of mortality in trauma patients [7, 11]. Therefore, this study aimed to compare the ability of ISS, NISS, RTS, and TRISS to predict mortality among trauma patients admitted to a tertiary-care center and to additionally assess the predictive performance of GCS as an individual physiological measure.

2. Methods

Study design and setting
This was a prospective observational study comparing the predictive performance of various trauma severity scoring systems for mortality among trauma patients. The study was

conducted in the Department of General Surgery, BRD Medical College, Gorakhpur, Uttar Pradesh, from February 2025 to January 2026.

Study population

Patients aged ≥18 years with traumatic injuries who were treated at the study center during the study period were included in the study. Patients with burn injuries, isolated minor injuries not requiring hospitalization, incomplete clinical data required for calculation of the trauma severity scores, and those who were brought dead to the hospital were excluded.

Sample size

The sample size was determined using the single-proportion formula, with an expected proportion of 0.08, a 95% confidence level, and an absolute precision of 0.05. A sample size of 113 patients was calculated, and 113 patients were included in the study.

Data Collection

A structured data collection form was used to record demographic characteristics, mechanism of injury, presenting complaints, vital signs, Glasgow Coma Scale (GCS), clinical findings, relevant radiological findings, and clinical outcome. At presentation, the GCS was assessed [11]. Patients were managed according to institutional trauma-care practices and Advanced Trauma Life Support principles [12].

Trauma Severity Scoring

Four trauma severity scores were calculated for each patient: the Injury Severity Score (ISS), New Injury Severity Score (NISS), Revised Trauma Score (RTS), and Trauma and Injury Severity Score (TRISS). The Glasgow Coma Scale (GCS) was additionally assessed as an individual physiological predictor of mortality. The total GCS score ranged from 3 to 15 and was determined using its eye, verbal, and motor components [11]. The Abbreviated Injury Scale (AIS) was used to identify the most severe injury in each of the six body regions. AIS severity scores were assigned using the AIS 2015 version and the AIS Digital Dictionary. The three body regions with the highest AIS scores were selected, and the squares of these scores were summed to calculate the ISS [5]. The NISS was calculated using the AIS by selecting the three most severe AIS-rated injuries, irrespective of their anatomical location, and summing the squares of their scores [6]. The RTS was calculated using the Glasgow Coma Scale, systolic blood pressure, and respiratory rate, according to the established RTS methodology [7]. The TRISS was calculated using anatomical injury severity, physiological status, age, and mechanism of injury to estimate the probability of survival [8]. All trauma severity scores (ISS, NISS, RTS, and TRISS) were calculated by the investigator. Microsoft Excel and a basic calculator were used to perform and verify the score calculations. No institutional trauma registry or dedicated trauma-scoring software was used.

Outcome measures

The primary outcome was in-hospital mortality, recorded as survival or death. The predictive ability of ISS, NISS, RTS, and TRISS for mortality was evaluated using receiver operating characteristic (ROC) curve analysis. GCS was additionally evaluated as an individual physiological predictor of mortality. The discriminatory performance of the scoring systems and GCS was assessed using sensitivity, specificity, and area under the ROC curve (AUC).

Statistical Analysis

IBM SPSS Statistics version 27.0 was used for statistical analysis. Continuous variables were presented as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. As appropriate, the independent-samples t test, chi-square test, Fisher's exact test, and one-way analysis of variance (ANOVA) were used. Multivariable logistic regression analysis was performed to identify factors independently associated with in-hospital mortality, and the results were reported as adjusted odds ratios (aORs) with 95% confidence intervals (CIs). ROC curves were generated, and AUC, sensitivity, specificity, and Youden index were calculated for GCS, ISS, NISS, RTS, and TRISS. DeLong's test for correlated ROC curves was used for pairwise comparison of the AUCs of ISS, NISS, RTS, and TRISS. Calibration was assessed using the calibration intercept, calibration slope, and Brier score. Calibration curves were generated to compare predicted and observed mortality across the evaluated risk range. Decision curve analysis was performed to evaluate the net clinical benefit of ISS, NISS, RTS, and TRISS across different threshold probabilities. Participants with missing data required for calculation of the primary trauma scores were excluded from the relevant analysis. No imputation was performed. A two-sided $p<0.05$ was considered statistically significant.

Ethical Considerations

The study was provisionally approved by the Institutional Human Ethical Committee of Baba Raghav Das Medical College, Gorakhpur (Uttar Pradesh), for the proposal titled "Comparison of Injury Severity Score, New Injury Severity Score, Revised Trauma Score and Trauma Injury Severity Score for Mortality Prediction in Trauma Patients in a Tertiary Care Centre." The approval number was 295/IHEC/2025, dated 20 December 2025. Eligible participants provided written informed consent, and the confidentiality of patient information was maintained throughout the study.

3. Results

Table 1 summarizes the characteristics of the 113 participants. Most were aged 21–40 years (38.94%) and male (87.61%). Road traffic accidents were the predominant mechanism of injury (73.45%), and all patients had blunt trauma. ICU admission was required in 35.40% of patients, while 21.24% underwent surgery. Overall, 74 patients (64.60%) survived and 39 (35.40%) died.

Table 1: Demographic and Clinical Characteristics of the Study Participants (N = 113)

Characteristic	Category	Frequency	Percentage (%)
Age group (years)	≤20	22	19.47
	21–40	44	38.9
	41–60	32	28.32
	>60	15	13.27
Gender	Male	99	87.61
	Female	14	12.39
Mechanism	Road traffic accident	83	73.45

of injury	Fall	20	17.70
	Assault	6	5.31
	Mechanical injury	3	2.65
	Unknown cause	1	0.88
Type of trauma	Blunt	113	100.00
	Penetrating	0	0.00
Limb injury	No limb injury	90	79.65
	Upper limb	13	11.50
	Lower limb	6	5.31
	Both upper and lower limb	4	3.54
Polytrauma	Yes	0	0.00
	No	113	100.00
ICU admission	Yes	40	35.40
	No	73	64.60
Surgical intervention	No surgery	89	78.76
	Surgery performed	24	21.24
Outcome	Survived	74	65.49
	Death	39	34.51

Table 2 shows the association between clinical characteristics and patient outcome. Chest injury was significantly more frequent among patients who died than among survivors (23.08% vs. 6.76%, p=0.030). ICU admission was strongly associated with mortality, with 97.44% of patients who died requiring ICU admission compared with 2.70% of survivors (p<0.001). Surgical intervention was also more frequent among patients who died (41.03% vs. 10.81%, p<0.001). Complications were reported in 25.64% of patients who died compared with 8.11% of survivors (p=0.006). No significant association was observed between outcome and head, abdominal, or pelvic injury.

Table 2: Association of Clinical Characteristics with Patient Outcome

Clinical variable	Category	Survived (n=74) n (%)	Death (n=39) n (%)	Total n (%)	Test	p-value
Head injury	Yes	73 (98.65)	37 (94.87)	110 (97.35)	$\chi^2 = 0.31$	0.576
	No	1 (1.35)	2 (5.13)	3 (2.65)		
Chest injury	Yes	5 (6.76)	9 (23.08)	14 (12.39)	$\chi^2 = 4.73$	0.030
	No	69 (93.24)	30 (76.92)	99 (87.61)		
Abdominal injury	Yes	5 (6.76)	2 (5.13)	7 (6.19)	Fisher's exact	1.000
	No	69 (93.24)	37 (94.87)	106 (93.81)		
Pelvic injury	Yes	0 (0.00)	1 (2.56)	1 (0.88)	Fisher's exact	0.749
	No	74 (100.00)	38 (97.44)	112 (99.12)		
ICU admission	Yes	2 (2.70)	38 (97.44)	40 (35.40)	$\chi^2 = 95.20$	<0.001
	No	72 (97.30)	1 (2.56)	73 (64.60)		
Surgical intervention	Yes	8 (10.81)	16 (41.03)	24 (21.24)	—	<0.001
	No	66 (89.19)	23 (58.97)	89 (78.76)		
Complications	Present	6 (8.11)	10 (25.64)	16 (14.16)	—	0.006
	Absent	68 (91.89)	29 (74.36)	97 (85.84)		

Table 3 compares demographic characteristics, physiological parameters, trauma severity scores, and hospital stay between survivors and non-survivors. Non-survivors were older than survivors (48.59 ± 20.76 vs. 31.80 ± 16.24 years, p<0.001). All GCS components and the total GCS score were significantly lower among non-survivors (all p<0.001). Non-survivors had higher respiratory rates and lower diastolic blood pressure and SpO_2 than survivors (p=0.034, p<0.001, and p<0.001, respectively). ISS and NISS were significantly higher among non-survivors than survivors (26.67 ± 8.18 vs. 9.47 ± 7.11 and 27.21 ± 8.94 vs. 9.47 ± 7.11, respectively; both p<0.001). RTS was significantly lower among non-survivors (5.03 ± 1.05 vs. 7.26 ± 0.68, p<0.001), while TRISS was also lower (61.52 ± 21.15 vs. 95.53 ± 11.50, p<0.001). ICU stay was longer among non-survivors (p=0.009), whereas total hospital stay did not differ significantly between the groups (p=0.095)

Table 3: Comparison of Demographic, Clinical, Trauma Severity Scores and Hospital Stay Between Survivors and Non-survivors (N = 113)

Category	Variable	Survived (n=74) Mean ± SD	Death (n=39) Mean ± SD	t-value	p-value
Demographic characteristics	Age (years)	31.80 ± 16.24	48.59 ± 20.76	-4.737	<0.001
	Weight (kg)	66.36 ± 15.66	65.54 ± 16.67	0.259	0.796
	Height (cm)	163.42 ± 15.52	160.33 ± 17.16	0.969	0.335
	BMI	24.26 ± 4.08	24.56 ± 4.71	-0.355	0.724
Glasgow Coma Scale	GCS Eye (E)	3.49 ± 0.73	1.46 ± 0.82	13.458	<0.001
	GCS Verbal (V)	4.22 ± 1.02	1.67 ± 0.99	11.598	<0.001
	GCS Motor (M)	5.38 ± 0.77	3.03 ± 1.20	12.630	<0.001
	Total GCS score	13.07 ± 2.47	5.77 ± 2.86	14.137	<0.001
Vital parameters	Heart rate (bpm)	89.05 ± 16.23	84.05 ± 29.31	1.169	0.245
	Systolic BP (mmHg)	115.86 ± 18.85	107.03 ± 32.46	1.832	0.070
	Diastolic BP (mmHg)	71.30 ± 11.35	65.33 ± 18.06	2.151	0.034
	Respiratory rate (/min)	18.59 ± 3.48	25.69 ± 4.01	-9.764	<0.001
	SpO_2 (%)	96.72 ± 2.93	90.28 ± 5.23	8.396	<0.001
	Temperature (°F)	100.43 ± 1.40	99.26 ± 1.66	3.955	<0.001
Trauma severity scores	ISS	9.47 ± 7.11	26.67 ± 8.18	-11.599	<0.001
	NISS	9.47 ± 7.11	27.21 ± 8.94	-11.511	<0.001

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	RTS	7.26± 0.68	5.03 ± 1.05	11.992	<0.001
	TRISS	95.53 ± 11.50	61.52 ± 21.15	11.094	<0.001
Hospital stay	ICU stay (days)	0.00 ± 0.00	0.82 ± 2.66	-2.660	0.009
	Hospital stay (days)	4.32 ± 3.65	3.18 ± 2.99	1.682	0.095

Table 4 presents the multivariable logistic regression analysis of predictors of mortality. Age was independently associated with mortality (adjusted OR [aOR] 1.008, 95% CI: 1.005–1.011; p<0.001). Lower GCS Eye score and systolic blood pressure were associated with higher odds of mortality (aOR 0.820, 95% CI: 0.684–0.984; p=0.034 and aOR 0.990, 95% CI: 0.986–0.994; p<0.001, respectively). Diastolic blood pressure, respiratory rate, SpO_2, and ICU stay were also significantly associated with mortality, while hospital stay showed an inverse association (all p≤0.037) (Table 4). The corresponding adjusted odds ratios and 95% confidence intervals are presented in Figure 1.

Table 4: Multivariable Logistic Regression Analysis of Predictors of Mortality

Variable	B	Std. Error	Adjusted OR	95% CI for OR	p-value
Age (years)	0.008	0.002	1.008	1.005–1.011	<0.001
GCS Eye (E)	−0.198	0.091	0.820	0.684–0.984	0.034
Systolic BP (mmHg)	−0.010	0.002	0.990	0.986–0.994	<0.001
Diastolic BP (mmHg)	0.012	0.003	1.012	1.005–1.018	0.001
Respiratory rate (/min)	0.022	0.009	1.022	1.005–1.040	0.013
SpO_2 (%)	0.022	0.010	1.022	1.001–1.044	0.037
ICU stay (days)	0.067	0.022	1.069	1.023–1.119	0.003
Hospital stay (days)	−0.034	0.008	0.967	0.952–0.981	<0.001

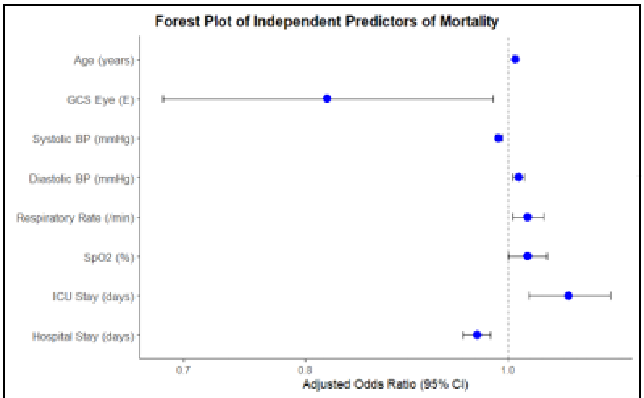

Figure 1: Forest plot of adjusted odds ratios for independent predictors of mortality.

Table 5 presents the diagnostic performance of GCS, ISS, NISS, RTS, and TRISS for mortality prediction. All five measures demonstrated statistically significant discriminatory ability (p<0.001). RTS had the highest AUC (0.948; 95% CI: 0.896–0.999), followed by GCS (0.945; 95% CI: 0.895–0.994), ISS and NISS (0.934 each), and TRISS (0.913; 95% CI: 0.838–0.987). RTS had the highest specificity (94.9%) and Youden index (0.868), while TRISS had the highest sensitivity (93.2%). The corresponding ROC curves are shown in Figure 2 (Table 5; Figure 2).

Table 5: Diagnostic Performance of GCS, ISS, NISS, RTS and TRISS for Prediction of Mortality

Parameter	GCS	ISS	NISS	RTS	TRISS
AUC	0.945	0.934	0.934	0.948	0.913
95% CI	0.895–0.994	0.891–0.977	0.892–0.977	0.896–0.999	0.838–0.987
p-value	<0.001	<0.001	<0.001	<0.001	<0.001
Optimal cutoff	≤9.5	≥16.5	≥16.5	≤6.5	≤80.5
Sensitivity (%)	91.9	92.3	92.3	89.2	93.2
Specificity (%)	89.7	81.1	81.1	94.9	82.1
Youden Index	0.818	0.760	0.760	0.868	0.814

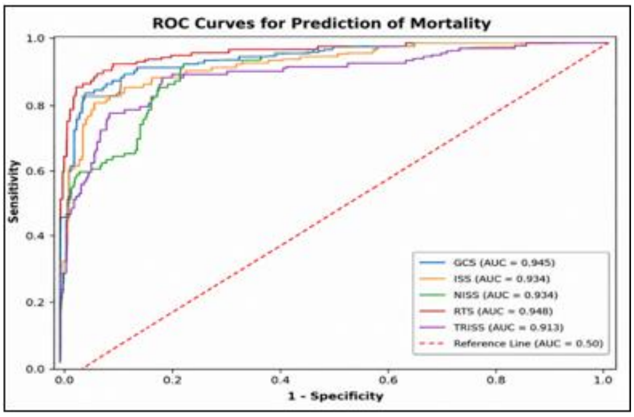

Figure 2: ROC curves for GCS, ISS, NISS, RTS and TRISS for prediction of mortality.

Table 6 presents the pairwise comparison of AUCs using DeLong's test. None of the comparisons between ISS, NISS, RTS, and TRISS showed a statistically significant difference in AUC, with all p-values >0.05. The p-values ranged from 0.391 for ISS versus NISS to 0.725 for NISS versus RTS (Table 6).

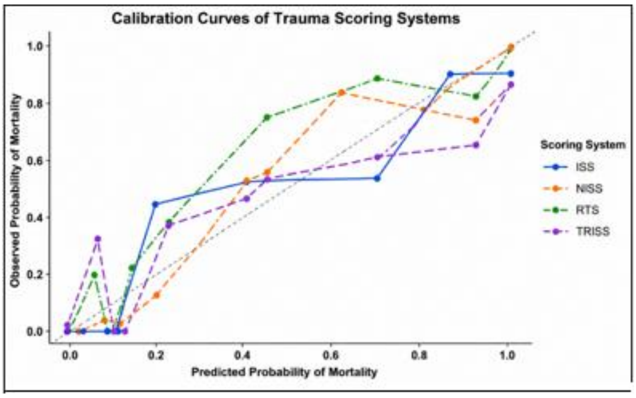

Figure 3: Decision Curve Analysis of ISS, NISS, RTS and TRISS for Prediction of In-Hospital Mortality.

Table 6: Pairwise Comparison of the Area Under the ROC Curves of the Trauma Scoring Systems Using DeLong's Test

Pairwise comparison	DeLong test p-value
ISS vs NISS	0.391
ISS vs RTS	0.711
ISS vs TRISS	0.554
NISS vs RTS	0.725
NISS vs TRISS	0.541
RTS vs TRISS	0.450

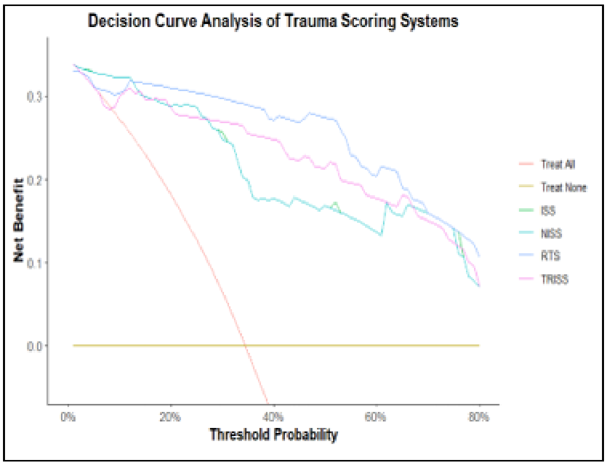

Figure 4: Calibration curves of ISS, NISS, RTS and TRISS for prediction of in-hospital mortality.

Table 7 presents the calibration and reliability measures of the four trauma scoring systems for in-hospital mortality. RTS had the highest calibration slope (0.902) and the lowest Brier score (0.073), followed by TRISS (0.867; 0.101), ISS (0.871; 0.110), and NISS (0.870; 0.110), respectively. The calibration intercepts were −0.046 for RTS, −0.051 for ISS and NISS, and −0.098 for TRISS. The corresponding calibration curves are presented in **Figure 4**.

Table 7: Calibration and Reliability of ISS, NISS, RTS and TRISS for Prediction of In-Hospital Mortality

Scoring system	Calibration intercept	Calibration slope	Brier score
ISS	−0.051	0.871	0.110
NISS	−0.051	0.870	0.110
RTS	−0.046	0.902	0.073
TRISS	−0.098	0.867	0.101

4. Discussion

In this prospective study, the mortality-prediction performance of ISS, NISS, RTS, and TRISS was compared in 113 adult patients with blunt trauma, with GCS additionally assessed as an individual physiological predictor. All five measures demonstrated significant discriminatory ability ($p<0.001$). RTS had the highest numerical AUC (0.948), followed by GCS (0.945), ISS and NISS (0.934 each), and TRISS (0.913). However, pairwise comparisons among ISS, NISS, RTS, and TRISS showed no statistically significant differences ($p>0.05$), indicating that the observed differences in AUC were not statistically conclusive. RTS also demonstrated the highest net benefit across most threshold probabilities, suggesting potentially greater clinical utility in this cohort.

The overall discriminatory performance was broadly comparable with previous validation studies, although the ranking of the scores varied across populations. Yadollahi et al., in 1,410 trauma patients, reported TRISS as the strongest predictor, with an AUC of 0.93, followed by RTS with an AUC of 0.85 [9]. Valderrama-Molina et al., in 4,085 trauma patients, reported the highest discrimination for RTS (AUC 0.92), although calibration was poor across the evaluated scores [13]. In contrast, Kaya et al. reported that TRISS and GCS had the highest predictive performance, with an AUC of 0.98 for both, whereas RTS showed lower predictive performance in their traffic-related trauma cohort [10]. Such variation may be related to differences in injury mechanism, case mix, trauma severity, and clinical setting. The relatively high mortality rate in the present cohort (34.5%) and the small sample size may also have influenced the observed discrimination and limited the statistical power to detect differences between AUCs.

RTS had the highest numerical AUC, highest specificity, highest Youden index, most favourable calibration profile, and greatest net benefit on decision curve analysis. Its components- GCS, systolic blood pressure, and respiratory rate- reflect important aspects of acute physiological derangement at presentation [7]. In the present study, these parameters differed between survivors and non-survivors, while GCS Eye score, systolic and diastolic blood pressure, respiratory rate, and SpO_2 were independently associated with mortality. Valderrama-Molina et al. also reported the highest AUC for RTS [13], whereas Abhinandan et al. found the highest specificity for RTS, although TRISS had the highest AUC and sensitivity in their cohort [14]. These differences support the context-dependent performance of physiological and combined trauma scores across different patient populations and clinical settings.

GCS alone also showed strong discrimination, with an AUC of 0.945, numerically exceeding ISS, NISS, and TRISS and approaching the performance of RTS. Similarly high performance has been reported previously, with Khari et al. reporting an AUC of 0.98 for GCS among ICU-admitted trauma patients and Kaya et al. reporting an AUC of 0.98 among patients with traffic-related trauma [15,10]. In the present cohort, the marked difference in GCS between survivors and non-survivors and the independent association of GCS Eye score with mortality further support the role of GCS as an early physiological predictor. The close relationship between GCS and RTS is also expected because GCS is one of the three components of RTS.

ISS and NISS showed identical AUCs (0.934), sensitivity (92.3%), and specificity (81.1%) in the present cohort, with no apparent discriminatory advantage of one score over the other. Li and Ma similarly reported comparable mortality-prediction performance for ISS and NISS among 1,825 blunt trauma patients (AUC 0.886 vs. 0.887; $p=0.91$), although NISS performed better among patients with ISS ≥25 [16]. Garcia et al. also reported comparable discrimination between ISS and NISS in patients with thoracic trauma (AUC 0.837 vs. 0.855) [17]. NISS was developed to address the limitation of ISS in patients with multiple severe injuries occurring within the same body region [6]. Its additional benefit may therefore be more evident in patients with more extensive or severe injury patterns. The absence of polytrauma in the present cohort may partly explain the comparable performance of ISS and NISS, while greater benefit of NISS has been reported in more severely injured patients [16].

TRISS had the lowest numerical AUC among the four principal scoring systems (0.913), although this difference was not statistically significant in pairwise DeLong comparisons. TRISS incorporates anatomical injury severity, physiological status, age, and injury mechanism [8], and its performance may vary across trauma populations. Javali et al. reported TRISS as the strongest predictor among elderly trauma patients, with an AUC of 0.972 [18], while Yadollahi et al. also reported the highest AUC for TRISS (0.93) in their general trauma population [9]. In the present study, the cohort was predominantly younger, all injuries were blunt, and no patient met the study definition of polytrauma. Differences in age, injury mechanism, and case mix may therefore have contributed to the relatively lower performance of TRISS in this setting. This finding should not be interpreted as evidence that TRISS is generally inferior, but rather as a possible indication of population-dependent performance.

Discrimination reflects the ability of a scoring system to distinguish between survivors and non-survivors, whereas calibration reflects the agreement between predicted and observed mortality and provides complementary information about prediction-model performance [19]. In the present study, RTS showed the most favourable calibration profile, with a calibration slope of 0.902 and the lowest Brier score (0.073), compared with ISS, NISS, and TRISS. As no formal statistical comparison of calibration was performed, these differences should be interpreted descriptively. Decision curve analysis additionally showed the greatest net benefit for RTS across most of the evaluated threshold probabilities, suggesting potentially greater clinical utility in this cohort. However, these findings are specific to the present dataset and require external validation before being translated into broader clinical recommendations. Discrimination, calibration, and decision-curve analysis provide complementary perspectives when evaluating prediction models.

Overall, these findings support the value of physiological assessment at presentation for early mortality risk stratification in blunt trauma. The independent associations of GCS Eye score, blood pressure, respiratory rate, and SpO_2 with mortality further reinforce the prognostic importance of the initial physiological state. ICU stay and total hospital stay were also associated with mortality; however, these are post-admission variables that reflect subsequent clinical course and should not be interpreted as baseline predictors for prospective risk assessment. Therefore, although these findings may help inform trauma triage and early risk stratification, they do not justify replacing established trauma-management protocols with a single scoring system on the basis of a single-centre study.

Several methodological features strengthen the study, including its prospective design, systematic calculation of all four major trauma scores, and comprehensive assessment of discrimination, pairwise AUC comparisons, calibration, and clinical utility. However, the single-centre design, relatively small sample of 113 patients, exclusive inclusion of blunt trauma, absence of polytrauma, and predominantly male population limit statistical power and generalisability to populations with penetrating trauma, polytrauma, paediatric or elderly patients, and different case mixes. The relatively high in-hospital mortality (34.5%) may further limit external applicability. Exclusion of patients with incomplete scoring data may have introduced selection bias, while the absence of external validation limits assessment of transportability. The logistic regression model was not internally validated, and inclusion of post-admission variables such as ICU and hospital stay limits its interpretation as a prospective prediction model. Finally, differences in calibration were descriptive because no formal statistical comparison was performed.

5. Conclusion

In this prospective cohort of adult blunt trauma patients, ISS, NISS, RTS, and TRISS demonstrated significant discrimination for in-hospital mortality. RTS showed the highest numerical AUC and most favourable calibration and decision-curve performance; however, pairwise DeLong comparisons did not demonstrate statistically significant differences between the scoring systems. GCS, evaluated as an additional standalone physiological predictor, also demonstrated high discriminatory ability. These findings support the utility of established trauma scoring systems for mortality risk stratification in this setting, while highlighting the need for larger multicentre studies and external validation before determining whether any individual scoring system offers a clinically meaningful advantage over the others.

Declarations

Competing interests: The authors declare that they have no competing interests.

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