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Evaluating trauma burden and predictive value of reverse shock index Glasgow Coma scale (rSIG) in need for early transfusion and mortality: The largest prospective study from India

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ABSTRACT

Objective: Trauma remains a leading cause of death and disability worldwide, with hemorrhage and traumatic brain injury being major contributors. The reverse shock index (SI) multiplied by Glasgow Coma scale (rSIG) is a novel scoring tool with potential for early identification of high-risk trauma patients. This study, the largest and first of its kind in India, aimed to assess the predictive value of rSIG for in-hospital mortality and early transfusion requirements in trauma patients.

Material and Methods: This was a prospective, hospital-based study conducted at Government Medical College, Kozhikode, Kerala, from December 2022 to December 2023. A total of 536 trauma patients admitted under the department of general surgery were enrolled. Data on demographics, mechanism of injury, vital signs, GCS score, transfusion requirements, and outcomes were collected. rSIG, SI, and revised trauma score (RTS) were calculated. Receiver operating characteristic analysis was used to assess predictive performance.

Results: A total of 536 trauma patients were analyzed (mean age 44.49±15.81 years; 80% males), with road traffic accidents (RTAs) accounting for 68% of cases. RTAs were significantly linked to head and multisystem injuries and contributed to 94% of deaths. Overall mortality was 11.9% (64 patients), exclusively among those with head injury. RTS showed marginally better mortality prediction than rSIG [area under the curve (AUC) 96% vs. 92%; $p<0.001$], while rSIG best predicted early transfusion need (AUC 91.8%; $p<0.01$).

Conclusion: This study demonstrates that RTAs are the predominant cause of trauma, with head injury as the principal determinant of mortality. While rSIG effectively predicted early transfusion requirements, RTS showed slightly higher accuracy than rSIG in predicting mortality. rSIG remains a practical and reliable triage tool in resource-limited settings.

Keywords: Reverse shock index multiplied by Glasgow Coma scale (rSIG), revised trauma score (RTS), trauma, road traffic accidents, early blood transfusion

INTRODUCTION

Trauma is the sixth leading cause of death worldwide and stands as the primary cause of death in individuals under 45 years of age. It significantly contributes to both mortality and morbidity, primarily due to conditions such as hemorrhagic shock and traumatic brain injuries (1,2). Trauma patients with elevated injury severity scores (ISS) and increased transfusion requirements are at a heightened risk of in-hospital mortality within the first 24 hours. Therefore, early recognition of trauma patients at high-risk of death is essential to facilitate prompt resuscitation and appropriate medical management (1-3).

Hemorrhage is responsible for approximately 40% of deaths within the first 24 hours following trauma and represents the most preventable cause of death in severely injured individuals (3). The implementation of Massive Transfusion Protocols has proven effective in managing severe bleeding; however, the timely identification of patients with massive hemorrhage remains critical (4).

The shock index (SI), defined as the ratio of heart rate (HR) to systolic blood pressure (SBP), was first introduced by Allgower and Burri (5) in 1967 to identify trauma patients experiencing hypovolemic shock. A SI value of ≥1 has been associated with uncompensated shock and increased mortality risk (5).

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Clinicians often perceive hemodynamic instability as a situation where SBP is lower than HR, rather than the reverse. Reflecting this clinical observation, researchers in Taiwan introduced the reverse (or inverse) shock index (rSI), calculated as SBP divided by HR. They found that an rSI <1 was predictive of poor outcomes, offering a potential tool for identifying high-risk trauma patients—even in the absence of hypotension (6,7).

The Glasgow Coma scale (GCS), a standardized tool for evaluating consciousness, has shown a strong correlation with mortality in patients suffering from traumatic brain injury (TBI) (8). Building on this, a Japanese study group developed the rSIG (rSI multiplied by GCS), a novel scoring system based on a multicenter retrospective study. By combining rSI and GCS, the rSIG has demonstrated comparable performance to existing methods that rely solely on age and vital signs for predicting in-hospital mortality (9).

Despite these promising findings, the utility of rSIG in predicting early transfusion requirements and mortality risk among adult patients with severe trauma remains underexplored. Hence, this study aims to evaluate the predictive value of rSIG in assessing both in-hospital mortality and the need for early transfusions in adult trauma patients.

MATERIAL and METHODS

Study Setting: Government Medical College, Kozhikode, Kerala, India.

Study Design: This was a hospital-based prospective study carried out in the department of general surgery using a convenience sampling technique.

Study Subjects: Patients presenting to the casualty with a history of trauma and admitted to the department of general surgery between December 2022 and December 2023. Each patient was followed until discharge or death.

Inclusion Criteria: Include trauma patients admitted during the study period and willingness to participate.

Exclusion Criteria: Missing data for HR, SBP, age, GCS, or hospital mortality, unrealistic vitals (SBP <50 or HR <30), unwillingness to participate or follow up.

Sample Size: Based on the study by Wan-Ting et al. (10), assuming a mortality proportion of 24%, sensitivity of 80%, and a precision of 15%, the minimum calculated sample size was 119. However, this study analyzed data from a total of 536 patients.

Data Collection and Analysis: Following approval from the Institutional Ethics Committee, data were prospectively collected from 536 trauma patients admitted to the Department of General Surgery, Government Medical College, Kozhikode, between December 2022 and December 2023. After obtaining informed consent, details regarding patient demographics, mechanism of injury, vital signs at presentation (HR, SBP, respiratory rate), GCS score, comorbidities, requirement for blood transfusion within 24 hours, and clinical outcomes were recorded using a structured proforma.

Statistical Analysis

The SI, rSI, and rSI multiplied by GCS (rSIG) were calculated for all patients. Data entry was performed using Microsoft Excel and statistical analysis was conducted using IBM SPSS Statistics version 26.0.

Continuous variables such as age, vital signs, hemoglobin, platelet count, ICU stay duration, and ventilator support days were summarized using mean ± standard deviation (SD) and ranges. Categorical variables including sex, mode of trauma, helmet usage, injury patterns, transfusion requirement, and mortality were expressed as frequencies and percentages.

Comparisons between groups (e.g., survivors vs. non-survivors) were made using the independent samples t-test for continuous variables and chi-square test or Fisher's exact test for categorical variables. Receiver operating characteristic (ROC) curves were plotted for SI, rSI, rSIG, and revised trauma score (RTS) to assess their predictive performance for in-hospital mortality and early transfusion needs. The area under the ROC curve (AUC), optimal cut-off values (based on the Youden index), sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated. Subgroup analyses were also performed for patients with isolated head injuries. A p-value of <0.05 was considered statistically significant.

Ethical Considerations: Approval was obtained from the Institutional Ethics Committee prior to the initiation of the study (IEC number: GMCKKD/RP2023/IEC/10 approved by Government Medical College Kozhikode, India on 09/01/2023). Written informed consent was obtained from all participants. The research process did not interfere with the clinical management of patients.

RESULTS

A total of 536 trauma patients were enrolled in the study. The mean age of the cohort was 44.49±15.81 years, ranging from 14 to 85 years. Most patients (43%) belonged to the 41-60-year age group, followed by 33% aged 21-40 years, 16% above 60 years, and 8% below 20 years. Males comprised 80% of the study population with a mean age of 43.64±15.78 years, while females accounted for 20%, with a slightly higher mean age of 47.89±15.56 years. Road traffic accidents (RTAs) were the predominant mode of injury, reported in 364 patients (68%), followed by non-RTA trauma in 120 patients (22%) and assault in 52 cases (10%). The mean age of RTA victims was 43.42±15.27 years, while those involved in non-RTA trauma were older on average (50.67±15.53 years). Assault victims had a lower mean age of 37.77±15.96 years, with this difference being statistically significant (p<0.001). Among RTA patients, the male-to-female ratio was 288:76, highlighting the predominance of male involvement. Assault cases were predominantly male (48 males vs. 4 females), and non-RTA trauma also showed male predominance with a ratio of 92:28 (Table 1).

The mechanisms of injury were varied, with 54 cases of assault, 2 cases of animal attack, 22 falls from less than 2 meters, 96 falls from a height greater than 2 meters, 24 pedestrian versus car collisions, 4 pedestrian versus bus, 24 pedestrian versus bike, 8 pedestrian versus auto, 4 car versus truck, 24 car versus car, 12 car versus bus, 64 slip and fall from bikes, 4 bike versus pedestrian, 12 bike versus truck, 76 bike versus car, 48 bike versus bus, and 60 bike versus bike incidents.

Multiple systemic involvement was most commonly observed in RTA cases (132), followed by trauma (76) and assault (8), with a highly significant association (p<0.001). Head injuries were predominantly seen in RTA patients (292), compared to trauma (80) and assault (20), which was also statistically significant (p<0.001). Chest injuries were significantly associated with mode of injury, being highest in RTA (108) followed by trauma (72) and assault (20) (p<0.001). Abdominal injuries showed a significant distribution across groups, with RTA accounting for 52 cases and both trauma and assault contributing 16 cases each (p=0.007). Spine injuries were more frequently observed in trauma cases (40) compared to RTA (28) and assault (4), and this association was highly significant (p<0.001). Overall, the pattern of systemic involvement varied significantly with the mode of injury (Table 2).

The mean physiological parameters at admission included a pulse rate of 97.9 bpm, SBP of 118.54 mmHg, and a respiratory rate of 17.76 breaths per minute. The average hemoglobin level was 12.05 g/dL (range: 7.1-15.2), and the mean platelet count was 2.52±0.85 lakh/μL. ICU stay averaged 1.48 days overall, being highest in RTA patients (1.70 days), followed by non-RTA trauma (1.20 days), and lowest in assault cases (0.54 days). The longest ICU stay recorded was 17 days. A total of 140 patients required ventilator support, with the majority (124) belonging to the RTA group and 16 to the trauma group, showing a statistically significant difference (p<0.001). The mean duration of ventilator use was 1.11 days. However, no statistically significant association was noted between mode of injury and history of procedures performed (p=0.661) (Table 3).

A total of 172 patients required early blood transfusion. Among them, the majority were due to RTA (132; 77%), followed by trauma (32; 19%) and assault (8; 5%), and this distribution was statistically significant (p<0.014). Patients requiring transfusion were significantly older (46.88±13.88 years) compared to those

Table 1. Demographics of the study population

Category	Subcategory	Number (n)	Percentage (%)	Mean age ± SD (years)
Age	Overall	536		44.49±15.81 (range: 14-85)
	≤20 years	44	8%	
	21-40 years	176	33%	
	41-60 years	232	43%	
	>60 years	84	16%	
Gender	Male	428	80%	43.64±15.78
	Female	108	20%	47.89±15.56
Mode of injury	RTA	364 (M: F=288:76)	68%	43.42±15.27
	Non-RTA trauma	120 (M: F=92:28)	22%	50.67±15.53
	Assault	52 (M: F=48:4)	10%	37.77±15.96

RTA: Road traffic accident, SD: Standard deviation.

Table 2. Distribution between mode of injury and the affected regions

Systemic involvement (multiple responses present)	Mode of injury			
	Trauma (n=120)	**Assault (n=52)**	**RTA (n=364)**	**p-value**
Multiple system	76	8	132	<0.001
Head injury	80	20	292	<0.001
Chest injury	72	20	108	<0.001
Abdomen injury	16	16	52	0.007
Spine injury	40	4	28	<0.001

RTA: Road traffic accident.

who did not require transfusions (43.36±16.54 years, p=0.016). Male patients were more likely to require transfusions (128 cases, p=0.02). The number of transfused units per patient averaged 0.77±1.32, with a range from 0 to 4 units (Table 4).

There were 64 deaths recorded in the study population. Mortality was predominantly observed among RTA patients (60; 94%), compared to trauma (4; 6%), which showed a highly significant association with mode of injury (p<0.001). All deceased patients had sustained head injuries, and this association was statistically significant (p<0.001). The mean age of deceased patients was significantly higher (56.8±12.83 years) compared to survivors (42.82±15.44 years, p<0.01). Although mortality was higher among males (52; 81%) compared to females (12; 19%), this difference was not statistically significant (p=0.45). Similarly, the presence of a surgical procedure post-admission was not significantly associated with mortality, with 28 (44%) deaths occurring in patients who underwent surgery and 36 (56%) in those managed without surgery (p=0.32) (Table 4).

Table 3. Details on patient parameters and course in hospital stay

Parameter	Mean	Standard deviation	Range
Vital signs			
Pulse rate (beats/min)	97.9	16.96	65-134
Systolic BP (mmHg)	118.54	21.05	74-170
Diastolic BP (mmHg)	72.37	10.84	45-100
Respiratory rate (/min)	17.76	4.42	9-30
Laboratory parameters			
Haemoglobin (g/dL)	12.05	1.74	7.1-15.2
Platelet count (L/μL) (in lacs)	2.52	0.85	0.98-5.2
ICU stay & injury duration (days)			
Overall	1.48	2.84	0-17
RTA	1.70	2.91	0-15
Assault	0.54	0.64	0-2
Trauma	1.20	3.12	0-17
Ventilator use duration (days)			
Overall	0.90	2.53	0-17
RTA	1.11	2.49	0-14
Trauma	0.67	3.06	0-17
History of ventilator usage (n)		**p-value**	
RTA	124	<0.001	
Trauma	16		
History of procedure done (n)			
RTA	144	0.661	
Trauma	48		
Assault	24		

ICU: Intensive care unit, BP: Blood pressure, RTA: Road traffic accident.

ROC curve analysis was performed to determine the optimal cut-off values of RTS, rSI, and rSIG for predicting mortality and the need for early blood transfusion within 24 hours.

For mortality prediction, RTS demonstrated excellent discriminatory power. At a cut-off value of 7.37, RTS showed 100% sensitivity and 91.5% specificity in all patients, with a PPV of 61.5% and a NPV of 100%. The AUC was 97.2% (p<0.01), with a high Youden index of 0.915, indicating outstanding predictive accuracy (Figure 1). Similar results were observed in the head injury subgroup, with an AUC of 96% (Figure 2). The rSIG also showed good predictive ability for mortality at a cut-off of 14.45, with sensitivity of 87.5%, specificity of 75.4%, and an AUC of 93.6% in all patients (p<0.01). In head injury patients, the AUC was 92%, indicating strong performance. The rSI, at a cut-off of 0.99, showed comparatively lower predictive accuracy, with an AUC of 82.6% in all patients and 80.9% in the head injury subgroup, although the association remained statistically significant (p<0.01). Overall, the RTS demonstrated the highest accuracy in predicting mortality among the three scoring systems, with rSIG showing comparable predictive performance (Table 5).

For predicting the need for early transfusion, rSIG demonstrated the highest overall predictive accuracy. At a cut-off of 15.73 in all patients, rSIG showed a sensitivity of 83.7%, specificity of 87.9%, PPV of 76.6%, NPV of 92%, and an AUC of 91.8% (p<0.01; Youden index 0.716) (Figure 3A). In the head injury subgroup, a similar cut-off (15.85) yielded an AUC of 93%, confirming its strong predictive performance (Figure 3B). The rSI also showed good

Table 4. Details on need for early transfusions and in-hospital mortality

Category		Number	Percentage (%)	p-value
Details on need for early transfusions				
Total patients receiving transfusions		172		
Mode of injury	RTA	132	77%	<0.014
	Trauma	32	19%	
	Assault	8	5%	
Gender	Male	128	74%	0.02
	Female	44	26%	
Details on mortality				
Total deaths		64		
Mode of injury	RTA	60	94%	<0.001
	Trauma	4	6%	
Gender	Male	52	81%	0.45
	Female	12	19%	
Surgical procedure (post-admission)	Present	28	44%	0.32
	Absent	36	56%	

RTA: Road traffic accident.

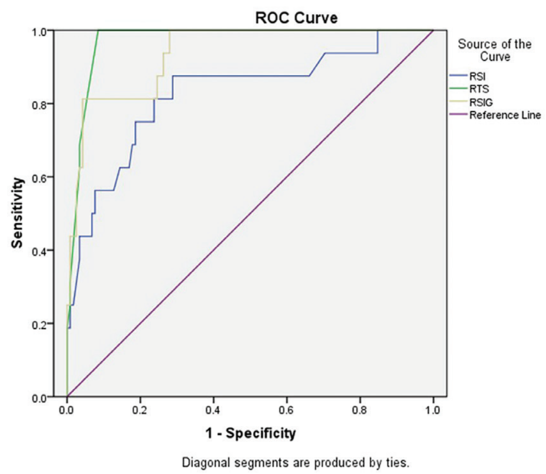

Figure 1. Area under the curve of rSIG, rSI and RTS in predicting the mortality of patients with all types of trauma.

rSIG: Reverse shock index Glasgow Coma scale, rSI: Reverse shock index, RTS: Revised trauma score, ROC: Receiver operating characteristic.

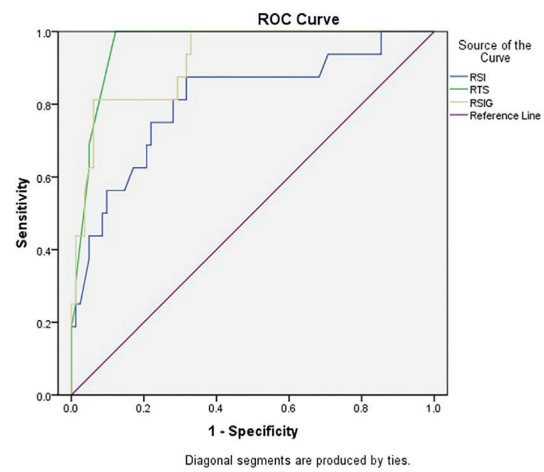

Figure 2. Area under the curve of rSIG, rSI and RTS in predicting the mortality of patients with head trauma.

rSIG: Reverse shock index Glasgow Coma scale, rSI: Reverse shock index, RTS: Revised trauma score.

Table 5. Details on various scoring systems and their respective cut-off, sensitivity, specificity, positive predictive value, negative predictive value, Youden index and area under the curve

Variable		Best cut-off	Sensitivity	Specificity	PPV	NPV	AUC (%)	p-value	Youden index
Cut-off to predict the mortality									
RTS	All patients	7.37	100	91.5	61.5	100	97.2%	<0.01	0.915
	Head injury	7.37	100	87.8	61.5	100	96%	<0.01	0.878
rSI	All patients	0.99	81.3	76.3	31.7	91.8	82.6%	<0.01	0.576
	Head injury	0.99	81.3	72	36.1	95.2	80.9%	<0.01	0.533
rSIG	All patients	14.45	87.5	75.4	32.6	97.8	93.6%	<0.01	0.629
	Head injury	14.45	87.5	70.7	36.8	96.7	92%	<0.01	0.582
Cut-off to predict the need for early transfusion									
RTS	All patients	7.37	52.5	96.7	88.5	81.5	75.4%	<0.01	0.492
	Head injury	7.37	63.9	95.2	88.5	81.9	80.1%	<0.01	0.591
rSI	All patients	1.19	83.7	86.8	75	91.9	87.5%	<0.01	0.705
	Head injury	1.23	88.9	80.6	72.7	92.6	88%	<0.01	0.695
rSIG	All patients	15.73	83.7	87.9	76.6	92	91.8%	<0.01	0.716
	Head injury	15.85	88.9	83.9	76.2	92.9	93%	<0.01	0.728

rSIG: Reverse shock index Glasgow Coma scale, rSI: Reverse shock index, RTS: Revised trauma score, AUC: Area under the curve, PPV: Positive predictive value, NPV: Negative predictive value.

predictive ability, with an AUC of 87.5% in all patients and 88% in head injury cases. In contrast, RTS demonstrated lower sensitivity (52.5%) despite high specificity (96.7%) for transfusion prediction, with an AUC of 75.4% (Table 5). rSI multiplied by GCS (rSIG) was found to be the most effective indicator for identifying the need for early blood transfusion. However, in assessing mortality risk, the RTS showed the highest accuracy, followed closely by rSIG.

DISCUSSION

This study provides a comprehensive evaluation of the demographic profile, injury patterns, and clinical outcomes among trauma patients. Comparable demographic trends were reported in a multicenter study by Kashid et al. (11), which analyzed 2,466 patients. Their mean age of 42.45±15.7 years was similar to our observed mean age of 44.49±15.81 years. A greater male predominance was noted in their study (91%) compared to ours (80%). Furthermore, RTAs constituted the leading cause of trauma in both cohorts, with 68% of cases in our study attributable to RTAs, demonstrating a consistent pattern (11).

These findings highlight the marked gender disparity in trauma incidence and reflect the increased susceptibility of individuals

Fig. 3A

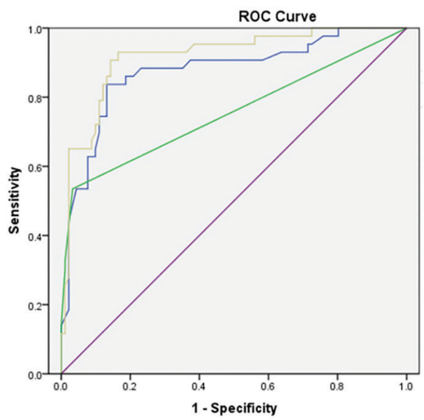

Fig. 3B

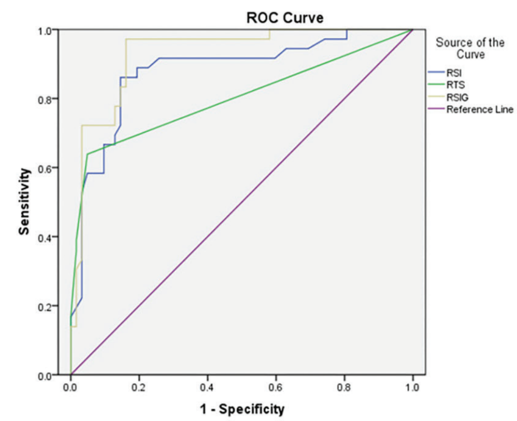

Figure 3. 3A) Area under the curve of rSIG, rSI and RTS in predicting the need for early transfusions in patients with all types of trauma; 3B) Area under the curve of rSIG, rSI and RTS in predicting the need for early transfusions in patients with head injury.

rSIG: Reverse shock index Glasgow Coma scale, rSI: Reverse shock index, RTS: Revised trauma score, ROC: Receiver operating characteristic.

in the economically productive age group, many of whom are engaged in occupations requiring frequent vehicular travel, to traumatic injuries (11). In our study, the mean age of patients involved in RTAs was 43.42±15.27 years, whereas patients sustaining non-RTA injuries were relatively older, with a mean age of 50.67±15.53 years. Victims of assault were significantly younger, with a mean age of 37.77±15.96 years ($p<0.001$). Similarly, Wui et al. (12) observed that falls were more prevalent among the elderly population, while RTAs predominated in younger individuals.

In our study, RTAs accounted for 68% of injuries and were significantly associated with multiple system involvement, head injuries, and chest trauma. All mortality cases in our cohort had sustained head injuries, underscoring TBI as the principal determinant of fatal outcomes. This finding aligns with prior studies demonstrating that severe TBI remains the leading cause of death in polytrauma patients (13). The strong association between head injury and mortality in our cohort likely explains the excellent predictive performance of scoring systems incorporating neurological parameters, particularly RTS and rSIG.

While most trauma patients had stable vital signs upon admission, many required intensive care. RTA victims had the longest ICU stays (mean 1.7 days), and 124 patients required ventilator support. These findings likely reflect the higher severity and complexity of injuries associated with high-speed collisions, particularly involving the head and multiple systems (14).

The demand for early transfusion was higher in RTA patients (77%), with older age and male sex being significant predictors. A large registry-based study involving 13,596 trauma patients at a Level I trauma center reported that males received significantly more packed red blood cell (PRBC) transfusions—consistent with our results. However, in contrast to our findings, they found that older patients received fewer transfusions (15). In our cohort, the higher transfusion rates in older patients may reflect reduced physiological reserve and a greater susceptibility to hemorrhagic shock. Differences in study design and population characteristics—such as an RTA-focused sample—may account for the variation.

Head injuries were observed in all deceased patients in our study, reaffirming their critical role in trauma-related mortality. Previous studies have also established head trauma as a major prognostic factor in both blunt and penetrating injuries (16).

rSIG was first introduced by Kimura and Tanaka (17), who reported an AUROC of 90.1% for in hospital mortality, closely comparable to our finding of 93.6%. Wu et al. (18) subsequently performed external validation of rSIG in a Taiwanese trauma center and documented an AUROC of 83%, which, although slightly lower than our results, still supports its good predictive accuracy.

We further compared the predictive performance of rSIG with other established trauma scoring systems. In our study, the RTS showed the highest accuracy for mortality prediction, with an AUC of 97.2%, marginally exceeding that of the rSI multiplied by the GCS (rSIG), which had an AUC of 93.6% (Figure 1). Among patients with isolated head injuries, RTS continued to demonstrate slightly superior predictive ability for mortality compared to rSIG (AUC 96% vs. 92%; $p<0.001$) (Figure 2), in line with its well recognized application in emergency care settings (19). In our analysis, rSIG demonstrated better performance than the conventional rSI, which showed an AUC of 82.6%.

Importantly, rSIG demonstrated superior performance in predicting transfusion requirements (AUC =91.8%), whereas RTS showed limited sensitivity (52.5%) for this outcome (Figure 3A, 3B). This finding indicates that rSIG may be more effective for the early identification of patients who require aggressive resuscitation, a feature that is particularly valuable in resource limited settings.

Although most previous studies have primarily examined the association between rSIG and mortality, relatively few have evaluated its utility in predicting transfusion needs. Lee et al. (20) reported an AUROC of 84.2% for rSIG in predicting transfusion, compared to 91.8% observed in our study. The improved predictive performance in our cohort may be explained by the integration of both hemodynamic and neurological parameters within rSIG. For example, TBI may be associated with substantial blood loss from scalp lacerations or oronasal trauma even in the absence of overt intracranial injury, while profound shock can itself lead to a reduction in GCS. By combining SI and GCS, rSIG offers a more comprehensive evaluation of trauma severity.

Although rSI alone demonstrated moderate predictive capability, it was clearly inferior to rSIG. The superior accuracy of rSIG was particularly evident among patients with head injuries (AUC =93%). Collectively, these findings reinforce the emerging role of rSIG as a reliable tool for early triage and informed decision making in trauma care.

In resource-limited emergency settings, rapid, accurate, and easily calculable scoring systems are essential for effective triage and appropriate resource allocation. Our results indicate that rSIG is a highly reliable and practical tool, particularly for predicting early transfusion requirement. While RTS demonstrates the strongest performance in mortality prediction, rSIG follows closely and shows comparable predictive ability. Considering its strong performance across both mortality prediction and early transfusion requirement, rSIG emerges as an effective overall scoring system in the trauma setting. Its simplicity, reliance on readily available parameters (SBP, pulse rate, and GCS), and strong predictive performance make it particularly attractive for use in high-volume trauma centers in developing countries. Incorporating rSIG into primary trauma assessment protocols may facilitate early identification of patients at risk of hemorrhagic shock and guide timely activation of transfusion protocols.

This study's strengths include its large prospective design, comprehensive data collection, and subgroup analysis in head injury patients.

Study Limitations

However, this study has certain limitations that must be recognized. Firstly, it was carried out at a single tertiary care center, which may restrict the generalizability of the results to other institutions with different patient demographics, trauma profiles, and resource availability. Secondly, mortality within the study cohort was largely attributable to head injuries, leading to a head injury–predominant mortality pattern. Long-term functional outcomes were not assessed, and anatomical scoring systems such as ISS or TRISS were not compared directly with rSIG. Therefore, larger multicenter studies involving more diverse trauma populations are necessary to externally validate these findings and to further assess the utility of rSIG across different injury patterns and healthcare environments.

CONCLUSION

This study represents the largest and first-of-its-kind investigation from India assessing the predictive utility of the rSIG in trauma patients for early transfusion requirements and mortality. The rSIG score demonstrated superior predictive accuracy for identifying patients requiring early blood transfusion and showed performance comparable to the RTS in predicting mortality. Integration of rSIG into routine trauma triage protocols may facilitate early risk stratification, optimize resource allocation, and support timely clinical decision-making, particularly in high-volume and resource-limited emergency settings.

Ethics

Ethics Committee Approval: Approval was obtained from the Institutional Ethics Committee prior to the initiation of the study (IEC number: GMCKKD/RP2023/IEC/10 approved by Government Medical College Kozhikode, India on 09/01/2023).

Informed Consent: Written informed consent was obtained from all participants. The research process did not interfere with the clinical management of patients.

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Footnotes

Author Contributions

Surgical and Medical Practices - Y.S., S.E.K., D.J., C.S.; Concept - Y.S.; Design - Y.S., C.S.; Data Collection or Processing - Y.S., S.E.K., A.D., D.J.; Analysis or Interpretation - Y.S., D.J., C.S.; Literature Search - Y.S., S.E.K., A.D.; Writing - Y.S.

Conflict of Interest: No conflict of interest was declared by the authors.

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