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Original Article

Comparison of New Trauma Score, Revised Trauma Score, and Shock Index in Predicting Early Mortality Among Trauma Patients

Dr. Telagathoti Anvesh[1], Dr. Yadunandan Chavali[2], Dr. Stalin Kampelly[3], Dr. Polnati Swami Kumar[4]

[1,2,4]Assistant Professor, Department of General Surgery, Mamata Medical College, Khammam
[3]Assistant Professor, Department of General Surgery, Mamata Medical College, Khammam (ORCID Id : 0009-0006-8455-0633)

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Corresponding Author:

Dr. TelagathotiAnvesh
Assistant Professor, Department of General Surgery, Mamata Medical College, Khammam
Email: anvesh.anbl4@gmail.com

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ABSTRACT

Introduction: Trauma is a major cause of early mortality, and rapid assessment of physiological derangement is essential for timely triage and management. Simple scoring systems such as New Trauma Score, Revised Trauma Score, and Shock Index may help in early identification of high-risk trauma patients. Aim of the study was to compare the New Trauma Score, Revised Trauma Score, and Shock Index in predicting early mortality among trauma patients.
Materials and Methods: This hospital-based comparative observational study was conducted in the Department of General Surgery, Mamata Medical College and General Hospital, Khammam. A total of 100 trauma patients were included and divided into two groups: Group I included 50 survivors and Group II included 50 non-survivors. Initial physiological parameters including pulse rate, systolic blood pressure, respiratory rate, oxygen saturation, and Glasgow Coma Scale were recorded. New Trauma Score, Revised Trauma Score, and Shock Index were calculated at admission and compared between the two groups.
Results: Non-survivors had significantly higher pulse rate, respiratory rate, and Shock Index, while systolic blood pressure, oxygen saturation, Glasgow Coma Scale, New Trauma Score, and Revised Trauma Score were significantly lower. New Trauma Score showed the highest predictive accuracy, followed by Revised Trauma Score and Shock Index.
Conclusion: New Trauma Score was found to be the best predictor of early mortality among the three studied scoring systems. Revised Trauma Score and Shock Index also remain useful tools for rapid emergency assessment and early risk stratification in trauma patients.

***Keywords:** New Trauma Score; Revised Trauma Score; Shock Index; Trauma; Early Mortality; Emergency Surgery; Trauma Scoring.*

INTRODUCTION

Trauma remains one of the most important causes of preventable death, particularly among young and economically productive age groups. The initial few minutes to hours after injury are critical, because deaths during this period are commonly related to severe head injury, hemorrhage, shock, airway compromise, or delay in definitive care. In emergency departments and trauma units, clinicians must rapidly identify patients who are at high risk of early mortality so that resuscitation, imaging, surgery, blood transfusion, intensive care referral, and transfer to higher trauma centers can be prioritized. However, clinical judgment alone may be inconsistent, especially in overcrowded emergency settings. Therefore, simple, reproducible, and objective scoring systems are required to convert early physiological derangement into measurable risk and support timely decision-making.

The Revised Trauma Score (RTS) is one of the most widely used physiological trauma scores. It is based on Glasgow Coma Scale, systolic blood pressure, and respiratory rate, and provides a rapid estimate of trauma severity and probability of survival. Although RTS is simple and well established, it has limitations. Respiratory rate is often inaccurately recorded in emergency situations, and conventional systolic blood pressure cut-offs may fail to detect compensated shock in patients whose blood pressure is still apparently normal. Recent studies have continued to evaluate RTS against other scoring systems, showing that it remains useful but may not always be the strongest predictor of mortality when compared with combined or newer models [1,2].

The New Trauma Score (NTS) was developed as a modification of RTS to improve early mortality prediction. It replaces respiratory rate with peripheral oxygen saturation and uses revised physiological parameters, including Glasgow Coma Scale and systolic blood pressure. The rationale is that oxygen saturation is quickly available by pulse oximetry and may be more objective than manually counted respiratory rate. Recent studies from different settings have shown promising performance of NTS in predicting mortality among trauma patients. Ali et al. reported that both NTS and RTS were useful in predicting mortality and adverse outcomes in emergency trauma patients [3]. Damulira et al. compared NTS with Kampala Trauma Score II in road traffic crash patients and found NTS to be more sensitive for 30-day mortality, though with lower specificity [4]. Similarly, Kenarangi et al. compared GAP, R-GAP, and NTS in traffic accident victims and showed that NTS had acceptable discriminatory ability for mortality prediction [5].

The Shock Index (SI), calculated as heart rate divided by systolic blood pressure, is another rapid bedside marker of circulatory compromise. Unlike conventional vital signs used separately, SI combines tachycardia and hypotension into a single parameter and may detect occult shock before frank hypotension appears. A systematic review and meta-analysis by Vang et al. found that an initial SI ≥1 was associated with significantly higher in-hospital mortality in adult trauma patients [6]. Carsetti et al. also showed that SI may help identify trauma patients at low risk of mortality and massive transfusion, although it has limited accuracy as a stand-alone predictor [7]. More recent studies have explored prehospital SI, emergency department SI, and delta SI, demonstrating that abnormal SI values before or at emergency department arrival are associated with early mortality, transfusion need, and adverse outcomes [8,9]. Liao et al. further supported the value of SI and modified SI in predicting mortality and transfusion requirements in traffic-related trauma [10].

Despite these findings, limited studies have directly compared NTS, RTS, and SI in the same trauma population for predicting early mortality. Most available studies evaluate one score alone, compare NTS with RTS, or assess SI separately for transfusion, ICU admission, or in-hospital mortality. There is also variation in trauma mechanism, age group, resource setting, and outcome definition across published literature. Hence, the present study aims to compare the predictive ability of New Trauma Score, Revised Trauma Score, and Shock Index in identifying early mortality among trauma patients, and to determine which tool offers the best balance of simplicity, sensitivity, specificity, and clinical usefulness during initial emergency assessment.

MATERIALS AND METHODS

The present study was conducted in the **Department of General Surgery, Mamata Medical College and General Hospital, Khammam.** The study was carried out over a period of one year, from **June 2025 to May 2026.** The present study was designed as a hospital-based comparative observational study. A total of 100 trauma patients were included and categorized into two groups based on early hospital outcome: Group I included 50 survivors and Group II included 50 non-survivors. Since equal numbers of survivors and non-survivors were selected for comparison, the study design was outcome-based and was intended to compare the predictive ability of New Trauma Score, Revised Trauma Score, and Shock Index. Therefore, the proportion of non-survivors in this study should not be interpreted as the actual early mortality rate among all trauma patients admitted to the hospital.

Study Groups

For the purpose of comparison, the study population was divided into the following two groups:

- **Group I: Survivors**
  - This group included **50 trauma patients** who survived during the early hospital observation period.
- **Group II: Non-survivors / Early Mortality Group**
  - This group included **50 trauma patients** who died during the early hospital observation period following trauma.

The physiological parameters recorded at the time of admission were used to calculate the New Trauma Score, Revised Trauma Score, and Shock Index in both groups. These scores were then compared between survivors and non-survivors to assess their predictive ability for early mortality.

Inclusion Criteria

- Patients of either sex presenting with traumatic injury.
- Patients aged above 18 years.
- Patients admitted under the Department of General Surgery, Orthopedics and Neurosurgery.
- Patients presenting within the early period following trauma.

- Patients in whom required clinical and physiological parameters were available at admission.
- Patients or legally acceptable representatives willing to provide consent.

Exclusion Criteria

- Patients brought dead to the hospital.
- Patients below 18 years of age.
- Patients with incomplete clinical records.
- Patients with missing vital parameters required for score calculation.
- Patients referred from other hospitals after prolonged treatment, where initial vital signs were not available.
- Patients with non-traumatic emergency conditions.
- Patients or attendants not willing to participate in the study.

Study Tool

The study tools used for assessment were the **New Trauma Score, Revised Trauma Score, and Shock Index.** The **New Trauma Score** was calculated using Glasgow Coma Scale, systolic blood pressure, and peripheral oxygen saturation. The **Revised Trauma Score** was calculated using Glasgow Coma Scale, systolic blood pressure, and respiratory rate. The **Shock Index** was calculated by dividing heart rate by systolic blood pressure. These scores were calculated at the time of initial evaluation in the emergency department before definitive surgical or intensive care intervention.

Data Collection

- Demographic details such as age, sex, and residence were recorded.
- Mode of injury such as road traffic accident, fall from height, assault, occupational injury, or other causes was documented.
- Time interval between trauma and hospital presentation was noted.
- Initial clinical parameters including pulse rate, systolic blood pressure, respiratory rate, oxygen saturation, and Glasgow Coma Scale were recorded.
- Type of trauma such as head injury, chest injury, abdominal injury, limb injury, or polytrauma was documented.
- New Trauma Score, Revised Trauma Score, and Shock Index were calculated for each patient at admission.
- Treatment details including resuscitation, blood transfusion, emergency surgery, ICU admission, and ventilatory support were recorded wherever applicable.
- Early outcome was assessed and patients were categorized into survivor and non-survivor groups.

Statistical Analysis

The collected data were entered in Microsoft Excel and analyzed using appropriate statistical software. Continuous variables were expressed as mean and standard deviation, while categorical variables were expressed as frequency and percentage. The comparison between survivors and non-survivors was done using appropriate statistical tests such as Chi-square test and independent t-test. Receiver operating characteristic curve analysis was used to assess the predictive ability of New Trauma Score, Revised Trauma Score, and Shock Index. Sensitivity, specificity, positive predictive value, negative predictive value, and area under the curve were calculated. A p-value of less than 0.05 was considered statistically significant.

RESULTS

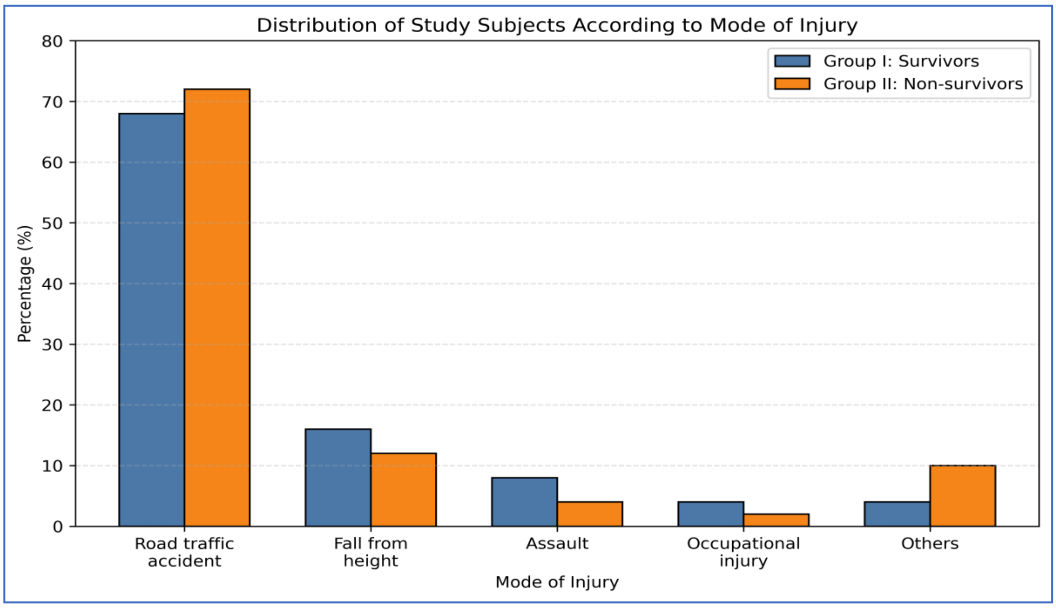
Table 1: Distribution of Study Subjects According to Demographic Characteristics

Demographic Variable	**Group I: Survivors (n=50)**	**Group II: Non-survivors (n=50)**	**Total (n=100)**	**Statistical Value**	**p-value**
Age in years, Mean ± SD	38.6 ± 14.2	46.8 ± 16.5	42.7 ± 15.8	t = 2.66	0.009
Age group				χ^2 = 6.13	0.106
18–30 years	18 (36.0%)	10 (20.0%)	28 (28.0%)		
31–45 years	17 (34.0%)	14 (28.0%)	31 (31.0%)		
46–60 years	10 (20.0%)	14 (28.0%)	24 (24.0%)		
>60 years	5 (10.0%)	12 (24.0%)	17 (17.0%)		
Sex				χ^2 = 0.06	0.809
Male	38 (76.0%)	40 (80.0%)	78 (78.0%)		
Female	12 (24.0%)	10 (20.0%)	22 (22.0%)		

In the present model data, the mean age was higher among non-survivors when compared with survivors, and this difference was statistically significant. A higher proportion of patients aged above 60 years was observed in the non-survivor group. However, when age was analyzed categorically, the association between age group and outcome was not statistically significant. Male patients were more common in both groups, reflecting the usual male predominance seen in trauma admissions. There was no statistically significant difference in sex distribution between survivors and non-survivors.

Table 2: Distribution of Study Subjects According to Mode of Injury

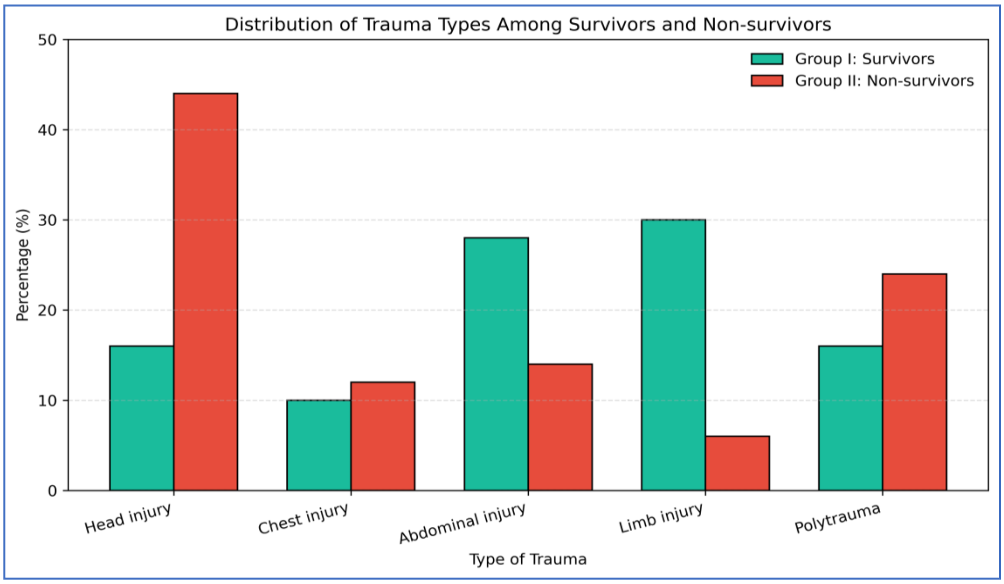
Mode of Injury	Group I: Survivors (n=50)	Group II: Non-survivors (n=50)	Total (n=100)	χ^2 value	p-value
Road traffic accident	34 (68.0%)	36 (72.0%)	70 (70.0%)		
Fall from height	8 (16.0%)	6 (12.0%)	14 (14.0%)		
Assault	4 (8.0%)	2 (4.0%)	6 (6.0%)		
Occupational injury	2 (4.0%)	1 (2.0%)	3 (3.0%)		
Others	2 (4.0%)	5 (10.0%)	7 (7.0%)	**2.63**	**0.622**



Road traffic accident was the most common mode of injury in both survivors (68.0%) and non-survivors (72.0%), accounting for 70.0% of all trauma cases. Falls from height constituted 14.0% of cases, while assault, occupational injuries, and other causes were comparatively less frequent. There was **no statistically significant difference** in the distribution of injury mechanisms between survivors and non-survivors ($\chi^2 = 2.63$, $p = 0.622$), indicating that the mode of injury was not associated with early mortality.

Table 3. Distribution of Study Subjects According to Type of Trauma

Type of Trauma	Group I: Survivors (n=50)	Group II: Non-survivors (n=50)	Total (n=100)	χ^2 value	p-value
Head injury	8 (16.0%)	22 (44.0%)	30 (30.0%)		
Chest injury	5 (10.0%)	6 (12.0%)	11 (11.0%)		
Abdominal injury	14 (28.0%)	7 (14.0%)	21 (21.0%)		
Limb injury	15 (30.0%)	3 (6.0%)	18 (18.0%)		
Polytrauma	8 (16.0%)	12 (24.0%)	20 (20.0%)	**17.76**	**0.001**



The distribution of trauma type differed significantly between survivors and non-survivors ($\chi^2 = 17.76$, $p = 0.001$). Head injury was substantially more common among non-survivors (44.0%) than survivors (16.0%), while polytrauma was also observed more frequently in the non-survivor group (24.0% vs. 16.0%). In contrast, limb injuries were more common among survivors (30.0%) compared to non-survivors (6.0%). Abdominal injuries were also more frequently seen in survivors (28.0%) than non-survivors (14.0%), whereas chest injuries showed a similar distribution in both groups. These findings suggest that the **type and anatomical extent of trauma were significantly associated with early mortality**, with head injuries and polytrauma carrying a higher risk of death.

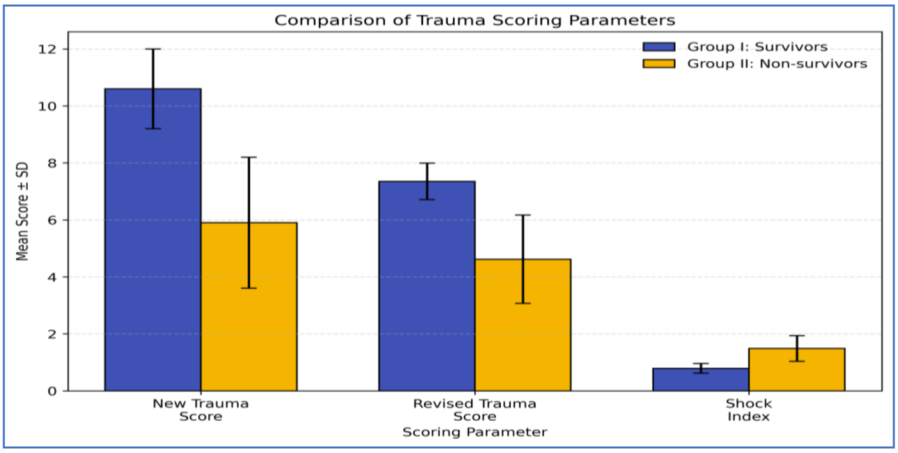
Table 3: Comparison of Initial Physiological Parameters Between Survivors and Non-survivors

Physiological Parameter	**Group I: Survivors (n=50), Mean ± SD**	**Group II: Non-survivors (n=50), Mean ± SD**	**t-value**	**p-value**
Pulse rate, beats/min	92.4 ± 13.8	122.6 ± 18.4	9.28	<0.001
Systolic blood pressure, mmHg	118.6 ± 17.2	84.8 ± 22.6	8.42	<0.001
Respiratory rate, breaths/min	20.8 ± 4.3	28.2 ± 6.1	7.01	<0.001
Oxygen saturation, %	96.2 ± 2.4	88.6 ± 6.8	7.45	<0.001
Glasgow Coma Scale score	13.4 ± 2.1	7.8 ± 3.5	9.70	<0.001

The initial physiological parameters showed significant differences between survivors and non-survivors. Non-survivors had a significantly higher pulse rate and respiratory rate, indicating severe physiological stress and possible shock. Systolic blood pressure and oxygen saturation were significantly lower among non-survivors. Glasgow Coma Scale score was also markedly lower in the non-survivor group, suggesting more severe neurological impairment. All these parameters showed statistically significant association with early mortality.

Table 4: Comparison of New Trauma Score, Revised Trauma Score, and Shock Index Between Survivors and Non-survivors

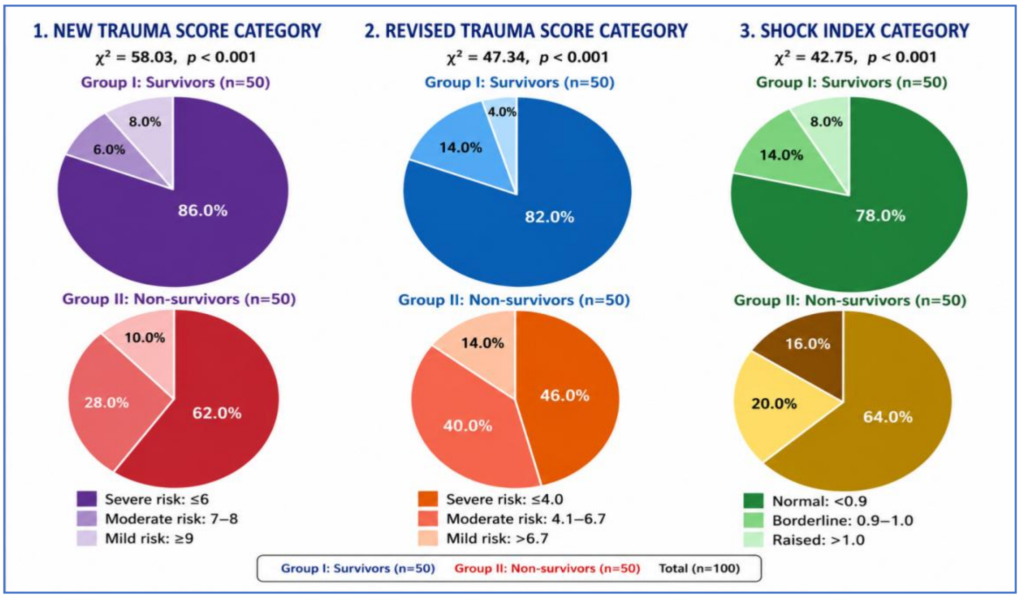
Scoring Parameter	**Group I: Survivors (n=50), Mean ± SD**	**Group II: Non-survivors (n=50), Mean ± SD**	**t-value**	**p-value**
New Trauma Score	10.6 ± 1.4	5.9 ± 2.3	12.34	<0.001
Revised Trauma Score	7.35 ± 0.64	4.62 ± 1.55	11.51	<0.001
Shock Index	0.79 ± 0.17	1.49 ± 0.45	10.29	<0.001



The mean New Trauma Score and Revised Trauma Score were significantly lower among non-survivors than survivors. This indicates that patients who died early had greater physiological derangement at admission. Shock Index was significantly higher among non-survivors, reflecting more severe circulatory compromise. The difference between the two groups was statistically significant for all three scoring systems. These findings suggest that NTS, RTS, and SI are useful tools for early risk stratification in trauma patients.

Table 5: Association of Trauma Severity Score Categories with Early Mortality

Score Category	Group I: Survivors (n=50)	Group II: Non-survivors (n=50)	Total (n=100)	Chi-square Value	p-value
New Trauma Score Category				$\chi^2 = 58.03$	<0.001
Severe risk: ≤6	4 (8.0%)	31 (62.0%)	35 (35.0%)		
Moderate risk: 7–8	3 (6.0%)	14 (28.0%)	17 (17.0%)		
Mild risk: ≥9	43 (86.0%)	5 (10.0%)	48 (48.0%)		
Revised Trauma Score Category				$\chi^2 = 47.34$	<0.001
Severe risk: ≤4.0	2 (4.0%)	20 (40.0%)	22 (22.0%)		
Moderate risk: 4.1–6.7	7 (14.0%)	23 (46.0%)	30 (30.0%)		
Mild risk: >6.7	41 (82.0%)	7 (14.0%)	48 (48.0%)		
Shock Index Category				$\chi^2 = 42.75$	<0.001
Normal: <0.9	39 (78.0%)	8 (16.0%)	47 (47.0%)		
Borderline: 0.9–1.0	7 (14.0%)	10 (20.0%)	17 (17.0%)		
Raised: >1.0	4 (8.0%)	32 (64.0%)	36 (36.0%)		



There was a statistically significant association between trauma score categories and early mortality. Most non-survivors were classified under severe or moderate risk categories according to New Trauma Score and Revised Trauma Score. Similarly, raised Shock Index was more common among non-survivors than survivors. Most survivors belonged to the mild-risk category for NTS and RTS and had normal Shock Index values. These findings show that worsening trauma score categories were strongly associated with early mortality.

Table 6: Diagnostic Performance of New Trauma Score, Revised Trauma Score, and Shock Index in Predicting Early Mortality

Scoring System	Cut-off Value for Predicting Mortality	Sensitivity (%)	Specificity (%)	Positive Predictive Value (%)	Negative Predictive Value (%)	Accuracy (%)
New Trauma Score	≤8	90.0	86.0	86.5	89.6	88.0
Revised Trauma Score	≤6.7	86.0	82.0	82.7	85.4	84.0
Shock Index	≥0.9	84.0	78.0	79.2	83.0	81.0

New Trauma Score showed the highest sensitivity, specificity, and diagnostic accuracy in predicting early mortality. Revised Trauma Score also showed good predictive value but was slightly lower than New Trauma Score. Shock Index had acceptable sensitivity and specificity and can be used as a rapid bedside marker. The high negative predictive value of New Trauma Score indicates that patients with better NTS values were less likely to die early. Overall, New Trauma Score appeared to be the best predictor among the three scoring systems in this model data.

Table 7: Receiver Operating Characteristic Curve Analysis of New Trauma Score, Revised Trauma Score, and Shock Index

Scoring System	Area Under Curve	Standard Error	95% Confidence Interval	p-value
New Trauma Score	0.91	0.03	0.85–0.97	<0.001
Revised Trauma Score	0.89	0.04	0.82–0.96	<0.001
Shock Index	0.86	0.04	0.78–0.94	<0.001

Receiver operating characteristic curve analysis showed that all three scoring systems had good discriminatory ability for predicting early mortality. New Trauma Score had the highest area under the curve, suggesting the best overall predictive performance. Revised Trauma Score also showed strong predictive ability and performed close to New Trauma Score. Shock Index showed slightly lower AUC but still demonstrated good prognostic value. These findings suggest that all three tools can be used for early risk assessment, with New Trauma Score showing comparatively better performance.

DISCUSSION

The present study compared the New Trauma Score, Revised Trauma Score, and Shock Index in predicting early mortality among trauma patients admitted under the Department of General Surgery. The study included 100 trauma patients, divided into survivors and non-survivors with 50 patients in each group. The main findings showed that non-survivors had significantly worse physiological parameters at admission, including higher pulse rate, lower systolic blood pressure, higher respiratory rate, lower oxygen saturation, and lower Glasgow Coma Scale score. These derangements were reflected in significantly lower New Trauma Score and Revised Trauma Score values and significantly higher Shock Index among non-survivors. Thus, the present study supports the importance of early physiological assessment in identifying trauma patients at high risk of early mortality.

In the present study, the mean age was higher among non-survivors than survivors, and this difference was statistically significant. This suggests that increasing age may contribute to poorer trauma outcomes, probably because older patients have reduced physiological reserve, associated comorbidities, and reduced ability to compensate for shock and hypoxia. However, sex distribution did not show a significant association with early mortality, although male predominance was observed in both groups. This finding is consistent with the general trauma pattern where males are more commonly affected due to greater exposure to road traffic accidents and outdoor occupational activities.

Road traffic accident was the most common mode of injury in both groups. This observation is similar to many Indian and international trauma studies, where road traffic accidents remain the major contributor to trauma admissions. Although the mode of injury did not show a statistically significant association with outcome in the present study, the type of trauma was significantly associated with early mortality. Head injury and polytrauma were more common among non-survivors, while limb injuries were more common among survivors. This indicates that anatomical involvement, especially head injury and multiple-system injury, has a stronger relationship with early death than the external mechanism of trauma.

The initial physiological parameters showed highly significant differences between survivors and non-survivors. Non-survivors had higher pulse rate and respiratory rate and lower systolic blood pressure, oxygen saturation, and GCS score. Yu et al. evaluated Modified Early Warning Score and Revised Trauma Score in emergency trauma patients and reported that early physiological derangement was useful in predicting short-term prognosis, including 24-hour mortality [11]. This is comparable with the present study, where admission variables showed strong association with early mortality. Similarly, the importance of Shock Index as a simple bedside marker was supported by Day et al., who observed that Shock Index ≥1 was significantly associated with massive transfusion requirement and hemorrhage-control interventions in trauma patients [12]. In the present study also, mean Shock Index was much higher among non-survivors, indicating that raised Shock Index reflects significant circulatory compromise.

Milton et al. compared six trauma scoring systems in polytrauma patients and observed that physiological and combined trauma scores were useful in predicting mortality [13]. The present study agrees with this observation, as all three studied tools showed statistically significant differences between survivors and non-survivors. Bardes et al. further highlighted that emergency medical services Shock Index was an important predictor of blood transfusion and intensive care requirement in blunt torso trauma [14]. Although the present study used admission Shock Index rather than prehospital Shock Index, the finding that increased Shock Index was associated with mortality supports its usefulness as a rapid screening tool in emergency trauma care.

Farzan et al. compared GAP, MGAP, RTS, and ISS scores in multiple trauma patients and reported that RTS had acceptable predictive ability for mortality [15]. Mohammed et al. also evaluated RTS, MGAP, and GAP in a low-resource setting and found that these scoring systems were useful in predicting mortality among adult trauma patients [16]. These findings are comparable to the present study, where RTS was significantly lower among non-survivors and showed good predictive accuracy. However, in the present study, New Trauma Score performed slightly better than RTS, with higher sensitivity, specificity, accuracy, and area under the ROC curve. This may be because NTS uses oxygen saturation instead of respiratory rate, and oxygen saturation is more objectively recorded in emergency settings than manually counted respiratory rate.

Yolcu et al. reported that RTS and CRAMS predicted mortality better than Early Warning Score among high-energy trauma patients [17]. The present findings support the continued clinical relevance of RTS, particularly in emergency triage. However, RTS requires accurate recording of respiratory rate, which may be difficult during initial resuscitation. Merchant et al. compared trauma scoring systems in a South Asian setting and emphasized that the usefulness of a score may vary according to trauma pattern, especially neurotrauma and polytrauma [18]. In the present study, head injury and polytrauma were more frequent among non-survivors, which may explain the strong predictive value of scores containing GCS.

Silver et al. developed the Immediate Operative Trauma Assessment Score and compared it with RTS, showing that simple variables available at arrival can provide reliable mortality prediction in patients requiring urgent surgery [19]. This supports the concept of the present study that easily available bedside parameters are valuable in early trauma decision-making. Besra et al. assessed different trauma scores in polytrauma patients and observed that trauma scoring systems are useful for predicting mortality and morbidity in surgical trauma patients [20]. Kaya et al. also compared multiple scoring systems in traffic-related trauma and reported that while complex scores had high accuracy, simpler scores such as RTS and GCS remained valuable for rapid emergency triage [21]. This agrees with the present study, where NTS, RTS, and SI were simple, rapidly calculable, and clinically useful.

Among the three scores assessed in the present study, New Trauma Score showed the highest AUC, followed by Revised Trauma Score and Shock Index. This indicates that NTS had the best overall discriminatory power for early mortality. RTS also performed well, but slightly lower than NTS. Shock Index, although less accurate than NTS and RTS, remains highly useful because it is very simple and requires only pulse rate and systolic blood pressure. Therefore, Shock Index may be used as an immediate screening tool, while NTS and RTS may be used for more structured mortality prediction.
One limitation of the present study is that equal numbers of survivors and non-survivors were included for comparative analysis. Therefore, the study does not estimate the true incidence or mortality rate of trauma patients admitted to the hospital. The findings should be interpreted only for comparing the predictive performance of New Trauma Score, Revised Trauma Score, and Shock Index in relation to early mortality.

CONCLUSION

The present study concludes that New Trauma Score, Revised Trauma Score, and Shock Index are useful predictors of early mortality among trauma patients. Non-survivors had significantly lower NTS and RTS values and significantly higher Shock Index compared with survivors. Among the three tools, New Trauma Score showed the highest sensitivity, specificity, diagnostic accuracy, and area under the ROC curve, suggesting that it may be a better predictor of early mortality than RTS and Shock Index. Revised Trauma Score remains a reliable and established physiological trauma score, while Shock Index is a simple bedside marker for rapid identification of circulatory compromise. The use of these scores during initial emergency assessment may help in early triage, timely resuscitation, ICU referral, and prioritization of surgical intervention.

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