Original Article

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Revised Trauma Score, Injury Severity Score, New Injury Severity Score and Trauma Revised Injury Severity Score among Trauma Patients in a Tertiary Care Hospital: A Comparative Study

Surgery Section

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ABSTRACT

Introduction: Injury severity scoring can provide objective correlations with resource utilisation, such as length of stay and treatment costs, and inform clinical decisions regarding managing injuries of specific severity. The ability to predict survival after trauma is perhaps the most fundamental use of injury severity scoring.

Aim: To compare the efficacy of the Injury Severity Score (ISS), Revised Trauma Score (RTS), New Injury Severity Score (NISS), and Trauma Revised Injury Severity Score (TRISS) in the prediction of mortality in trauma patients.

Materials and Methods: In this comparative prospective observational study conducted in the Department of General Surgery, SRM Medical College Hospital and Research Centre, Chennai, Tamil Nadu, India from April 2021 to September 2022 in 400 trauma patients who were clinically assessed and managed per the latest Advanced Trauma Life Support (ATLS) guidelines (10th edition). After the stabilisation of the patient, RTS, ISS, NISS and TRISS was obtained from the trauma chart, imaging studies and intraoperative findings. Statistical analysis was done using the statistical software Statistical Package for the Social Sciences (SPSS) version 16.0.

Results: Most trauma patients showed more blunt injuries 284 (71.0%) than penetrating injuries 116 (29.0%). The major trauma region was external 161 (40.3%), followed by extremity 124 (31.0%). The mortality rate in this study was 17 (4.3%). The cut-off points for predicting mortality in trauma patients in ISS, RTS, NISS and TRISS systems were 22, 6.8, 28.5, 87.95 with sensitivity of 94.12%, 88.24%, 88.24%, 100.00% and specificity of 94.78%, 94.52%, 92.95%, 95.56%, respectively.

Conclusion: According to the current study's findings, TRISS was a more accurate prognosticator among trauma patients.

Keywords: Anatomical, Mortality rate, Physiological, Prognosticator, Receiver operating curve

INTRODUCTION

Injury severity grading, regarded as a fundamental prerequisite for trauma management and clinical tests, is the primary determinant in determining the degree of an injury. The observed statistical discrepancies in the rate of long-term disability after trauma between various healthcare facilities can highlight the variations in injury severity grading and patient management standards in each population under study. It is crucial to have a suitable technique or index for traumatic patient evaluation to manage these patients accurately [1]. The number of lives saved and the quality of the outcomes have improved due to advancements in trauma prevention and quality control of treatment systems for trauma patients [2]. Through quality improvement programs, databases contain trauma records with severity scores, the outcomes of care systems for trauma patients can be managed most successfully [3]. Severity scores in trauma are predictive screening or evaluation methods based on the patient's physiological changes and anatomical injuries. When examining the level of service delivered, evaluating these scores enables the computation and study of the patient's survival probability (Ps) and comparing results within or between care services [4].

The most popular trauma severity scores currently available are divided into three categories based on the patient's information: anatomical scores, such as the Abbreviated Injury Scale (AIS) [5] and the ISS [6]; physiological scores, like the RTS [7], and mixed scores, which combine anatomical and physiological scores, like the TRISS [8].

To give numerical values to anatomical lesions and physiological changes following an accident, trauma scores were first presented more than 30 years ago. According to changes in vital signs and consciousness, physiological scores translate alterations brought on by trauma. All injuries that have been identified by a clinical examination, imaging, surgery, or autopsy are given anatomical scores. Anatomical scores are utilised once the diagnosis is made, usually following the patient's discharge or postmortem, if physiological scores are used at the time of the patient's initial contact (for triage) and then again to track the patient's progress. They are used in trauma patients to categorise and to predict the severity of the lesion. For predicting a patient's prognosis, mixed scores- scores that consider both morphological and physiological criteria- are helpful [9].

The scores have problems especially in the evaluation of penetrating trauma, such as a patient with multiple injuries in an area. An effective tool is needed to assess the prognosis of the patient in trauma. Given the significance of evaluating the prognosis of trauma patients, the present study was conducted to evaluate the prediction of mortality in trauma patients. The study aimed to compare the efficacy of the ISS, RTS, NISS, and TRISS in the prediction of mortality in trauma patients.

MATERIALS AND METHODS

This comparative prospective observational study was conducted in the Department of General Surgery SRM Medical College Hospital and Research Centre, Chennai, Tamil Nadu, India, from April 2021 to September 2022 in patients admitted with the clinical diagnosis of "TRAUMA" under General Surgery care. Institutional Ethical Committee (IEC) gave permission to conduct the study with approval number: 2357/IEC/2021.

Inclusion criteria: All patients older than 13 years with clinical/radiological evidence of trauma and who gave informed consent were included in the study.

Exclusion criteria: Patients/Attendants of patients who were unwilling to participate were excluded from the study.

Sample size calculation: Sample size was calculated considering the RTS score of survivors to be 7.60±0.48 [10]; d=0.05 Z=1.96, ((Z^2)*(0.48^2))/(0.05^2)=368.64. Considering loss of data, 30 patients were added and the final sample size was 400.

Study Procedure

Patients history including demographics, general examination data were collected. Patients were clinically assessed and managed per the latest ATLS guidelines (10th edition) [11]. After stabilising the patient, detailed history was recorded, and a general physical/systemic examination was done. After the stabilisation of the patient, the RTS (<7.108), ISS (>15), NISS (>17) and TRISS (<91.6) was obtained from the trauma chart, imaging studies and intraoperative findings [10].

STATISTICAL ANALYSIS

The statistical analysis was done using the statistical software SPSS for windows (version 16). The Student's t-test was used to compare the mean value. Receiver Operating Characteristics (ROC) curve was plotted to find the cut-off points. A p-value <0.05 was stated as statistically significant.

RESULTS

Four hundred patients who experienced trauma were included in the study. The mean age of the trauma patients was 37.07±12.7 years. Most trauma patients were 344 men (86.0%) and 56 women (14.0%). The most common mode of injury was road traffic accidents 268 (67.0%), followed by assault 132 (33.0%) [Table/Fig-1]. Most trauma patients showed blunt injuries 284 (71.0%) than penetrating injuries 116 (29.0%). The major common trauma region was external 161 (40.3%), followed by extremity 124 (31.0%). The mortality rate in this study was 4.3% (n=17) [Table/Fig-2].

Patients' characteristics		N (%)
Age group (years)	≤20	24 (6.0)
	21-30	122 (30.5)
	31-40	103 (25.8)
	41-50	86 (21.5)
	51-60	37 (9.3)
	≥61	28 (7)
Gender	Female	56 (14)
	Male	344 (86)
Mode of injury	Assault	132 (33)
	Road traffic accident	268 (67)

[Table/Fig-1]: Distribution of patient characteristics.

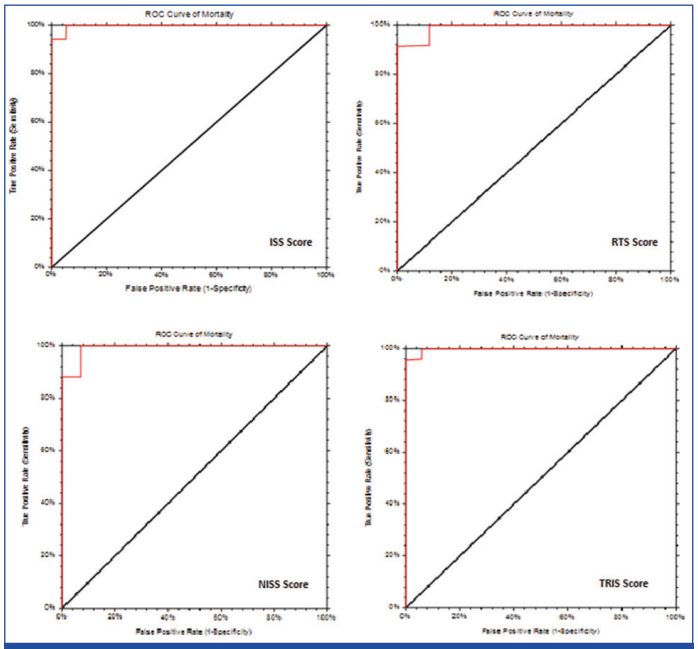
Patients' characteristics		N (%)
Nature of injury	Blunt	284 (71)
	Penetrating	116 (29)
Major region of trauma	Abdomen	31 (7.8)
	External	161 (40.3)
	Extremity	124 (31)
	Head and neck	64 (16)
	Thorax	20 (5)
Mortality	Yes	17 (4.3)
	No	383 (95.8)

[Table/Fig-2]: Distribution of trauma and mortality.

The cut-off points for predicting mortality in trauma patients in ISS, RTS, NISS and TRISS systems were 22, 6.8, 28.5, 87.95 with sensitivity of 94.12%, 88.24%, 88.24%, 100.00% and specificity of 94.78%, 94.52%, 92.95%, 95.56%, respectively. All these values were found to be statistically significant (p<0.0001) [Table/Fig-3,4].

Score	Mortality	Mean±SD	p-value	Cut-off	Yes	No
ISS score	Yes	39.05±7.25	<0.0001	>22	16	20
	No	6.59±6.57		<22	1	363
RTS score	Yes	4.67±1.19	<0.0001	>6.8	15	21
	No	7.58±0.49		<6.8	2	362
NISS score	Yes	43.35±8.24	<0.0001	<28.5	15	27
	No	8.72±8.33		>28.5	2	356
TRIS score	Yes	35.07±23.98	<0.0001	<87.95	17	17
	No	94.28±3.25		>87.95	0	366

[Table/Fig-3]: Comparison scores of mortality.



[Table/Fig-4]: ROC of ISS score, RTS score, NISS score and TRIS score. ISS score showing sensitivity and specificity of 86% and 87%; RTS score showing sensitivity of 85 % and specificity of 84%; NISS score showing sensitivity of 84% and specificity of 87%; TRIS score showing sensitivity of 87% and specificity of 87.8%

DISCUSSION

The outcomes of trauma patients can be improved with appropriate training and application of these principles at trauma centres. Following that, the various ISS come into play. These standardised instruments are used to compare the severity of injuries with regard to clinical outcomes as well as for triaging trauma patients. Physiologic, anatomic, and mixed anatomic and physiologic scoring systems are among the many trauma scores that are utilised. The anatomic scores are ISS and NISS. Both rely on the AIS, although their methods of calculation are different. NISS is better than ISS for evaluating injured individuals. The most popular and effective physiological trauma severity scoring method is RTS. Rapid characterisation of neurologic, circulatory, and respiratory injuries is possible using the RTS system. RTS has been decried as little more than a triage tool, though [12,13].

This study included only the basic parameters for all the scores which includes the type of injury and the site of injury, Glasgow coma scale, systolic blood pressure, respiratory rate and using formulas the scores were calculated. In most of the cases- the most influential parameter was age and in TRISS score the age included along with the RTS and ISS score and calculated using formula.

ISS permits documenting one injury per body region (the most severe damage). To get over some of the drawbacks of ISS and make it possible to take into account severe injuries in numerous body locations, the NISS was created. Regardless of body part, the NISS only squares and adds the scores associated with the three most serios injuries.

The mean ISS in patients who died was 39.05±7.25 and in patients who survived was 6.59±6.57 with 22 being a cut-off, 94.12% sensitivity, and 94.78% specificity. The study by Javali RH et al., which had 15 as ISS cut-off, had 91% sensitivity and 89% specificity, being consistent with the findings of researcher [10]. Another study by Samin OA and Civil ID revealed that the ISS score, 91% sensitivity and 90% specificity, cut-off point 38 has been utilised [14].

The mean RTS in patients died was 4.67±1.19 and in patients who have survived are 7.58±0.49, with 6.8 as a cut-off point, 88.24% sensitivity, and 94.52% specifity and AUC of 0.99. The RTS score could not be utilised to predict death. The sensitivity and specificity of 11 studies (total trauma patients=20,631) that evaluated RTS by Mansour DA et al., were 82% and 91%, respectively. The study had been carried out in six different nations. Most of the samples (76.68%) were of men [15]. In the study by Javali RH et al., the average RTS score was 7.108 (97% sensitivity, 98% specificity) [10].

With a cut-off point of 28.5, the mean NISS was 43.35±8.24 in patients who passed away and 8.72±8.33 in those who survived. Mortality was predicted with a sensitivity of 88.24% and a specificity of 92.95%. Unlike Javali RH et al., the NISS cut-off value was 17 (91% sensitivity, 93% specificity), and the mean NISS value for patients who passed away was 27.657.49 and 8.806.19 for survivors [10]. The average NISS for non-survivors was reported by Orhon R et al., to be 27.62±12.85 [16].

The mean TRISS was 35.07±23.98 in patients who died and 94.28±3.25 in patients who survived, with a cut-off point of 87.95 with a mortality prediction sensitivity of 100.0% and 95.56% specificity. The TRISS score can be used to predict mortality in the study population. With a sensitivity of 97% and a specificity of 88%. Javali RH et al., reached the cut-off value of 91.6. The mean TRISS for those who passed away was 58.48±25.58, and 95.49±4.41 for those who survived [10]. The mean TRISS rate in the group that passed away in Orhon R et al., was greater, coming in at 72.80±19.35 and 98.34±6.58 for those treated [16]. Accordingly, the TRISS score had a sensitivity of 97.1% and a specificity of 76.7% for predicting mortality among the 426 trauma cases included in the study by Höke MH et al., [17].

The prognosis of trauma victims can be accurately predicted using the TRISS grading system, according to a 2007 study by Mitchell AD et al., in Canada [18]. In a study done in India, Hariharan S et al., concluded that the TRISS method can be used to predict morbidity and death in older patients after falls [19].

The sensitivity and specificity of TRISS, ISS, and RTS were found to be 87%, 68%, 81%, and 60%, respectively, in studies conducted by Milton M et al., in Africa. In polytrauma population using these scores mortality was calculated, and found that TRISS had the highest sensitivity among all these scores [20]. ISS and NISS scores for the recovered were considerably lower than those who died, although the RTS and TRISS scores of survivors were greater than those of the deceased. Javali RH et al., also looked at the statistically significant difference between ISS, NISS, RTS, and TRISS with p>0.0001 [10].

Several variables could have an impact on TRISS's ability to predict death. The score cannot consider several injuries to the same body part. Second, the score cannot consider systemic co-morbidities, which also affected the patient's prognosis. Third, because the score is based on the patient's breathing rate, it cannot be used to evaluate intubated patients [21]. Other unique situations must be considered, including trauma epidemiology, emergency care, referral networks, and medical care. The intensity of the trauma, the presence of co-morbid conditions, emergency professionals, and the trauma treatment system all have a role in the polytrauma patient's final prognosis. TRISS can predict survival following trauma. Recalculating the TRISS coefficients increased prediction accuracy; however, models that took co-morbidity data into account did not show any further gains. In addition, there may be diversity in trauma depending on several variables, such as the patient's co-morbidities and injury severity, how the doctor treats each patient, and how the trauma centre's particular system is handled [22].

Limitation(s)

The study was a single-centred study and was conducted during the COVID-19 pandemic, hence, could not follow-up the patients.

CONCLUSION(S)

The present study was carried out to study the efficacy of ISS, RTS, NISS and TRISS in predicting mortality in trauma patients. According to the current study's findings, TRISS was a more accurate prognosticator among trauma patients. This rating system can determine a patient's prognosis and the need for early, intensive treatment. Trauma patients' mortality and morbidity may be decreased if structured care is started as soon as possible.

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