Original Article

Comparative Evaluation of Revised Trauma Score and Injury Severity Score as Prognosis Predictor among Polytrauma Patients

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Abstract

Background and Objectives: The trauma is a major reason for various disabilities and even death around the world. Prompt actions and appropriate management are needed to minimize the level of injuries and mortality. An effective tool is needed to assess the prognosis of the patient in trauma. The objective of the study was to compare the evaluation of RTS and injury severity score (ISS) as a prognosis predictor among trauma patients. **Methodology:** A cross-sectional clinical observational study was conducted in the emergency department. A total of 88 samples were selected by random sampling technique. The data collection was done using demographic and clinical tools, Glasgow Coma Scale, Revised Trauma Score (RTS), and ISS. Data analysis was performed using SPSS 18. **Results:** In the present study, the majority of the participants (79.54%) were male. The most common mode of injury among the patients was road traffic accidents (54.54%) with blunt trauma. The findings revealed a negative correlation (–0.368) between RTS and ISS scores with significant $P = 0.0004$. RTS (<10) and ISS (≥20) have significant association with mortality and hospital stay. The sensitivities of ISS and RTS with mortality were 84.2% and 89.4%, respectively. **Conclusion:** RTS is a comparatively better predictor of prognosis than ISS among trauma patients. Lower RTS and higher ISS are significantly associated with mortality and long hospital stay. Early evaluation of the injury level can be effective in patient management.

Keywords: Hospital stay, injury severity score, mortality, prognosis, revised trauma score, trauma patient

Introduction

Globally, the traumatic injury is one of the major reasons of morbidity and mortality. As per the World Health Organization, 16% of the world burden of disease concerns injuries. Approximately 5.8 million deaths occur in the world due to traumatic injuries. Studies revealed that nearly 90% of deaths happen in low- and middle income countries (LMICs).[1,2] After cardiac diseases and cancer, trauma is the third leading cause of death among developed countries. Prompt assessment and management of patients in the emergency department is crucial.[3] The expansion in the road network drastically increased in vehicles and the increased population in the country all contribute toward the expanding numbers of road accidents, casualties, and mortality. From 2001 to 2011 in our country, the number of mortality and morbidity because of road accidents were increased by 5.8% and 2.4%, respectively.[4] Due to excessive bleeding, 35% traumatic injury patients lost their life before reaching hospital and over 40% died within 24 h of accident.[5] Trauma is one of the leading causes of mortality in India. Thoracic trauma is the third most common

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traumatic death, followed by head and spinal cord injury. The chest injuries mortality rate is variable ranging from about 10%–60%.[6] There are various global polytrauma scales are available to measure the severity of the trauma. In 1950, exploring the severity of the trauma as a quantitative approach to show the severity of injury was begun.[7] In 1981, trauma score (TS) was used as a tool for triage of trauma patients. Accurate scores such as Glasgow Coma Scale (GCS) and TS that could be assessed quickly. The revised TS (RTS), which is developed from the TS, has been designed to be utilized in clinical assessment and follow-up of trauma patients. It was better than TS in predicting mortality and patient outcomes.[8] The Revised TS was generated by a combination of results from three categories: GCS, systolic blood pressure, and respiratory rate.[7,9,10] Each parameter is assigned a coded value from 0 to 4 and the score range 0–12. Its parameters can easily be determined.[11] The injury severity score (ISS) is built upon the Abbreviated Injury Scale. To estimate an ISS for an injured patient, the body is divided into five ISS body regions. The ISS scores range from 1 to 75. It has been highlighted that the ISS can better predict the likelihood of mortality, but there are still few constraints that cannot estimate serious multiple injuries in a part of the body. Therefore, it has problems especially in the evaluation of penetrating trauma, such as a patient with multiple injuries in an area.[9] The purpose of the trauma system is to minimize death.[7,12] Due to the severity of accidents, the majority of patients are associated with multiple traumas. It is needed to assess and predict the severity of trauma and determine the prognosis and death rates, possibility of survival, and rapid management in its treatment.[13] Given the significance of evaluating the prognosis of trauma patients, the present study was conducted to enhance treatment and care approaches related to trauma patients. The aim of this study was to assess and compare RTS and ISS rating systems in terms of prognosis and outcomes in patients with multiple traumas in New Civil Hospital Trauma Center and compare these two tools together.

Methodology

The present cross-sectional clinical observational study was conducted in the emergency department of selected hospital, over a study period of 6 months from June 2016 to November 2016. The participants were randomly selected from all age groups and both genders that were presented to the emergency department with trauma over more than one body region involvement, excluding the patients without injury, who had taken prior treatment at anywhere else and who did not give consent for the study. The sample size for the present study was 88 only. The patients were subjected to thorough clinical examination, detailed history including the patient's name, age, sex, date and time of injury, time of admission, mode of injury, and address were recorded in the history sheet, followed by recording the vital signs, i.e., temperature, pulse rate, respiratory rate, and blood pressure. Physical examination was performed to identify the extent of head injury and other systemic involvement. The data collection was done with the help of demographic and clinical tools, GCS, Revised Trauma Score (RTS), and ISS. The patients were evaluated with respect to GCS with recording of different individual parameters such as systolic blood pressure and respiration rate. With the help of above parameters, RTS was calculated for each patient. To calculate ISS, thorough local examination finding notes regarding each region of body according to ISS protocol and presence or not of advanced airway in the form of surgical or nonsurgical approach was also documented. After completion of primary survey, secondary survey of each patient was done according to ATLS guidelines.[7] In between, a primary survey is frequently done to reassess the ongoing clinical condition of the patient. On the basis of RTS scores, patients were divided into two groups with RTS <10 and ≥10.[11] Similarly, in ISS, patients were divided into two groups with ISS <20 and ≥20.[9] After admission of a patient to their respective ward, each patient was followed up for the final outcome of the patient in terms of discharge, death, and duration of hospital stay. The study was conducted after obtaining permission from the Institutional Ethical Committee. The data analysis was done with the help of SPSS Version 18.0. IBM Corporation, Armonk, NY.

Results

In the present study, Table 1 revealed that the majority

Table 1: Distribution of demographic and clinical variables of patients (*n*=88)

	n (%)
Age (years)	37.22±7.436
GCS score	12.78±4.224
Hospital length (days)	7.59±4.942
Gender	
Male	70 (79.54)
Female	18 (20.46)
Mode of injury	
RTA	48 (54.54)
Fall down	33 (37.50)
Assaults	6 (6.81)
Others	1 (1.13)
Types of injury	
Blunt trauma	82 (93.18)
Penetrating	6 (06.82)
Mortality	
Yes	19 (21.59)
No	69 (78.41)
Area of injury	
Head and neck	30 (34.09)
Chest	3 (3.41)
Abdomen	11 (12.50)
Extremities and pelvis	44 (50)
Need of mechanical ventilation	
Yes	16 (18.18)
No	72 (81.82)

GCS: Glasgow Coma Scale, RTA: Road traffic accident

of the participants (79.5%) were male. Majority of the participants (64.7%) were <51 years of age, and the mean age was 37.22 years. The most common mode of injury among the patients was road traffic accidents (54.5%) with blunt trauma. Out of total 88 patients, 68 (77.3%) were in the mild category according to GCS. Half of the subjects have injuries on extremities and pelvis and one–third of patients were suffered from head-and-neck injuries. Among the 88 patients, 73.8% patients had stayed up to 10 days in the hospital. Only 19 (21.6%) patients lost their lives and the rest 78.4 % survived (Table 2 and Figure 1). The percentage of patients who needed mechanical ventilation was only 18.2%. The mean RTS score was 11.462.41 and mean ISS score was 20.108.20. The findings suggested that there was a moderate negative correlation (–0.368) between RTS and ISS scores (Table 2). There was a steady increase in the death rate with decreasing RTS score (<10), but in ISS, higher score was significantly associated with mortality. Present data in Table 2 communicated that cutoff points of mortality in RTS and ISS were <10 and above 20, respectively (Table 3). The mean RTS score among deceased patients was 8.842, but it was high among survivors (1.675). ISS score among patients who died was 27.105 (Table 4). The patients, who stay in hospital <15 days, have higher RTS scores and less ISS scores. The cut of score, sensitivity, specificity, positive predictive value and negative predictive value were considered as predictive characteristics of RTS & ISS for outcomes of the patients. The cutoff scores for the RTS and ISS scores were determined according to the outcomes for each risk score. In Table 5, the sensitivities of ISS and RTS were 84.2% and 89.4%, respectively. Patient's hospital stay was significantly associated with higher RTS score and less ISS scores. The present findings suggested that RTS and ISS both were effective in the assessment of patient prognosis.

Discussion

Various injury scores are available at the global level to assess the level of injury and severity of trauma. Trauma and injury assessment tools can also be used for clinical decision-making when a patient has just arrived at the casualty or emergency department. These tools can also be helpful to prepare the patient for surgical interventions.[14] These tools are equally useful in estimating the prognosis of patient and final outcomes. Heydari-Khayat showed that the main causes of multiple traumas (74.2%) are related to traffic accidents.[15-17] The study also revealed that the most common mode of injury (54.5%) was RTA. According to Table 2, mean RTS score and ISS score were 11.462.41 and 20.108.20, respectively. The mean RTS score obtained in the present study was consistent with the findings from other studies.[11,18,19] The ISSs of our study were 20.108.20, which were comparable to the findings of Deshmukh *et al*. and Gaikwad *et al*.[20,21] Galvagno *et al*. reviewed 43,082 trauma patients' records and showed that there was poor and negative correlation (–0.29) between RTS and ISS.[22] Our findings also indicated that there was a moderate negative correlation (–0.368) between RTS and ISS scores. Watts *et al*. also stated that ISS and RTS were better prognosticators of mortality but had lean correlation.[23] Mansour *et al*. conducted a study among 200 trauma patients with objective to calculated and correlated RTS with injury severity and final outcome of the patients. The researchers stated that there was a remarkable correlation between mortality and RTS. Patients belonging to the RTS category 10 or less have a higher mortality rate.[11] Several other studies Bilgin *et al*.[24] and Yousefzadeh-Chabok *et al*.[25] showed the results equal to the present study. Table 4 reveals that the mean RTS score of the patients who survived was 11.898 ± 0.389, but patients who died showed a significantly lower RTS (8.842 ± 1.675) as compared to that among the

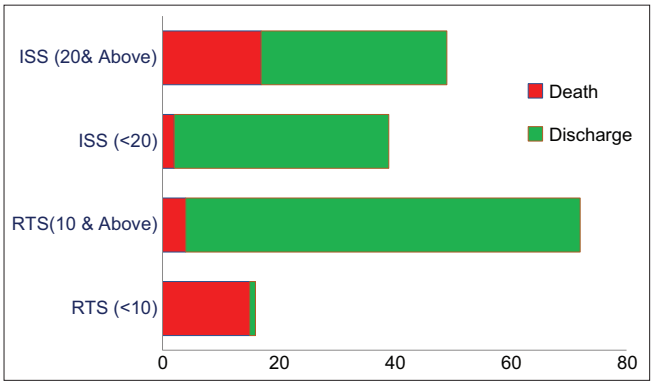

Figure 1: Bar graph showing final outcome of trauma patients according to RTS and injury severity score

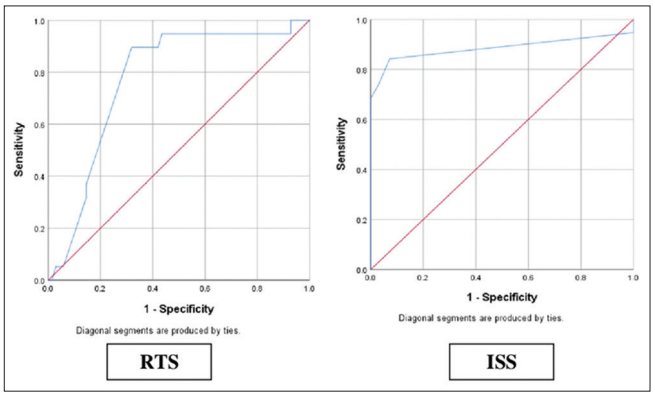

Figure 2: Receiver operating characteristic curve comparing RTS score, injury severity score and outcome of the patients

Table 2: Correlation between revised trauma score and injury severity scores of patients (n=88)

Scale	Mean score±SD	Coefficient of variation (%)	Correlation (r)	P
RTS	11.46591±2.411414	21.02	−0.36865	0.0004*
ISS	20.10227±8.20014	40.49		

*Significant at 0.05 level (P<0.05). SD: Standard deviation, RTS: Revised trauma score, ISS: Injury severity score

survivors.[15] Rathore *et al*. reported a lower (4.59 ± 2.09) mean RTS comparable to ours among expired patients.[3] Karata and Cam[26] conducted a study among seventy trauma patients to assess the prognosis status using various trauma injury scales. The authors reported that the mean ISS score was 19.22 ± 8.85 for patients who were alive and a statistically notable difference was found between ISS score and survival. Our study also stated that the mean ISS score was 18.464 ± 8.159 among survived patients. The mean ISS was significantly higher among those who died (27.105 ± 2.998) as compared to those who survived. Rathore *et al*.[3] also stated that patients who did not survive have higher ISS (30.16 ± 11.753). When RTS and ISS of survivors and dead were compared with the final outcome of the patient, a significant $P < 0.05$ was obtained. The findings suggested that, with increasing RTS and decreasing ISS, the chances survival is higher. Rathore *et al*.[3] communicated the similar findings in their study. Orhon *et al*. conducted a study among 633 trauma patients Figure 2. They found that the RTS helped them in the prediction of hospitalization requirements, as the RTS was increased in patients who were discharged from the emergency department in comparison with those who required hospitalization ($P = 0.004$).[27] The present study also indicated that higher RTS is a predictor of lower hospital stay. Our results showed that the ISS was significant for both survivors and hospital stay. Various studies have shown the relationship between increased ISS and increased mortality rates and complications.[3,19,28]

Table 3: Mortality at cut-off point of revised trauma score and injury severity score among the patients (*n*=88)

Criteria	Score	Discharge, *n* (%)	Death, *n* (%)	*P*
RTS	<10	1 (1.14)	15 (17.04)	0.0001*
	>10	68 (77.27)	4 (4.55)	
ISS	<20	37 (42.04)	2 (2.28)	0.008*
	>20	32 (36.36)	17 (19.32)	

*Significant at 0.05 level (P<0.05). RTS: Revised trauma score, ISS: Injury severity score

Table 4: Comparison of patient's final outcomes with revised trauma score and injury severity score (*n*=88)

Trauma score	Death	Survived	*P*
RTS	8.842±1.675	11.898±0.389	0.002*
ISS	27.105±2.998	18.464±8.159	0.01*

*Significant at 0.05 level (P<0.05). RTS: Revised trauma score, ISS: Injury severity score

In the current study, both RTS and ISS were significant with mortality and hospital stay of the patient, but comparatively RTS was more significant than ISS. Revised Trauma Scale (RTS) had better sensitivity 89.4%, which was higher than ISS 84.2% in its ability to predict mortality accurately. When using the RTS to predict mortality, the cutoff value was 7.108 with a sensitivity of 97% and a specificity of 80%.[28-30] In addition, the present study revealed that RTS has a better specificity (89.4%) and area under receiver operating characteristic (ROC) (77.1%) than the ISS has specificity (84.2%) and area under ROC (88.5%). However, the RTS resulted in better specificity (0.91) and ROC (0.93) curves than the Kampala TS (KTS) during the same meta-analysis, which studied mortality prediction.[1] Singh J *et al*.[31] also communicated the same findings that RTS is a better tool than ISS to evaluate the prognosis of the patient. Manoochehry *et al*. conducted a meta-analysis study to assess and contrast the accuracy of the RTS and KTS in estimating mortality in LMICs.[1] The study concluded that RTS was better than KTS to predict the prognosis of trauma patients. Furthermore, the RTS can predict mortality rates, even when compared with other assessment tools.[29,30,32] Our results showed that RTS was comparatively better to ISS in predicting the patient's prognosis Table 3.

Limitations

The present study is limited to the selected study setting and limited to the selected sample size. The study could not be generalized on larger scale due to small sample size. The present study shows a correlation between RTS and ISS as a prognosis predictor among trauma patients.

Conclusion

Thus, from the present study, it can be concluded that RTS is a better predictor of prognosis among trauma patients. Lower RTS (RTS <10) and higher ISS (ISS >20) are associated with high mortality and longer hospital stay. This scoring system may be used to identify a patient's prognosis and early intensive focused care. The early onset of organized care may reduce the mortality and morbidity among trauma patients.

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Table 5: Predictive characteristics of revised trauma score and injury severity score for outcomes of the patients

Scoring system	Cut off Score	95% CI				AUC[2]	95% CI
		Sensitivity (%)	Specificity (%)	Positive predictive value (%)	Negative predictive value (%)		
ISS	≥20	84.21 (60.4-96.6)	92.75 (83.9-97.6)	76.2 (52.8-91.8)	95.5 (87.5-99.1)	0.885	0.799-0.943
RTS	<10	89.47 (66.9-98.7)	68.12 (55.8-78.8)	43.6 (27.8-60.4)	95.9 (86.0-99.5)	0.771	0.669-0.854

RTS: Revised trauma score, ISS: Injury severity score, CI: Confidence interval, AUC: Area under the curve

Conflicts of interest

There are no conflicts of interest.

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