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Original Research Article

A prospective study of comparison of scoring systems in trauma patients

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ABSTRACT

Background: Trauma is a neglected area of the society. It is a health problem that is responsible for mortality and disability, predominantly among the young generation. Thereupon, the risk stratification of such patients become essential to avoid the mortality, for which various scoring systems are employed.
Methods: A prospective observational study was conducted among the 300 polytrauma patients who presented in a tertiary care institute over a span of one and half year (March 2018 to December 2019). The severity of injuries of each patient was assessed using various scoring systems (GCS, RTS, AIS, ISS, NISS), and accordingly the outcome (mortality and hospital stay) was recorded.
Results: Of the total 300 cases of polytrauma, the young men are most commonly afflicted with road traffic injuries as the leading cause. Most patients presented after a latent period of 2-8 hours since injury with predominantly accidental injuries. Total 21% mortality was observed in this study of which 5% patients succumbed early (<24 hours) despite all possible resuscitative efforts. Mortality was associated with lower GCS and RTS scores but higher ISS and NISS scores.
Conclusions: All patients should have their GCS and RTS scores computed on admission along with the primary survey as they are good predictors of outcome and can predict salvageable patients from the non-salvageable ones. Both anatomical scores ISS and NISS can significantly predict the need for emergency life-saving surgery within 24 hours of admission.

Keywords: Disability, Mortality, Scoring system, Trauma

INTRODUCTION

Trauma is essentially a man-made health problem of the modern era, which has assumed epidemic proportions. Worldwide it is the leading cause of death and disability in the first four decades of life and is the third most common cause of death overall in our country, particularly affecting the young population.[1] It is the neglected disease of modern society.

Trauma literally means wound or injury, whether physical or psychic. Here the term "trauma" is used to denote physical injury. Trauma is characterised by a structural alteration or physiological imbalance, that results when energy is imparted during interaction with physical or

chemicals agents. Injuries are observed in civilian settings or military settings.

The major challenge in evaluation of trauma outcome is the heterogeneity of population. Different body systems are affected; sometimes in isolation, and often in combination. Some injuries are immediately life threatening while management of some injuries can be postponed. Different specialities are involved in effective management of patients with multiple injuries. Therefore, various scoring systems have been devised to objectively measure severity of trauma. These have become the cornerstones of trauma epidemiology. These scoring systems objectively determine the level of the injuries, which enables the care units to classify the patient's centres according to the specified special care they need. The probabilities for ICU deaths for critically ill trauma patients can be calculated using the scores and can predict in hospital mortality and helps in counselling patient's relatives. Epidemiological databases about the injuries and their severity can be created.[2]

This study was undertaken to predict the outcome of trauma patients i.e., by computing various scoring systems on admission; and triaging the patients, how these scores by predicting morbidity and mortality particularly early mortality (within 24 hours); and direct appropriate resources towards salvageable patients which in turn translates into better limb and life outcomes.

METHODS

Study setting

The study was carried out in tertiary teaching institute of King Edward Memorial Hospital, Mumbai.

Study design and duration

This was a prospective observational study of polytrauma cases, conducted from March 2018 to December 2019.

Inclusion criteria

All patients admitted in trauma ward with history of accidental or intentional injury including pregnant females.

Exclusion criteria

Those with age <18 years of age, not willing to participate or have been discharged against medical advice. Burn patients were also not included in the study.

Sample size

It was a time bound study, so all patients of polytrauma who presented between March 2018 to December 2018 and fulfilled the inclusion criteria were included in the study. During this period, we were able to recruit 300 cases of polytrauma.

Consent

Cases of polytrauma were identified and informed consent was obtained from those who were willing to be the part of the study. For the acutely ill patients who could not give consent at admission, a third party (adult relative/guardian) was asked to give consent on behalf of the patient.

Data collection details

Cases of polytrauma admitted in trauma ward during the study duration were identified. The demographic details like age, sex, address and history that included mode of injury, mechanism of injury, intention of injury were recorded on prescribed performa. The general and clinical examination was done and appropriate initial treatment was initiated after pre-requisite investigations. The secondary survey was done to document any injuries on the head, neck, face, chest, abdomen, pelvis, spine, limb/s, skin and soft tissue and for any evidence of acute limb ischaemia. The severity of other associated injuries was assessed by computing the following scores for each patient: 1) Glasgow coma scale (GCS): Sum of eye-opening response and best verbal response and best motor response on admission. 2) Revised trauma score (RTS): Sum of GCS with systolic blood pressure and respiratory rate. Each of the 3 parameters is assigned a score between 0-4 and the sum of all three is taken as RTS. 3) Abbreviated injury score (AIS): Severity of injury in each of the 6 anatomical regions- head and neck, face, thorax, abdomen and visceral pelvis, bony pelvis and extremities and external structures i.e., skin and soft tissue structures is given a score from 0-6 depending on their severity. AIS is imperative to compute the ISS and NISS. 4) Injury severity score: It is the squared sum of the AIS of the 3 most severely injured organs. 5) New Injury severity score: It is the squared sum of the AIS of the 3 most severe injuries to the body, irrespective of the organ injured.

Statistical analysis

Study type was Descriptive. The data was recorded in Microsoft Excel sheet. The statistical analysis of the present study was made by SPSS 15.0 (Chicago, IL) program. Qualitative data studies like gender, organs injured in trauma, surgical procedures, complications of aforementioned trauma were represented in the form of frequency and percentages. Nominal and ordinal parameters were tabulated and non-parametric tests like chi square were applied for comparing categorical variables between the groups. Continuous variables are given together with the mean value and standard deviation values. In this study, $p<0.05$ was considered significant. Description of the various surgical outcomes with respect to above mentioned criterion were given and

presented in the form of tables and diagrams whichever are appropriate.

RESULTS

In this study of 300 cases of polytrauma was seen uniformly across all age groups, predominantly in the prime of life between 21-30 years (28.3%) followed by 31-40 years age groups (19.7%) (Table 1).

Table 1: Age group wise distribution of polytrauma cases.

Age group (in years)	N (percentage)
≤20	17 (5.7)
21-30	85 (28.3)
31-40	59 (19.7)
41-50	51 (17)
51-60	42 (14)
61-70	43 (14.3)
>71	3 (1)
Total	300 (100)

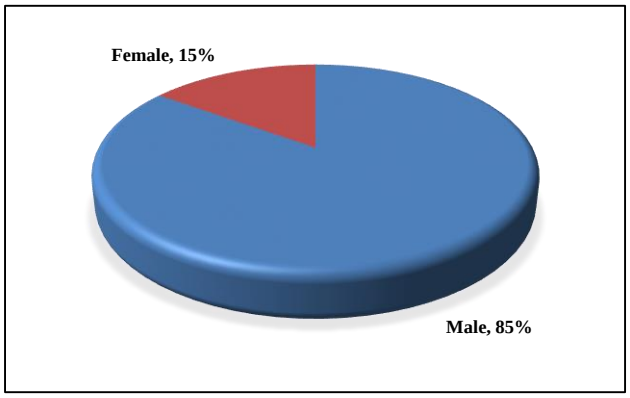

Figure 1: Gender wise distribution of polytrauma cases.

The mean age of presentation was 40.58 years. The gender distribution has male preponderance with a male: female ratio of 5.8:1 (Figure 1). The most common mode of injury observed in the study was road traffic accidents (51%), followed by fall from height which contributed 25% cases. The mechanism of injury was evaluated and blunt trauma accounted for 91% of the cases, followed by penetrating trauma which accounted for only 9% admitted cases.

Among 128 patients who presented within 2 hours of injury, 26 patients (20.3%) patients expired; 30 out of 145 patients i.e., 20.7% of the study population admitted within 2-8 hours died. Maximum mortality was observed amongst the patients who were admitted with a latent period beyond 8 hours in which 25.9% patients i.e. 7 out of 27 patients succumbed. The p value of the association between pre-admission time and mortality was found to be 0.803 which was insignificant as multiple factors besides latent period since injury influence the final outcome of the patient. This indicated that latent period between injury and admission has no association with the mortality of the patient.

Application of scoring systems

The ability to predict outcome from trauma (i.e. mortality) is perhaps the most fundamental use of injury severity scoring, a use that arises from the patient's and the family's desires to know the prognosis. In our study of 300 polytrauma patients; their GCS, RTS, ISS and NISS were calculated on admission. The following table summarizes the minimum, maximum and mean scores of these patients as computed in our study (Table 2).

Table 2: Comparison of mean scores of GCS, RTS, ISS and NISS.

Score	Mean±standard deviation
GCS	12.4±3.72
RTS	11.22±1.363
ISS	23.51±11.32
NISS	24.93±12.64

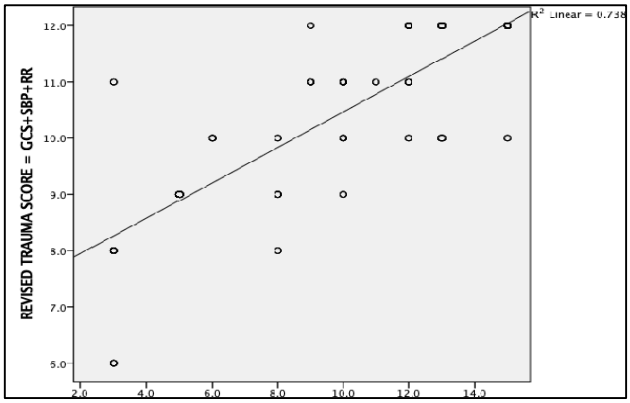

Figure 2: Correlation between GCS and RTS.

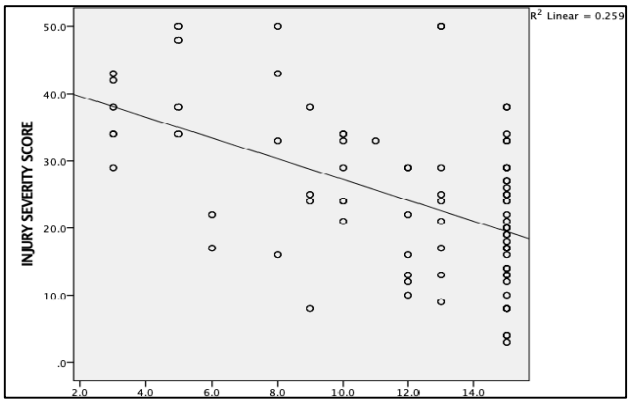

Figure 3: Correlation between GCS and ISS.

Both GCS and RTS have a positive correlation of 0.859 which is statistically significant at a p value of 0.001.

Higher GCS scores correlate with higher RTS scores (Figure 2). Both GCS and RTS have a positive correlation of 0.509 which is statistically significant at a p value of 0.001 (Figure 3). This can be understood as patients with poor GCS scores have more severe injuries and consequently higher ISS scores.

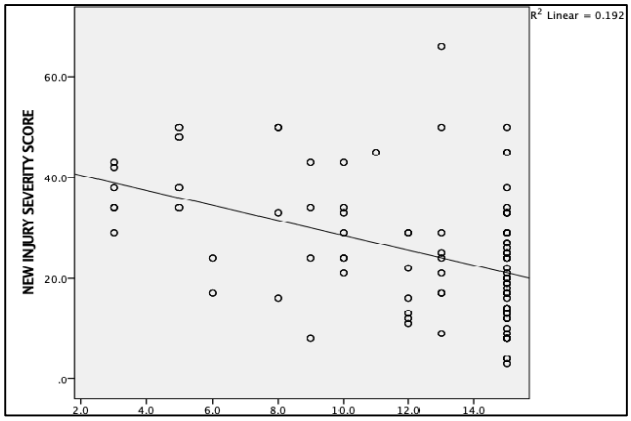

Figure 4: Correlation between GCS and NISS.

Both GCS and NISS have a negative correlation of 0.439 which is statistically significant at a p value of 0.001 (Figure 4). Lower GCS scores correlate with higher NISS scores. This can be understood as patients with poor GCS scores have more severe injuries and consequently higher NISS scores.

Correlation of RTS and ISS and NISS

The correlation between ISS and NISS was 0.959 which had a p value of <0.001 which was statistically significant. An increasing trend in ISS correlated with an increasing NISS. Both ISS and NISS were positively correlated an increase in ISS was seen to be associated with a corresponding increase in NISS. Both ISS and RTS have a negative correlation of 0.468 i.e. with an increase in RTS, the ISS decreases. This observation was statistically significant with a p value of <0.001. This can be understood as higher RTS and lower ISS both correspond to a better patient prognosis and outcome (Table 3).

Table 3: Correlation of RTS, ISS and NISS.

Scores	Pearson correlation	Sig. (2-tailed)
ISS versus NISS	0.959**	<0.001
ISS versus RTS	-0.468**	<0.001
NISS versus RTS	-0.390**	<0.001

Both NISS and RTS have a negative correlation of 0.39 i.e. with an increase in RTS, the ISS decreases. This observation was statistically significant art a p value of <0.001. This can be understood as higher RTS and lower NISS both correspond to a better patient prognosis and outcome. It was observed that both ISS and NISS have similar correlation with RTS.

Correlation between hospital stay and trauma scores of all the patients

This study showed that hospital stay had a weak correlation with GCS score (r=0.19) and moderate correlation with NISS score (r=0.11). There was poor correlation with ISS score (r=0.052) while RTS inversely correlated (r=-0.019) with hospital stay. In spite of the fact that the p values were statistically significant at 0.001, for RTS, ISS and NISS but not for GCS the correlation coefficient was weak for all trauma scores for hospital stay (Table 4).

Table 4: Correlation between hospital stay and trauma scores.

Trauma score	GCS	RTS	ISS	NISS
Hospital time	0.19	-0.019	0.052	0.11
P value	0.74	0.001	0.001	0.001

Association between hospital stay and mortality

All patients admitted in trauma were initially evaluated and simultaneously resuscitated. However, once the acute crisis had been tided over, patients were shifted from the ICU to general ward. In this study of 300 patients, mean duration of ICU stay was 5 days among survivors versus 18 days among those who died. The p value for the above was <0.001 indicating that a lesser duration of ICU stay is inversely related to mortality. The mean duration of hospital stay was 13 days among the survivors and 21 days among those who expired. The above data indicates that critical patients require prolonged duration of both ICU care and hospitalization (Table 5).

Table 5: Association between hospital stay and mortality.

Parameters	Death	Mean±SD	t (DF=298)	P value
Length of hospital stay (days)	No	12.95±12.60	-2.897	0.004
	Yes	21.33±37.40		
Length of ICU stay (days)	No	4.49±6.71	-5.641	<0.001
	Yes	18.57±36.10		

DISCUSSION

This prospective, observational study of 300 cases of polytrauma, carried out in a tertiary care centre, revealed that young men are most commonly afflicted due to trauma; with road traffic injuries as the leading cause. Most patients presented after a latent period of 2-8 hours since injury with predominantly accidental injuries. Blunt to penetrating injuries were seen in a ratio of 10:1.

In an attempt to summarize the severity of injuries sustained by polytrauma patients; GCS, RTS, ISS and NISS were calculatedon admission for all patients.

Total 21% mortality was observed in this study of which 5% patients succumbed early (<24 hours) despite all possible resuscitative efforts. Mortality was associated with lower GCS and RTS scores but higher ISS and NISS scores. As we have seen that young adults are more commonly involved, trauma is contributing to loss of productive years of life. Thus, prevention and measures to decrease morbidity and mortality from polytrauma is essential. This can be achieved by observance of traffic rules both by pedestrians and drivers, wearing seatbelts, use of helmets, avoiding crossing railway tracts and refraining from alighting as well as boarding of moving trains.

The age of 300 patients studied ranged from 19 to 72 years. Most of the patients 28.3% were between 21-30 years followed by 19.7% between 31-40 years. The mean age of presentation was 40.58 years. The age incidence was shown to be variable in different series, but the results are comparable to findings of Puri.et al and Shahram et al who stated that in polytrauma patients, most common age of presentation was between 15 and 30 years and 15 and 44 years respectively.[3,4]

The male: female ratio was 5.8:1. The findings were synonymous with the results of the study conducted by Puri et al, Makanga et al where male:female ratio were 5:1 and 4.13:1 respectively.[3,5]

Latent period is the interval between the time of injury to the time of admission. In our study 128 (40%) out of 300 patients were admitted within 2 hours of injury and of this mortality of 26 patients was observed. Most of the patients (48.33%) presented between 2 to 8 hours since injury. There were 30 mortalities in this group. Amongst 27 patients who were admitted beyond 8 hours, 7 patients expired. Mortality increases as the time interval between injury and hospital admission increases. Among patients admitted beyond 8 hours since injury, 25.9% patients expired whereas among patients admitted within 2 hours of injury, 20.3% patients died. However, the p value for association between latent period and mortality was 0.803 which is not statistically significant. This indicates that the time elapsed between injury and definitive treatment at a tertiary centre does not impact the mortality of trauma patients as critical patients are stabilized at a local facility before being transferred to a tertiary hospital and those presenting beyond 8 hours usually have minor to moderate injuries and are hemodynamically stable.

63 patients (21%) of the total 300 patients studied died in the present study. Ofthese 63 patients, 15 expired within first 24 hours of admission. This is comparable to findings of Ali et al, which showed a mortality rate of 22% in adult trauma patients. Mean GCS and mean NISS had comparable values in our study and Ali et al.[6] However, mean RTS in our study was 11.22±1.363 but was only 6.9±1.6 in study by Ali et al.[6] Mean ISS in our study was found to be greater at 23.51±11.32 while it was only 19.9±13.7 in the findings of Ali et al.[6] In the study conducted by Reyhan et al, mean GCS was not computed while RTS, ISS and NISS had very low values compared to the other two studies.[2]

In both studies, RTS was correlated negatively with hospital time which was statistically significant at a p value of 0.001. This meant that patients with higher RTS scores had less severe injuries and were consequently discharged earlier from the hospital. In our study, ISS had a weak positive correlation of 0.052 with hospitalization time whereas in Reyhan et al, the correlation was relatively strong at 0.36.[2] In our study, NISS had a moderate positive correlation of 0.11 with hospitalization time whereas in Reyhan et al, the correlation was relatively stronger at 0.42.[2]

As this study has been carried out over a limited period of time with limited number of patients and there was lack of financial and infrastructural support, the study results are enough to be of reasonable precision. Moreover, the study population and area were restricted only to a single tertiary level hospital, the significance of this score in other populations is yet to be studied. All of the facts and figures mentioned here may considerably vary from those of large series covering wide range of time, but still then, as the cases of this study were collected from a tertiary level hospital in our country, this study has some credentials in reflecting the factors/parameters involved in polytrauma and their correlation with the outcome and management of the trauma patients.

CONCLUSION

The study confirmed the well-known fact that predominantly younger population of 21-30 years that constitute the reproductive age group is affected by trauma with a marked male preponderance. Road traffic accidents form the most common mode of injury. All patients should have their GCS and RTS scores computed on admission along with the primary survey as they are good predictors of outcome and can predict salvageable patients from the non-salvageable ones. These scores can assist in rapid triage and help to direct the already scarce resources in the ICU such as ventilator to salvageable patients over those who are moribund. GCS and RTS can significantly predict outcome in terms of mortality, ventilatory support and end organ failure.

Further research with an ample number of such patients can be contemplated so that the external validity of the study can be concluded. Furthermore, the need for life saving interventions such as intubation, chest tube insertion, blood transfusion etc. within first the golden hour of admission can be evaluated.

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