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Original Research Article

Assessment of trauma and injury severity score model for survival of trauma patients: a single centre experience

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ABSTRACT

Background: Trauma and Injury Severity Score (TRISS) designed by Major Trauma Outcome Study (MTOS) in United States, is commonly used for outcome prediction in polytrauma patients. It determines the probability of survival (PS) of a patient from the Injury Severity Score (ISS) and Revised Trauma Score (RTS) using TRISS methodology.
Methods: A total number of 136 patients presenting within 24 hours of trauma that were admitted were included in the study. The probability of survival was calculated using TRISS index (RTS, ISS, and age combination index). The predicted probability of survival and that of death among the study subjects were calculated using TRISS. A cut off 0.5 or lesser of TRISS score was taken as death and above 0.5 as survival status.
Results: The mean TRISS among males and females were 86.12±21.76 and 79.49±27.70 and based on TRISS score the expected deaths were predicted to be 11.03%. But, in actual, the deaths were 23.52% showing a negative correlation with TRISS score in our set up thereby indicating a need to improve emergency facilities for trauma patients.
Conclusions: TRISS methodology when applied to our setup predicted fewer deaths as compared to the actual deaths and also did not accurately predict the survival in the trauma patients.

Keywords: Injury severity score, Polytrauma, Survival rate, TRISS

INTRODUCTION

Trauma is an important health problem worldwide.[1] According to the chronological occurrence of death, trauma deaths are assorted in a tri-modal distribution. "Immediate deaths" which happen immediately after trauma are due to non-salvageable injuries. "Early deaths" occur in the first six hours and are due to conditions like continuous blood loss. "Late deaths" occur days or weeks after in the hospital and are due to sepsis or multiple organ failure. In traumatology, improvement of survival rate focuses on reducing the number of "early deaths", beacause they are deemed preventable.[1,2]. Trauma and Injury Severity Score (TRISS) designed by Major Trauma Outcome Study (MTOS) in United States, is commonly used to predict outcome in polytrauma patients. It determines the probability of survival (PS) of a patient from the Injury Severity Score (ISS) and Revised Trauma Score (RTS). Lack of studies about TRISS in Indian scenario is the rationale behind conducting this study.

METHODS

In this longitudinal study conducted at a tertiary care academic hospital, patients of age more than 18 years with a history of trauma presenting within 24hrs and requiring admission at tertiary care hospital were included in this study. Patients treated on OPD basis or being referred from other hospitals and those with co

morbid conditions like congestive heart conditions, chronic pulmonary disease or burns were excluded from the study. A predesigned performa was used to collect the data among the study population. The performa included socio demographic factors like age, gender, residence etc. It also had details of injury like time of injury, time interval between trauma and hospitalization, mode of injury, region and site affected etc. The vital signs like blood pressure, respiratory rate and appropriate investigations were also documented on admission.

TRISS methodology

The probability of survival was calculated using TRISS index (RTS, ISS, and age combination index).

The revised trauma score (RTS) is made up of a combination of Glasgow Coma Scale (GCS), Systolic blood pressure (SBP), and respiratory rate (RR). The score ranges from 0-12. The sum of these three parameters is revised trauma score (RTS).

RTS = 0.9368 (GCSc) + 0.8326 (SBPc) + 0.2908 (RRc)

*[c is for code].

The Injury severity score (ISS) as calculated by abbreviated injury score (AIS) is a simple numerical method for grading and comparing injury by severity. The AIS is a consensus derived, anatomically based system of grading injuries on an ordinal scale ranging from 1 (minor injury) to 6 (Lethal injury). The ISS is defined as the sum of squares of the highest AIS grade in the 3 most severely injured body regions. Only one injury per body region is allowed. The ISS ranges from 1-75, and an ISS of 75 is assigned to anyone with AIS of 6. The higher are the ISS values the more serious the trauma is. It identifies all anatomical injuries (from clinical examination, imagery examinations, surgical procedures or autopsy) on six body regions: 1. Head and neck, 2. Face, 3. Chest, 4. Abdomen, 5. Extremities (including pelvic bones), 6. External injuries

Calculating formula

$ISS = (AIS1)^2 + (AIS2)^2 + (AIS3)^2$.

The comparison between the predicted and actual outcome and various systems of evaluation has been made. TRISS is widely used method to predict probability of survival P(s) based on formula:

$P(s) = 1/(1+ e^{-b})$ e = 2.718282 (base of natural logarithm),

$b = b_0 + b_1$ (RTS) + b_2 (ISS) + b_3 (Age index).

For patients under 55 years old, the age index is = 0, but for patient >55 years old the age index is = 1. The coefficients b_0, b_1, b_2, b_3 are produced from multiple regression analyses from database. The predicted death rates in present study were calculated. A cut off of 0.5 or lesser of TRISS score was taken as death and above 0.5 as survival status.

Statistical analysis

Data was collected, compiled, and analysed using Epi Info version 7.2. The qualitative data was expressed using percentages. The quantitative data was expressed in terms of mean and standard deviation. The difference between the two proportions was analysed using Fisher's exact/ chi square test. The difference between two means has been analysed using unpaired t test. For assessing the trend of variables chi square for trend were applied. All analysis was two tailed and the significance level was set at 0.05.

RESULTS

A total of 136 cases were enrolled in two study years. Mean age of the patient was 38.39 Years (S.D. 16.36 years). Male to Female ratio was 5.47:1. Majority of the study subjects had come with history of road traffic accidents followed by fall from height and assault cases. Majority of the study subjects had systolic blood pressure of more than 89 mmHg (86.76%) followed by 76 to 89 mmHg (7.35%) and 50 to 75 mmHg (4.41%). Only two patients were having systolic blood pressure less than 49mmHg.

Majority of the study subjects were having GCS 15 to 13 followed by 12 to 9 (32.35%) and 8 to 6 (8.09%). And 5 to 4 was in 7.35% cases. Majority of study subjects were having respiratory rate of 10 to 29 per min. About 12.50% patients were tachypnoeic and 1.47% had respiratory rate of 6 to 9. Based on these parameters, the revised trauma scores among males and females were 7.04±1.07 and 6.67±1.41 respectively. The difference was found to be statistically insignificant (p>0.05).

The Injury severity scores among males and females were 25.67±13.34 and 24.22±8.91 respectively. This difference was not statistically significant. (p>0.05).

The TRISS among males and females were 86.12±21.76 and 79.49±27.70 respectively and this difference was not statistically significant. (p>0.05) as shown in Table 1.

Table 1: Distribution of study subjects based on the TRISS scores.

TRISS scores	Males		Females		Total	
	Mean	SD	Mean	SD	Mean	SD
	86.12	21.76	79.49	27.70	85.10	22.79
P value 0.3084*						

*Un Paired t test applied

Majority of the study subjects had come with history of road traffic accidents followed by fall from height and assault cases.

Based on the TRISS scores, we found the expected deaths to be 11.03%. But in actual the deaths were 23.52% (Table 2).

Table 2: Distribution of study subjects based on the expected deaths and incidence of deaths.

Status of the patient	Expected		Incidence	
	Number	%	Number	%
Died	15	11.03	32	23.52
Survival	121	88.97	104	76.48
Total	136	100	136	100

DISCUSSION

In trauma, scores are used to obtain a numerical description of the severity of an individual's injuries and clinical condition, which in turn is associated with prognosis. Since the initial Injury Severity Score(ISS) was proposed, it has become a common language for the healthcare community to compare mortality rates based on severity and also a basis for clinical decision-making, and for research purposes. As ISS covers only 3 different regions of the body and only measures one injury per region, its most important limitation is in penetrating trauma. Consequently, severe injuries with a high score are masked because they are in the same area of the body, given that involvement of other organs is not considered. TRISS was developed by Champion et al and they observed that the anatomical description of injuries using the ISS needed the additional information of the patient's physiologic response.[3] It was developed based on the data from the Major Trauma Outcome Study and is an estimate of the probability of survival, with a result between 0 and 1.

The mean revised trauma scores of our study were 6.98±1.14. A study conducted by Deshmukh VU et a1 reported the revised trauma scores reported it to be 6.63±1.79 and another study by Karsteadt et al reported 6.6±1.7.[4,5] These scores were in accordance with our study. Further, we did not find any significant difference between the revised trauma scores among both the gender. The injury severity scores of our study were 25.47±12.74 which were comparable to the findings of Deshmukh et al.[4] But lower scores were reported by Domingues et al and Karsteadt et al.[5,6] Further, we did not find any significant difference between the injury severity scores between the males and females.

The mean TRISS scores in our study were 85.10±22.79. A study conducted by Domingues et al reported similar results.[6] Based on the TRISS scores, the calculated death rate in our study was 11.03%. But in actual the deaths were more than the predicted (23.52%). Males were more commonly involved when compared to females in terms of death rates and the age group of more than 50 years was more commonly involved. A study conducted by Moon et al predicted deaths in their study to be 11.13% and in reality the deaths were 12.64% and this difference was not significant.[7] Similar findings were reported by Narouzi et al and Fernandez et al.[8,9]

Deshmukh et al conducted a study to evaluate the outcome of severely injured patients using the TRISS method in a developing country like India and to compare it with the major trauma outcome study (MTOS).[4] A prospective study of 300 patients of trauma was done. Outcome assessment was done for the severely injured patients using the TRISS method. Road traffic accidents (213 cases) were the most were categorised as cause of injury. Fifty-seven (19%) cases were severely injured having an injury severity score ≥16. Outcome assessment was done for these patients using the TRISS method. The predicted mortality was 15.7%, while the observed mortality was 33.3%. The mean revised trauma score was 6.63±1.79 and the mean injury severity score (ISS) was 23.7±8.17. Compared to the MTOS, the patients in the present study had more severe injuries with higher mortality. Mazandarani et al (2016) conducted a study to compare the ability of trauma injury severity score (TRISS) and acute physiology and chronic health evaluation (APACHE) III in predicting mortality of intensive care unit (ICU) admitted trauma patients which was a prospective cross-sectional study that included ICU admitted multiple trauma patients of Imam Hossein and Hafte-Tir Hospitals, Tehran, Iran, during 2011 and 2012.[10] Demographic data, vital signs, mechanism of injury and required variables for calculating APACHE III score and TRISS were recorded.[10] The accuracy of the two models in predicting mortality of trauma patients was compared using area under the ROC curve. 152 multiple trauma patients with mean age of 37.09±14.60 years were studied (78.94% male).

48 (31.57%) cases died. For both APACHE III and TRISS, predicted death rates significantly correlated with observed death rates ($p < 0.0001$). The mean age of dead patients was 37.21±14.07 years compared to 37.03±14.96 years for those who survived ($p = 0.4$). The area under ROC curve was 0.806 (95% CI: 0.663-0.908) for TRISS and 0.797 (95% CI: 0.652-0.901) for APACHE III ($p = 0.2$). To summaries, the most common mode of injury in present study was road traffic accidents, which is a public health issue nowadays. TRISS methodology applied to our setup predicted fewer deaths when compared to the actual deaths occurred in our study showing a scope of improvement in managing the emergency trauma subjects and also a better scoring system for accurately predicting mortality in trauma patients.

CONCLUSION

This study concludes that road traffic accidents were the commonest mode of injury affecting mainly the male gender of younger age group and the TRISS methodology when applied to our setup predicted fewer deaths as compared to the actual deaths and also did not accurately predicted the survival in the trauma patients.

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