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TRISS score- A guide for survival in trauma patients

General Surgery

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ABSTRACT

India is rapidly developing and is currently one of countries with the fastest growing economy in the world. Due to the rapid economic transition, there is an increase in number of automobiles in the road and rapid increase in RTA. One person die every four minutes in India Each day 400 people die due to RTA. There are so many injury scores has been developed but among them only few were able to come in practice. Among them TRISS score has shown promising results in predicting survival of trauma patients. In 1981, the Trauma Score Injury Severity Score (TRISS) was introduced as an instrument to identify trauma patients with unexpected outcome and to compare patient outcomes among institutions. TRISS combines an anatomic scoring system, the Injury Severity Scale (ISS) and a physiologic scoring system, the Revised Trauma Score (RTS), as well as age and mechanism of injury, to calculate the individual patient probability of survival.

KEYWORDS:

TRISS Score, Injury severity score, revised trauma score, GCS score, probability of survival.

INTRODUCTION

India is rapidly developing and is currently one of countries with the fastest growing economy in the world. Due to the rapid economic transition, there is an increase in number of automobiles on the road and resulting into rise in number of road traffic accident (RTA). One person dies every four minutes in India. Each day 400 people die due to RTA while each year 300,000 people die of RTA and more than 8 million people suffer injuries. In the past one decade, over 1.3 million people have been killed in road accidents. India is the leading country in the number of deaths due to RTA.[1]

Trauma is time-sensitive condition, especially during the first hour of trauma. Easy-to-use trauma scoring systems inform physicians of the severity of trauma in patients and help them decide the course of trauma management. Resuscitation, assessment, management and definitive care are very important. Providing definitive care early at trauma centres has shown to decrease mortality.[2]

Many trauma scoring systems have been developed and used. For instance, the Revised Trauma Score (RTS) is most widely cited used. The Trauma and Injury Severity Score (TRISS) system was developed in the 1980s to improve the prediction of patient outcome following trauma through the use of age, physiological and anatomical criteria.[3]

TRISS combines an anatomic scoring system i.e the Injury Severity Scale (ISS) and a physiologic scoring system i.e the Revised Trauma Score (RTS) as well as age and mechanism of injury to calculate the individual patient probability of survival. The RTS consists of three physiologic parameters; Glasgow Coma Scale (GCS), systolic blood pressure and respiratory rate. The ISS provides an overall injury severity for patients with multiple injuries.[4,5]

The key mathematical element of TRISS is the logistic function
$Ps=1/(1+e^{-b})$
e= 2.718282 (base of natural Naperian logarithms)
where Ps is an estimate of the patient's probability of survival and
$b=b0+b1(RTS)+b2(ISS)+b3(AGE)$

Age index = 0 for < 54 years
1 for ≥ 55 years.
Coefficients derived from the MTOS are:

Mode of injury	Constant(α)	RTS(β1)	ISS(β2)	Age(β3)
Blunt	-0.4499	0.8085	-0.0835	-1.7430
Penetrating	-2.5355	0.9934	-0.0651	-1.1360

In this study, we calculated individual probability of survival in trauma patients by using TRISS score and simultaneously compared with GCS, RTS and ISS scoring system.

MATERIAL AND METHODS

This study was conducted in the Department of surgery, Pandit Bhagwat Dayal Sharma, Post Graduate Institute of Medical Sciences, Rohtak, India. 100 consecutive patients irrespective of age and sex formed the material of study.

Inclusion Criteria:

- Patients with history of trauma including referrals from primary health centre, community health centre and other private hospitals.
- Patients with all injuries including cranio-cerebral, blunt, penetrating chest and abdomen.

Exclusion Criteria:

- Patients with pure orthopedics injuries.
- Unknown patients.
- Burn patients.

The patients of Trauma admitted to the accident and emergency department were identified and informed consent was obtained from the patient/attendants for inclusion in the study. Required data for TRISS was collected. TRISS score was calculated at the time of reporting of patient in accident and emergency department after all necessary investigations. After recording all details, patients were followed till discharge or death. Data so collected was put in the formula of TRISS.

Statistical analysis:

At the end of study, complete data was analyzed. Data were collected prospectively in a Microsoft Excel Database. After completion of data collection, the database was imported into SPSS for Mac (v24.0, SPSS, Chicago, IL, United States). Continuous base line descriptive variables were expressed as mean with standard deviation and were compared using Mann- Whitney Test and univariate ANNOVA test. Categorical variables were expressed as absolute numbers and proportions. Statistical significance was assessed by Chi-square (for categorical variables) and T-test or Analysis of variance (for continuous variables). Receiver Operating Characteristic (ROC) curves were calculated for GCS, RTS and TRISS scores using cut-off values and predictive accuracy of each scoring system was measured by the area under the ROC curve (AUC) with standard error and 95% confidence intervals (CI). A p value of <0.05 was considered statistically significant.

OBSERVATIONS & RESULTS

This study included 100 patients out of which 83 were discharged while 5 patients expired and 12 patients left against medical advice. Along with TRISS score, various parameters were also analyzed: -

- Age and sex distribution: The mean age of patients in the study was 34.23 years. A majority of the patients were in a range of 20-29 years. The study included 24% female patients and 76% male patients showing male preponderance and young age group more involved in trauma.

- Mode of injury: This study consisted of 66% of RSA, 17% of assault and 17% of patients with history of fall from height. Out of these only 9% of patients had history of consumption of alcohol.

- Patterns of injury: Majority of patients in this study had head injury (88%). Associated orthopedic trauma was seen in (14%), chest injury in (12%) and 5% had abdominal trauma.

- Analysis of GCS score: In the present study 78% patients had mild brain injury, 7% moderate brain injury and 15% of patients had severe brain injuries.
  Mean GCS of mild brain injury was 14.602
  Mean GCS of moderate brain injury was 10.428
  Mean GCS of severe brain injury was 5.333.

- Analysis of RTS score: This study consisted of 85 patients with RTS score 6-8, 13 patients with RTS score 5-6 and 2 patients with RTS score 3-5. Minimum RTS score in our study was 3.361 and maximum was 7.841.

- Analysis of ISS score: Minimum ISS calculated was 4 and maximum was 54 with an average ISS score of 19.22.

- **Comparison of mean values for TRISS, ISS and RTS score**

	ISS	RTS	TRISS
Mean score of patients who were discharged	18.180	7.519	95.315
Mean score of patients who were expired	26.6	5.908	73.84
Mean score of patients who left against medical advice	23.333	7.138	89.808

The mean values suggested that there was direct relationship of mortality with ISS score. More the ISS score more would be the chances of mortality. The mean values of RTS suggested that there was inverse relationship with mortality. The mean value of TRISS suggested that there was also inverse relationship with mortality.

- On applying t-test on various scores for the validation of outcome in terms of survival.

Score	t- value	p- value	Significance at p < .05	impression
RTS	4.20882	0.000063	Significant	Good
ISS	-1.8474	0.068128	Not significant	Not good
GCS	4.5707	0.000016	Significant	Good
TRISS	4.8064	<0.00001	Significant	Good

- On applying chi-square test on TRISS score for validation for probability of survival.

Results: The chi-square statistic was 7.5006. The p- value was 0.006168. The result was significant at p<.05.

The statistics result showed that sensitivity of TRISS was 98.80% on 95% CI while specificity was 20.00% on 95% CI. Positive predictive value was 95.35% and negative predictive value was 50.00% on 95% CI.

- Analysis of Scoring systems with ROC curve:

Area under the curve was maximum for GCS while minimum for RTS score.

Comparison of cut-off value of TRISS with length of hospital stay:

	Number of patients	Mean length of stay
TRISS below cut off i.e. 88.150	9	14.6666667
TRISS above cut off i.e. 88.150	91	5.86486486

- On these variables, Mann Whitney U test was applied.

Results: The Z-Score was -3.2294. The p-value was .00124. The result was significant at p < .05.

The results of Mann Whitney U test suggest that the patients with TRISS less than cut off value would be having longer duration of hospital stay while patients with TRISS more than cut off value would stay for shorter duration in hospital.

- On applying ANOVA test for various trauma scores, p-value of TRISS score was minimum (<0.00001).

DISCUSSION

Prediction of survival in trauma patients particularly those with polytrauma is very important from treatment angle as well as giving rough prognostic forecast of patient to the relatives. The current study has been able to fulfill this criterion to some extent.

A majority of the patients in the present study were in a range of 20- 29 years. The mean age was 34 years. Brainard et al6 studied Injury profiles and in their study the majority of the victims were men (72%), and the average age of all patients was 35 years. Allen et al7 also studied that mean age was 39 years.

In the present study, 66% patients were of RSA, 17% of assault and 17% of patients had history of fall from height. In the study of Daly and Thomas,8 road traffic accidents was found to be the commonest cause of death from trauma. Zargar et al9 found that road traffic accident as the main cause of injury, followed by stab wound (89

cases, 32.1%) and injuries by fall from height (32 cases, 11.6%).

In the present study, 88% pateints were of craniocerebral trauma, 14% had orthopaedic trauma, 12% chest injury and 5% abdominal truma. Jaspal Singh et al10 found that head and injuries as the commonest injuries (43.7%) followed by lower limb injuries (33.8%). The findings of the present study are comparable with results in this regard with other studies.[11-13]

ANALYSIS OF GCS SCORE: In the present study, 78% patients had mild brain injury, 7% had moderate brain injury and 15% patients had severe brain injuries. The statistical data suggested that GCS score provide a good prediction for survival in head injury patients and similar results were also found in other studies.[14]

RTS SCORE ANALYSIS: The RTS score of patients in the present study was calculated and it was found that minimum RTS score in present study was 3.361 while maximum was 7.841. The mean value of RTS score for discharged patients was 7.519 and for expired, it was 5.908. On applying t-test, the p-value was .000063. In the study of Gustavo et al,14 the mean Revised Trauma Score (RTS) was 7.1 and in the study of Koo et al15 involving 198 patients, the mean RTS was 10.8 (2.5). Accordingly, RTS appears good score in predicting outcome of trauma patients.

ISS SCORE ANALYSIS: In the present study, minimum ISS score was 4 while maximum was 54. Mean ISS score of discharged patients was 18.180 while that for expired was 26.6. Bishop et al16 studied 434 patients and found a mean ISS score of 21. Chong et al17 found a mean ISS score of 20 in a study of 343 patients.

ANALYSIS OF TRISS SCORE: The TRISS score was calculated in 100 patients of trauma in this study and it was observed that mean TRISS score for discharged patients was 95.315± 8.689 while mean TRISS score for expired patients was 73.84± 21.824. On applying t-test on TRISS score for the validation of outcome in terms of survival, the t-value was 4.8064. The p-value was < .00001. On applying chi-square test on TRISS score for validation for probability of survival, the chi-square statistic was 7.5006. The p-value was 0.006168 sensitivity of TRISS was 98.80% on 95% CI while specificity was 20.00% on 95% CI. Positive predictive value was 95.35% and negative predictive value was 50.00% on 95% CI. On applying ANOVA test on TRISS score, f-value was 23.10145 and p-value was <0.00001. ROC curve was plotted and it was found that sensitivity and specificity of TRISS score was maximum at 88.150. Goel et al18 studied 180 trauma patients and TRISS methodology was applied to 88.6% of patients. All the 113 survivors had a probability of survival more or equal to 0.5 and were considered expected survivors. Among the 42 deaths, 32 had a probability of survival more or equal to 0.5 and were considered unexpected deaths, while 10 of the deaths had a probability of survival <0.5 and were expected deaths.

CONCLUSION

This study was conducted for evaluation of survival prediction by using TRISS score in a trauma patient and was carried out in 100 patients. The data so collected from patients was analyzed using SPSS statistics and results were as follows:

1. The mean age of trauma patients was 34.23 years. Majority of patients were in middle age group and peak incidence of trauma was in 20-29 age group and out of them 76% were males and 24% were females in the study with male to female ratio of 3.17:1.

2. The most common etiology was RSA in the present study. This study consisted of 66% of RSA, 17% of assault and 17% of patients with history of fall from height and only 9% patients were under effect of alcohol.

3. The most common impact of trauma was found to be blunt. Our study consisted of 1% of patients with penetrating injuries while 99% with blunt traumatic injuries. In the present study, 88% of patients suffered from head injury.

4. A total number of 83 patients were discharged after a mean 6.819 days of duration. A total of 25 patients expired and had a mean length of stay of 7.6 days.

5. In this study t-test was applied on GCS score and t-value was 4.5707. The p-value was .000016. Hence, GCS can predict the survival in a trauma patient.

6. Minimum RTS score in the present study was 3.361 and maximum was 7.841. On applying t-test on RTS score for the validation of outcome in terms of survival the t-value was 4.20882. The p-value was 0.000063. Hence, RTS score can also predict the survival in a trauma patient.

7. It was observed that mean TRISS score for discharged patients was 95.315 and cutoff value was 88.15 after obtaining data from ROC curve. This value was statistically significant (p-value was 0.00124).

8. In the present study, sensitivity of TRISS was 98.80% on 95% CI while specificity was 20.00%. Positive predictive value of TRISS was 95.35% and negative predictive value was 50.00%.

To conclude, TRISS score is a good predictor for survival of a trauma patient. It can be used as a triage at the site of trauma. It is superior from other trauma scoring systems as it includes age, physiological and anatomical parameters at the same time.

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