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Evaluation of the usefulness of Trauma and Injury Severity Score (TRISS) versus BIG Score in Management of Polytrauma Patients at Menoufia University Hospitals

Athar Fekry Lasheen [1*], Ayman Ahmed Omar [2], Samar Soudi Abo Nawarg[2]
1- Emergency Medicine, 2-General Surgery Department, Faculty of Medicine, Menoufia University, Egypt
***Corresponding author:** Athar Fekry Lasheen, **Mobile:** +201225898608, **E- mail:** Lasheen.asar@gmail.com

ABSTRACT

Background: Trauma is a worldwide cause of death and morbidity for all age groups. Accurate early prediction of mortality risk could facilitate triage decisions, therapy, or additional care. Multiple scores were developed for the purpose of prediction of early outcomes in polytrauma patients.

Objective: This research aimed to compare the predictive performance of the TRISS, and BIG score (Base deficit (B), International normalized ratio (I), and Glasgow Coma Scale (G)) in an adult trauma population at Menoufia University Hospitals.

Patients and methods: This was prospective comparative research done on 200 polytrauma adult cases, who were presented to the Emergency Department of Menoufia University through the period from October 2023 till October 2024. All patients were assessed by primary and secondary survey. TRISS and BIG scores were applied to assess their performance, the relation between the two scores and the outcomes were analyzed.

Results: TRISS and BIG scores were applied on 200 adult patients with trauma meeting inclusion criteria. The mean age of cases in group A was 42.8 ± 15.7, vs 43.6 ± 15.1 in group B where males were more than females. The Road Traffic Accident has been observed to be the most frequent cause. There was a statistically significant relation between TRISS, BIG score and the ED outcomes. The mortality rate in ED was 10% & 7% in group A and group B respectively. A BIG score of 15.75 was determined as the cut-off, with 94.4% sensitivity and 81.51% specificity. The cut-off point of TRISS score was 24.6, with sensitivity and specificity of 92.3 % and 81.6% correspondingly.

Conclusion: The TRISS and BIG scores could be satisfactorily predict mortality and interventions in a case of adult multiple trauma.

Keywords: BIG score, Emergency Department, Polytrauma, TRISS, Outcomes.

INTRODUCTION

Trauma-related morbidity and death represent a significant concern and prevalent health problem across all age groups. The total death rate of trauma cases in Emergency Center has progressively risen [1, 2].

A variety of techniques for polytrauma treatment exist to enhance the management of these cases and to identify predictive factors of morbidity and mortality, hence facilitating the establishment of preventative measures against trauma [3].

Particular instruments include trauma scores, which are expressed as numerical values that fluctuate based on the severity of injuries resulted from trauma, particularly in the pre-hospital environment and throughout initial care in the emergency room [4].

Numerous trauma scores exist, varying in complexity for practical application. The New Injury Severity Score (NISS), Injury Severity Score (ISS), Revised Trauma Score (RTS), and Trauma and Injury Severity Score (TRISS) are widely utilized scoring systems [5, 6].

TRISS is a combination index dependent on ISS, RTS, and cases' age. The methodology gives a standardized approach for following up and evaluating the results of trauma care. Physiological, anatomical, and age-characteristics are utilized to assess the possibility of survival in relation to injury severity [7].

The BIG score comprises base deficit, Glasgow Coma Scale (GCS). and international normalized ratio (INR). Its accuracy hasn't been evaluated against existing trauma death prediction instruments for adults [8]. So, the goal of this investigation was to assess the findings and death prediction of BIG score in an adult traumpa population, and comparing its predictive ability with the frequently utilized mortality-predicting TRISS.

PATIENTS AND METHODS

This prospective research performed in Menoufia University hospitals, it was done over 200 patients presented to Emergency department from October 2023 till October 2024 following obtaining an approval from the Hospital Local Medical Ethics Committee.

Study population: The studied cases have been separated into two groups (100 in each group):

- **Group A:** TRISS group assessed by TRISS score
- **Group B:** BIG group assessed by BIG score.

Inclusion criteria: All patients of both gender (18 years old or more) presenting by polytrauma.

Exclusion criteria: Cases under eighteen years old. Cases undergoing cardiopulmonary resuscitation on arrival. Pregnant female. Information has been gathered

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in pre-organized data sheet (Case Sheet). All cases have been exposed to the following:

- ☒ **Full history taking**
- ☒ **Thorough clinical examination using (ABCDE) protocol:**

Primary survey (ABCDE): Airway & cervical spine control, disability and exposure, breathing, circulation and hemorrhage control.

Secondary survey included: Allergy, Medication, Past illness/pregnancy, last meal and events related to injury.

Investigations: Radiological: X-ray (chest and pelvis), abdominal US and CT abdomen & chest if needed.

Laboratory: CBC, PT, INR, ABG, urea, creatinine, liver functions and blood glucose level. **eFAST** was performed as part of primary survey to detect the fluid collection in four spaces in addition to lung view by non-radiologist emergency sonographer.

Calculation of TRISS score by calculator and BIG score as [base deficit + (INR × 2.5) + (15 − GCS)]. Follow up of the patients and outcomes were reviewed. The relation between the two scores and the outcome were analyzed.

Statistical analysis

Information was gathered, tabulated and statistically examined utilizing an IBM compatible personal computer with SPSS statistical package version 26 (IBM SPSS statistics for windows, version 26.0 on IBM compatible computer). 2 types of statistical analysis have been carried out: a) Descriptive statistics: Qualitative information was expressed in percentage (%) & number (No), whereas quantitative information was represented as standard deviation (SD), mean ($\bar{x}$), range and median.

b) **Analytic statistics** e.g., Student's t-test (t) is a test of significance applied for comparison of quantitative variables among 2 groups of normally distributed information, whereas Mann-Whitney's test (U) has been applied for comparison of quantitative variables among both groups of not normally distributed information. Chi-square test (χ^2) has been applied to examine correlation between qualitative variables. P value above 0.05 has been deemed statistically non-significant. P value ≤ 0.05 was deemed statistically significant. P value not more than 0.001 has been deemed statistically highly significant.

Ethical Consideration: Written consents were taken from the participants, which has been permitted through the ethical committee of, Emergency Medicine Department, Faculty of Medicine, Menoufia University. Participation in the research was voluntary and each patient has the right to withdraw from the research when he wants. Confidentiality and anonymity of the participants were assured through coding. The research participants were not recognized through name in any report or publication regarding this research. Prior to the participants have been admitted in this investigation, the nature and purpose of the research, in addition to the risk/benefit evaluation has been clarified to them. The study followed The Declaration of Helsinki through its excution.

RESULTS

The mean age of cases presented in a trauma event in group A was 42.8 ± 15.7, ranged from 18 – 70 vs 43.6 ± 15.1, and a range of 19 – 77 in group B. Males were more than females in both groups. There was insignificant variance among the examined groups with regard to their co-morbidities (p value > 0.05). Also, there was no significance among both groups regarding the mode of trauma, where most of patients presented by Road Traffic Accident (RTA) (67% & 74% respectively) (Table 1).

Table (1): Socio-demographic characteristics, medical history and mode of trauma in examined groups (N=200)

		Group A (number=100)	Group B (number =100)	P value
Age (Years)	Mean ± SD Range	42.8 ± 15.7 18 – 70	43.6 ± 15.1 19 – 77	0.707*
Sex	Male Female	76 (76 %) 24 (24 %)	72 (72 %) 28 (28 %)	0.519#
DM		30 (30%)	33 (33%)	0.648#
HTN		45 (45%)	49 (49%)	0.571#
Smoking		45 (45%)	51 (51%)	0.396#
CKD		6 (6%)	12 (12%)	0.138#
Mode of trauma RTA FFH Alleged assault Building collapse		 67 (67 %) 11 (11 %) 10 (10 %) 12 (12 %)	 74 (74 %) 10 (10 %) 12 (12 %) 4 (4 %)	 0.206

N: number, Range: minimum-maximum, ***:** Student's t test **#:** Chi squared test.

Regarding the primary triage of the patients and laboratory data, there was insignificant variance among the examined groups regarding (ABCDE approach), or laboratory findings (HB, INR, creatinine and liver functions as p-value above 0.05 (Table 2).

Table (2): Comparing the primary survey and laboratory data among the studied groups (Number=200)

		Group A (number =100)	Group B (number =100)	P value
Airway	Patent Threatened	66 (66 %) 34 (34 %)	63 (63 %) 37 (37 %)	0.658#
RR	Mean ± SD Range	26.0 ± 10.0 15 – 40	26.4 ± 9.7 15 – 47	0.791@
SBP	Mean ± SD Range	90.5 ± 41.1 0 – 140	91.3 ± 41.8 0 – 160	0.893@
Pulse	Mean ± SD Range	89.8 ± 25.2 40 - 160	89.9 ± 25.1 50 – 155	0.975@
GCS	Mean ± SD Range	10.9 ± 4.0 3 – 15	10.9 ± 4.0 3 – 15	1.000@
INR	Mean ± SD Range	1.9 ± 1.4 0.8 – 9	1.8 ± 1.7 1 – 8	0.955@
Hb	Mean ± SD Range	11.0 ± 2.6 3 – 14	11.0 ± 2.6 3 – 15	0.979*
Creatinine	Mean ± SD Range	1.4 ± 0.9 0.5 – 5	1.5 ± 0.8 0.5 – 4	0.377@
LFT	Normal Elevated	91 (91 %) 9 (9 %)	89 (89 %) 11 (11 %)	0.637#

*: Student's t test **@:** Mann-Whitney U test **#:** Chi squared test

By bedside Ultrasound (eFAST), there was insignificant variance between the studied groups with regard to any of the eFAST data (p-value above 0.05 (Table 3).

Table (3): Comparing the eFAST data among the examined groups (Number =200)

		Group A (number =100)	Group B (number =100)	P value#
eFAST	Positive Negative	34 (34 %) 66 (66 %)	37 (37 %) 63 (63 %)	0.658
Findings in chest positive eFAST	Pneumothorax Hemothorax Hemo-Pneumothorax	13 (50 %) 9 (34.9 %) 4 (15.4%)	15 (50 %) 11 (36.7 %) 4 (13.3 %)	0.972
Abdominal collection detected by eFAST	Minimal Mild Moderate	15 (53.6 %) 7 (25 %) 6 (21.4%)	16 (47.1 %) 7 (20.6 %) 11 (32.4 %)	0.628
Abdominal organ injuries detected by eFAST	Splenic Liver	9 (52.9 %) 8 (47.1 %)	15 (65.2 %) 8 (34.8 %)	0.433

The ED outcomes and the mortality rate were documented where there was insignificant variance among the two groups in admission, intervention operation or mortality rate as most of patients were admitted in ICU or ward, ED mortality recorded in both groups was 10% & 7% respectively (Table 4).

Table (4): Outcomes of studied population (Number = 200)

		Group A (number =100)	Group B (number =100)	P value
ED outcome	Admission Operation Referral Discharge Dead in ED	46 (46 %) 28 (28 %) 7 (7 %) 9 (9 %) 10 (10 %)	51 (51 %) 23 (23 %) 9 (9 %) 10 (10 %) 7 (7 %)	0.812#
Hospital mortality	Yes No	13 (17.6 %) 61 (82.4 %)	18 (24.3 %) 56 (75.7 %)	0.313#
Length Of Stay in ER (h)	Mean ± SD Range	3.6 ± 2.2 1 – 8	4.1 ± 2.5 1 - 12	0.120@
LOS in ICU (days)	Mean ± SD Range	1.9 ± 2.7 0 – 10	2.2 ± 2.7 0 -10	0.425@

There was a significant relation between TRISS score and the outcomes in group A, where the highest mean TRISS score was for patients who discharged (71.6 ± 28.6), and least TRISS score was among those who were died (12.9 ± 0.7). The information illustrated a statistically significant association (P < 0.001) between lower TRISS and mortality where patients who died in hospital had a mean TRISS of 17.8 ± 31.2, while survivors had just59.3 ± 39.1. There was a significant negative correlation between TRISS and length of stay in ER, ICU or hospital (Table 5).

Table (5): Relationship between TRISS score and the Outcome data in group A (Number =100)

		TRISS	P value
ED outcome	Admission Operation Referral Discharge Died in ED	44.2 ± 27.0 55.7 ± 7.4 15.2 ± 23.1 71.6 ± 28.6 12.9 ± 0.7	<0.001$
Hospital mortality	Yes No	17.8 ± 31.2 59.3 ± 39.1	<0.001@
LOS in ER (h)	R	-0.213	0.007
LOS in hospital (days)	R	-0.262	0.008
LOS in ICU (days)	R	-0.270	0.033

r: Correlation coefficient **@:** Mann-Whitney U test **$:** Kruskal-Wallis test

A statistically significant association was detected among BIG score and the ED outcomes where patients who died in the ED had the highest BIG scores (21.0 ± 4.2), followed by those who had surgery (14.6 ± 6.8) and those admitted (12.7 ± 4.3). Patients referred or discharged had much lower scores (18.1 ± 8.4 and 5.9 ± 1.9). Patients who died in hospital also had much higher BIG scores (21.0 ± 4.2) compared to survivors (9.6 ± 5.3), with a strong significance (P-value < 0.001). A significant positive association has been found between BIG score and LOS in hospital and ICU (p= 0.004 and < 0.001 respectively). There was insignificant association between BIG score and LOS in ER (p>0.05) (Table 6).

Table (6): Relationship between BIG score and the Outcome data in group B (Number =100)

		BIG	P value
ED outcome	Admission Operation Referral Discharge Dead in ED	12.7 ± 4.3 14.6 ± 6.8 8.1 ± 4.9 5.9 ± 1.9 21.0 ± 4.2	<0.001$
Hospital mortality	Yes No	18.1 ± 8.4 9.6 ± 5.3	<0.001@
LOS in ER (h)	R	0.010	0.922
LOS in hospital (days)	R	0.285	0.004
LOS in ICU (days)	R	0.413	<0.001

r: Correlation coefficient **@:** Mann-Whitney U test **$:** Kruskal-Wallis test

the cut-off point of TRISS score was 24.6, the sensitivity and specificity of TRISS score in expecting the hospital death in polytrauma patients were 92.3 % and 81.6% respectively (Table 7 & figure 1).

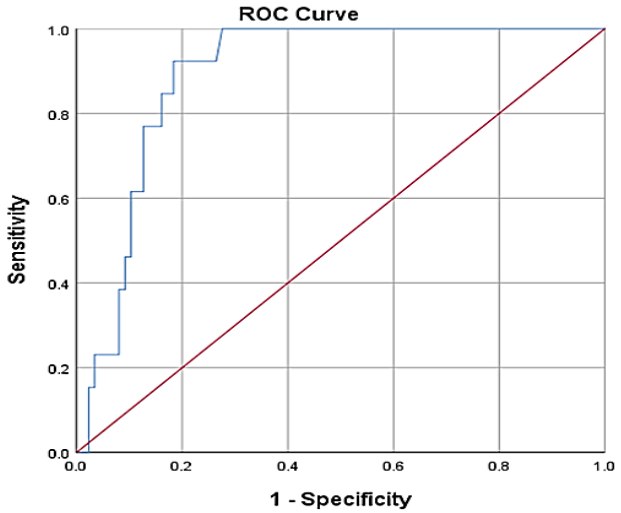

Figure 1: ROC curve for the accuracy of TRISS score in predicting the hospital mortality Mechanism of injury in studied group A(n=100).

Table (7): ROC curve of TRISS score in predicting the hospital mortality in group A (n=100)

	TRISS
AUC	0.892
SE	0.033
95% CI	0.828 - 0.956
Cut-off point	24.6
Sensitivity	92.3%
Specificity	81.6%

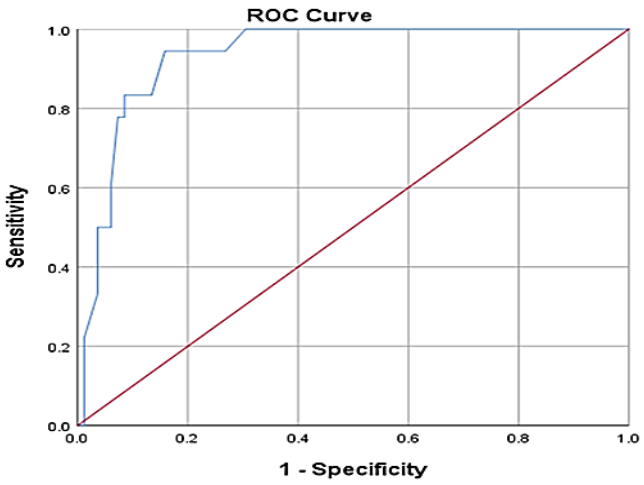

Table (8) and figure (2) showed that at a cut-off point of 15.75, the sensitivity and specificity of BIG score in expecting the hospital death in polytrauma patients were 94.4 % and 84.1% respectively.

ROC curve of BIG in prediction of hospital mortality in group B.

Table (8): ROC curve of BIG score in expecting the hospital mortality in group B (n=100).

	BIG
AUC	0.934
SE	0.025
95% CI	0.884 - 0.983
Cut-off point	15.75
Sensitivity	94.4%
Specificity	84.1%

There was non-significant difference between TRISS and BIG scores in their accuracy in predicting the outcomes and mortality in adult trauma patients (p value $p > 0.05$) (Table 9).

Table (9): Comparing the accuracy of the two scores.

	TRISS	BIG	P value
AUC	0.892	0.934	0.310
SE	0.033	0.025	

DISCUSSION

Trauma is a significant cause of to death and morbidity globally. It is the primary cause of death in the initial four decades of life [(9)].

Trauma scores enable doctors to translate various degrees of injuries into a common language. TRISS integrates anatomical injury, physiological derangement, age of cases, and injury mechanism for predicting survival following trauma. TRISS rapidly established itself as a standard for assessment of results [(10)].

Numerous clinical investigations have shown that the BIG score outperforms other trauma scoring systems in precisely evaluating severity of trauma in pediatric cases. Nonetheless, its efficacy in adult trauma remains unclear due to insufficient data. This research examined the efficiency and reliability of the BIG score and TRISS in expecting outcomes and death in adults with multiple traumata [(11)].

The mean age of cases in group A was 42.8 ± 15.7, ranged from 18 – 70 vs 43.6 ± 15.1, and a range of 19 – 77 in group B where males were more than females in both groups. There was insignificant variance between the studied groups with regard to their co-morbidities (p value > 0.05) and most of them were hypertensive and diabetic.

Regarding the mechanism of injury, there was no significance between both groups where the Road Traffic Accident (RTA) was observed to be the most common cause (67% & 74% respectively) followed by FFH, building collapse and alleged assault. The majority of the patients presented in blunt trauma. Similarly, **Indurkar *et***

al. [12] and **Javali *et al.*** [13] stated cases injured in road traffic accidents constituted the maximum caseload in the form of blunt trauma. **Az *et al.*** [14] stated that the mean age of the studied patients was 57.53 ± 24.88 years. Among the cases, 77.09% presented with blunt trauma, whereas 22.91% had penetrating injuries, falls (59.15%) and traffic accidents (20.96) were the most frequent trauma causes.

Upon view of the primary survey of the examined patients, an insignificant variance was found among the examined groups with regard to ABCDE approach or laboratory findings (p>0.05). On a presentation, the airway was maintained in 66% vs 63% of them and the range of heart rate was 40-160 beats/minute.

The ED outcomes were in the form of ICU admission or referral, emergent operations, ward admission and outpatients, there were insignificant variance among the two groups in their results and most of patients were admitted in hospital primarily or after underwent operations.

Regarding the mortality rate in the studied patients in ED, there were 10% & 7% respectively in group A and group B.

In the present study, the highest mean TRISS score was for patients who discharged (71.6 ± 28.6), and the least TRISS score was among those who died (12.9 ± 0.7). The information illustrated a statistically significant association (P < 0.001) between lower TRISS and mortality where patients who died in hospital had a mean TRISS of 17.8 ± 31.2, while survivors had just 59.3 ± 39.1. Similarly to **Höke *et al.*** [4] who reported a significantly higher TRISS score (mean 93.7 ± 12.9) indicating a higher predicted probability of survival.

Kazemi *et al.* [15] found that lower TRISS values were associated with increased ICU admission, supporting our results.

It was noted that, the cut-off point of TRISS score was 24.6 and the sensitivity and specificity of it in expecting the hospital death in polytrauma patients were 92.3 % and 81.6% correspondingly. This is in accordance with the research of **Indurkar *et al.*** [12] in which the sensitivity of TRISS was 94.7% in predicting the patient outcome.

It was observed in this study that patients who died in the ED had the highest BIG scores (21.0 ± 4.2), followed by those who had surgery (14.6 ± 6.8). Patients referred or discharged had much lower scores (18.1 ± 8.4 and 5.9 ± 1.9). Patients who died in hospital also had much higher BIG scores (21.0 ± 4.2) compared to survivors (9.6 ± 5.3), with a strong significance (P < 0.001).

It was found that the cut-off points of BIG score in expecting the hospital death in polytrauma adult cases was15.75 and its sensitivity and specificity were 94.4 % and 84.1% correspondingly.

A BIG score of 10.65 has been determined as the death cut-off, with 67.7% sensitivity & 86.5% specificity in the research of **Az *et al.*** [14]**.** In the research of **Brockamp *et al.*** [16] BIG score of <12 points recommend a death of under five percent, whereas a cut-off of > 26 points correspond to a death of > 50%.

Finally, in our research there was insignificant variance between TRISS and BIG scores in their accuracy in predicting the outcomes and death in adult trauma cases (p value p>0.05). This is in contrast to **Park *et al.*** [17] who found that the predictive value of the BIG score for death among adult trauma cases was significantly greater compared to other scoring trauma system.

LIMITATIONS: The research has been carried out in a single center and with a small sample size.

CONCLUSION

This study revealed that The TRISS and BIG scores can satisfactorily predict mortality and interventions in a case of trauma.

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