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Original Article

# Correlation between trauma and injury severity score and prognosis in patients with trauma

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الملخص

**أهداف البحث:** تهدف هذه الدراسة إلى تحديد العلاقة بين درجة خطورة الإصابات والصدمات والتنبؤ بنتيجة مرضى الصدمات.

**طرق البحث:** قمنا بتحليل ١٨٧ سجلا طبيا بأثر رجعي لمرضى الصدمات الذين قدموا إلى قسم الطوارئ في مركز الصدمات من المستوى الثاني في شرق جاوة ، إندونيسيا بين أغسطس وديسمبر ٢٠١٨. قمنا بتحليل البيانات بما في ذلك الخصائص الديموغرافية، ومقياس غلاسكو للغيبوبة، وضغط الدم الانقباضي ومعدل التنفس ودرجة الإصابة لستة أجزاء من الجسم. وتم استخدام اختبار ارتباط رتبة سبيرمان لتحديد الارتباط بين المتغيرات.

**النتائج:** تمت مراجعة ما مجموعه ١٨١ سجلا طبيا لمرضى الصدمات في هذه الدراسة. كان ثلثا المرضى من الذكور (ن = ١١٣، ٦٢.٤٪). ما يقرب من نصف الإصابات الناجمة عن حوادث الطرق (ن = ٨٩، ٤٩.٢٪) ؛ نتجت غالبية هذه الإصابات عن صدمة حادة (ن = ١٦٧، ٩٢.٣٪). تراوحت درجات خطورة الإصابات والصدمات لمعظم المرضى (ن = ١٧٨، ٩٨.٣٪) مع تشخيص جيد بين ٧٧.١٪ - ٩٩.٧٪. كانت هناك علاقة ذات دلالة إحصائية بين الصدمات، ودرجات خطورة الإصابات والصدمات والتشخيص لمرضى الصدمات، مع ارتباط إيجابي بين المتغيرات.

**الاستنتاجات:** كان هناك ارتباط معنوي بين درجات خطورة الإصابات والصدمات والتنبؤ بنتيجة مرضى الصدمات.

**الكلمات المفتاحية:** الإصابات؛ نظام تسجيل الإصابات؛ الإنذار؛ الخطورة؛ الصدمة

**Abstract**

**Objectives:** This study aims to determine the correlation between Trauma and Injury Severity Score (TRISS) and prognosis in patients with trauma.

**Methods:** We retrospectively analysed 187 medical records of patients with trauma who presented to the emergency department of a level II trauma centre in East Java, Indonesia, between August and December 2018. We analysed the data, which included demographic characteristics, Glasgow Coma Scale score, systolic blood pressure, respiratory rate, and injury scores of six parts of the body. Spearman's rank correlation was used to determine the correlation among variables.

**Results:** A total of 181 medical records of patients with trauma were reviewed in this study. Two-third of the patients were male (n = 113, 62.4%). Approximately half of the trauma injuries were caused by road traffic accidents (n = 89, 49.2%); the majority of these injuries resulted from blunt trauma (n = 167, 92.3%). The TRISSes of most of the patients (n = 178, 98.3%) with a good prognosis ranged from 77.1% to 99.7%. There was a statistically significant correlation between trauma, TRISS, and prognosis ($p = 0.002 < 0.05$), with a positive correlation among variables (r = 0.225).

**Conclusion:** There was a significant correlation between TRISS and prognosis in patients with trauma.

**Keywords:** Injuries; Injury scoring system; Prognosis; Severity; Trauma

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## Introduction

Trauma is a severe health problem that exacts a heavy burden on society.[1,2] Trauma occurs when a series of unexpected accidents involve violence and accidents that cause the victim to be injured. It is the leading cause of morbidity and mortality worldwide.[2,3] According to the World Health Organization, more than 5 million people die from casualties every year.[4] Injuries caused by traffic accidents accounted for a quarter of 5 million deaths. Globally, the number of males who die from injuries is more than twice that of females. Similarly, more than 90% of injury deaths occur in low- and middle-income countries.[2,5]

Road traffic accidents are estimated to be the ninth leading cause of death for all age groups globally. They are predicted to become the seventh leading cause of death by 2030, and currently account for 1.2 million deaths each year.[6,7] Injuries caused by accidents such as head injuries, musculoskeletal or limb injuries, fractures, open wounds, spinal cord injuries, and other injuries can cause death.[2,5]

In addition to being a significant cause of death, trauma is also a cause of morbidity and has a significant impact on disability every year.[8] The mortality and morbidity of injured patients can increase when insufficient care is provided. Therefore, understanding each patient's prognosis or health status is a priority in clinical practice.[9] The patient's prognosis can be assessed from his or her condition and severity. Patients with poor prognosis need to be referred for advanced care. These patients need subspecialty medical service to improve their prognosis.[10]

There are multiple methods of trauma assessment. With an accurate initial assessment, medical personnel (especially nurses) can provide appropriate treatment or interventional measures and quickly monitor the patient's prognosis.[11] Application of the Trauma and Injury Severity Score (TRISS) evaluation system has been documented in the literature. Previous research has reported that the TRISS uses a very accurate method to assess mortality in patients with trauma and is statistically superior to the Injury Severity Score (ISS) and the Revised Trauma Score (RTS).[12] The TRISS is the most potent predictor of mortality in patients with trauma due to its physiological and anatomical parameters.[13] The trauma assessment gap in developing countries is caused by many factors, including the lack of approved trauma centres, need for more trained staff and medical professionals, and inexperience in trauma assessment systems among staff and medical professionals.[12] Therefore, there is a need for an accurate initial assessment system to measure the severity of trauma and to estimate patient prognosis.

This study aimed to determine the correlation between TRISS and prognosis in patients with trauma.

## Materials and Methods

We retrospectively analysed the clinical data of 187 patients who were admitted to a level II emergency centre in a military hospital in East Java Province, Indonesia, from August 2018 to December 2018. The hospital provides healthcare services in Malang, East Java Province, Indonesia. Malang is the second-largest city in East Java, following Surabaya. We did not conduct telephone follow-ups on the patients' survival status. Figure 1 shows the flow diagram of the study.

Patients with trauma with complete data, including Glasgow Coma Scale (GCS) score, systolic blood pressure (SBP), respiratory rate (RR), age, sex, mechanism of trauma, and injury characteristics, were included in this study. We excluded patients with incomplete or unclear records, such as those without data on SBP.

There were three steps used to calculate the TRISS. First, we calculated the Abbreviated Injury Scale score assigned to one of the six body regions. The six parts of the body are the head or neck, face, chest, and abdomen or pelvis, which are classified into extremities or pelvic girdle and outer surface. The score for each injury site ranges from 1 to 6. A score of 1 indicates slight injury, and 6 indicates the most severe injury. The ISS is then calculated as the sum of the squares of the highest Abbreviated Injury Scale scores for the three most seriously injured body parts ($ISS = x^2 + y^2 + z^2$). The minimum score on the ISS is 3, and the maximum score is 75.

Second, we calculated the RTS, a convenient physiology-based triage score for on-site triage for trauma. We entered the GCS score, SBP, and RR of the patients into the following formula: $RTS = 0.9368\ GCS + 0.7326\ SBP + 0.2908\ RR$. The RTS ranges from 0 to 12. The higher the score, the better the prognosis.

Finally, we calculated the TRISS to predict the survival rate for blunt and penetrating trauma based on the patient's age, ISS, and RTS. The TRISS ranges from 0% to 100%; the higher the score, the higher the probability of injury.

In this current study, prognoses of patients with trauma were categorised based on their condition after initial treatment in the emergency department. A good prognosis was given if the patient was in stable condition, and a poor prognosis was given if the patient was referred to a level I emergency centre.

Data were analysed using SPSS software package, version 20.0 (IBM Corporation, Armonk, NY, USA). Demographic characteristics and patient prognosis data were presented using frequency distribution (percentage). TRISS was reported using central tendency (minimum−maximum). The Spearman rank correlation test was used to analyse the correlation between variables, and a p-value <0.05 was considered statistically significant.

## Results

A total of 181 patients with trauma were included in the analysis. Of all the patients in the study, 113 (62.4%) were male, and one-third were adolescents and young adults (n = 55, 30.4%). The most common mechanism of injury was road traffic accidents (n = 89, 49.2%), and were characterised by blunt trauma (n = 167, 92.3%) (Table 1). The median TRISS was 99.4% (77.1%−99.7%) (Table 2). Table 3 presents the prognoses of the patients. Of the 181

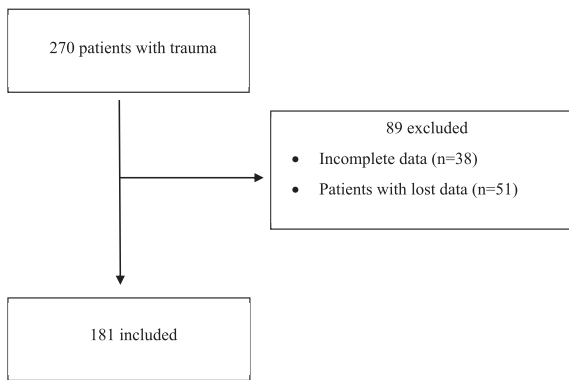**Figure 1:** Flow chart of the participants.

**Table 1: Characteristics of patients with trauma in the study (N = 181).**

| Characteristic | n | (%) |
|---|---|---|
| Age | | |
| 5−11 years old | 7 | 3.9 |
| 12−25 years old | 55 | 30.4 |
| 26−45 years old | 32 | 17.7 |
| 46−55 years old | 37 | 20.4 |
| >56 years old | 50 | 27.6 |
| Sex | | |
| Male | 113 | 62.4 |
| Female | 68 | 37.6 |
| Mechanism of injury | | |
| Traffic accident | 89 | 49.2 |
| Fall | 70 | 38.7 |
| Exposure to a sharp object | 14 | 7.7 |
| Hit by an object | 3 | 1.7 |
| Fall of objects | 5 | 2.8 |
| Injury type | | |
| Blunt | 167 | 92.3 |
| Penetrating | 14 | 7.7 |

**Table 2: Trauma and injury severity score results (N = 181).**

| Characteristic | Median | Minimum | Maximum |
|---|---|---|---|
| Trauma and Injury Severity Score | 99.4 | 77.1 | 99.7 |

**Table 3: Prognoses of patients with trauma in the study (N = 181).**

| Patient Prognosis | n | (%) |
|---|---|---|
| Good | 178 | 98.3 |
| Poor | 3 | 1.7 |

patients, most had a good prognosis (n = 178, 98.3%). Patients with poor prognoses were referred to a level I hospital to receive subspecialty health care according to medical indications to increase their chances of survival.

Table 4 indicates a significant and positive correlation between TRISS and prognosis in the patients in the study.

**Table 4: Correlation between trauma and injury severity score and prognosis (N = 181).**

| | Prognosis of Patients with Trauma | |
|---|---|---|
| | r | p |
| Trauma and Injury Severity Score | 0.225 | 0.002 |

$p < 0.005$.

This finding suggests that the higher the TRISS, the better the predictive effect in patients with trauma.

## Discussion

This study was conducted at a trauma centre in a military hospital in a low/middle-income country. Most of the patients in our study had a TRISS > 90%, and most were admitted to the hospital with mild injuries. Because of their moderate physiological status, there was a high survival rate among the patients. In line with the current study, another study found that the majority TRISS was 98% among living patients with a good prognosis.[11] This finding was most likely due to the patients' mild injuries; their physiological status was moderate, and their average age was <55 years.[11] Another study also supported our finding; it indicated that the higher the TRISS, the greater the patient's chances of survival.[14] However, in a study by Okasha et al., conducted at a university hospital in Alexandria, Egypt, most of the patients with trauma with good prognoses had a TRISS <50%.[15] This finding was most likely due to the fact that most of the patients had extremely severe injuries, which resulted in severe physiological conditions.

In the current study, most of the patients were adolescents and young adults (12−25 years), which is alarming because adolescents and young adults who have complete functionality for activities may have a high mobility rate.[16] In one study, patients with trauma aged >55 years with serious injuries had a TRISS <90%. Patients aged >55 years tended to participate in more outside activities and had more active lifestyles, putting them at more risk.[17] Furthermore, older adult patients have been found to have more post-traumatic injury complications compared with younger age groups, contributing to poorer outcomes.[13,17]

In our study, most of the patients had suffered from blunt trauma. The majority of cases that occurred due to blunt trauma were traffic accidents and falls. Almost half of the adolescent and young adults age group were injured in a road traffic accident. These cases involve human behavioural factors, such as level of knowledge and understanding of the traffic system, driving experience, skills and attitudes regarding risky behaviour before a traffic accident occurs, driving speed, and alcohol consumption.[18,19]

The majority of patients with trauma in our study had a good prognosis. These results are similar to those of several previous studies in which almost half of the patients had a good prognosis.[8,13,20] Although most patients with trauma

have a good prognosis, a small number have a poor one. These patients are likely to have severe injuries to the head, have a GCS score of 7–12, and be in the > 55 age group. These patients are referred to level I trauma centre hospitals for subspecialty treatment according to medical indications. One study indicated that a small percentage of patients with trauma admitted to level I hospitals were older adult patients, had severe traumatic brain injury, and had a GCS score ≤ of 7, leading to a poor prognosis.[10] In another study by Jain et al., it was found that in some regional hospitals, patients with trauma were referred to level I hospitals because they needed specialised care and were high-risk patients. This was especially the case for older adult patients.[21]

The current study observed a relationship with a weak correlation between TRISS and prognosis in patients with trauma. Our results are in line with those of Gunawan et al., who found a significant correlation between TRISS and patient prognosis.[22] We believe the reason for these findings was because most patients with trauma in the hospital have suffered minor injuries, so almost all the patients have a good prognosis. However, in the study by Okasha et al.,[15] there was a significant and robust correlation between TRISS and prognosis. Our study has shown that patients with a poor prognosis have higher TRISSes than those with a good prognosis. Karatas & Cam[20] also found a significant and robust correlation between mortality and intubation indicators with TRISS. In that study, the patients' injuries were severe, and they had multiple traumas.[20]

This study had one major limitation. We could not determine the survival or death of patients referred to a class I trauma centre. However, most trauma cases admitted to the hospital where we conducted the study involved minor injuries, and therefore the patient's prognosis was good.

## Conclusion

TRISS is a combination method often used to assess prognosis and mortality in patients with trauma. TRISSes can also help healthcare providers, especially nurses, in making decisions when treating these patients. The score is obtained from the values of the ISS, RTS, age of the patient, and injury mechanism. This study demonstrated a weak correlation between TRISS and prognosis in patients with trauma.

## Recommendations

We recommend that similar studies be conducted in other level I trauma centres with trauma cases and injury levels that are more diverse. This study provides information about the trauma scoring system that can aid in determining the prognosis of patients trauma. Applying the TRISS assessment system to hospitals in Indonesia should be considered because the trauma assessment system is standardised and easy to use, and has fair accuracy. With an effective initial evaluation system, healthcare providers can quickly determine the results and appropriately treat patients with trauma. The results of this study can encourage medical staff, especially nurses and doctors, to make appropriate decisions about the patient's condition and know when to refer patients to specialty medical service.

## Conflict of interest

The authors have no conflict of interest to declare.

## Ethical approval

This study was approved by the institutional review board of the all authors' institution (No.E.5.a/113/KEPK-UMM/ V/2019).

## Authors' contributions

CC and IDP conceived and designed the study and wrote the initial draft of the manuscript. CC, IDP, and CHA conducted the data analysis and interpretation. IDP and CHA critically revised the manuscript. All authors critically reviewed and approved the final draft and are responsible for the manuscript's content and similarity index.

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