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Study of Various Trauma Scoring Systems in Polytrauma Patients at A Tertiary Care Hospital

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Abstract

Trauma continues to represent one of the most important global public health challenges, contributing significantly to mortality, disability, and socioeconomic burden worldwide. Polytrauma patients often present with complex injury patterns involving multiple organ systems and severe physiological derangements, making early assessment and management extremely critical in emergency care settings. Accurate evaluation of injury severity is therefore essential for guiding clinical decision-making, prioritizing treatment, and predicting patient outcomes.

The present study was conducted to evaluate and compare the prognostic accuracy of these trauma scoring systems in predicting outcomes among polytrauma patients presenting to a tertiary care hospital.

The study demonstrated that trauma scoring systems showed a significant association with patient outcomes. Patients who expired had significantly higher anatomical severity scores such as ISS and NISS, whereas physiological scores such as RTS and combined scores such as TRISS were significantly lower among non-survivors. The findings indicate that trauma scoring systems are valuable tools for early assessment and risk stratification in polytrauma patients. The study concludes that combined scoring systems integrating both anatomical and physiological variables provide better predictive accuracy for mortality and can significantly aid clinical decision-making in tertiary trauma centers.

Keywords: Polytrauma, Trauma scoring systems, Injury Severity Score, Revised Trauma Score, TRISS, Mortality prediction.

1. Introduction

According to the World Health Organization, injuries account for approximately five million deaths every year, contributing to nearly ten percent of global mortality[1]. Among these injuries, road traffic accidents constitute a major proportion and are responsible for approximately 1.35 million deaths annually across the world[2]. In addition to mortality, trauma also results in significant morbidity, long-term disability, and socioeconomic loss, particularly affecting individuals belonging to the most productive age groups.

In India, the burden of trauma has increased considerably during the past few decades due to rapid urbanization, industrialization, increased vehicular density, and changing lifestyle patterns. Data from the National Crime Records Bureau indicate that road traffic accidents alone account for more than 150,000 deaths annually in India, placing the country among those with the highest trauma-related mortality globally[3]. Furthermore, a significant proportion of trauma victims belong to the age group of 15–44 years, which represents the economically productive segment of the population. Consequently, trauma not only affects individual health but also imposes substantial social and economic consequences for families and communities[4].

Polytrauma is a clinical condition characterized by multiple traumatic injuries involving two or more anatomical regions, often associated with significant physiological compromise. Patients presenting with polytrauma frequently exhibit complex injury patterns including traumatic brain injury, thoracic trauma, abdominal injuries, long bone fractures, and soft tissue damage. These patients require rapid clinical assessment, prompt stabilization, and coordinated multidisciplinary management to improve survival outcomes[5]. The management of polytrauma patients remains challenging because the severity and combination of injuries vary widely among individuals.

Early and accurate assessment of injury severity is essential in trauma management. Emergency physicians and trauma surgeons must rapidly determine which patients require immediate surgical intervention, intensive care, or transfer to higher-level trauma centers. However, reliance solely on clinical judgment may lead to inconsistencies in assessment and decision-making. To address these limitations, various trauma scoring systems have been developed that provide objective measures for evaluating injury severity and predicting outcomes[6].

AIM AND OBJECTIVES

The present study was undertaken with the aim of evaluating the predictive accuracy of various trauma scoring systems in determining outcomes among polytrauma patients presenting to a tertiary care hospital.

MATERIALS AND METHODS

The present study was conducted as a hospital-based observational study in the Department of Emergency Medicine of a tertiary care teaching hospital that receives a large number of trauma referrals from surrounding urban and rural regions. The study was carried out over a total period of eighteen months. This duration included twelve months for patient recruitment and data collection and an additional six months for compilation of data, statistical analysis, and interpretation of results.

The study population consisted of patients presenting to the emergency department with polytrauma. Polytrauma was defined as the presence of injuries involving two or more anatomical regions, with at least one injury being potentially life-threatening. A total of one hundred polytrauma patients fulfilling the inclusion criteria were included in the study. The sample size was determined based on the average number of trauma cases admitted to the emergency department during the preceding years.

Patients were enrolled using purposive sampling. All eligible patients presenting to the emergency department during the study period were screened for inclusion. After explaining the purpose of the study, written informed consent was obtained from the patient or from the patient's attendant in cases where the patient was unable to provide consent.

Patients with isolated trauma involving only a single anatomical region were excluded from the study. In addition, patients below five years of age and those with severe comorbid conditions that could significantly influence mortality outcomes were also excluded from the study.

Detailed demographic and clinical information was recorded for each patient using a structured case record form. Demographic data included age, sex, and area of residence. Information regarding the mechanism of injury, time interval between injury and hospital arrival, and intoxication status was also documented. Clinical parameters such as blood pressure, heart rate, respiratory rate, and Glasgow Coma Scale were recorded at the time of presentation to the emergency department.

RESULTS

A total of 100 polytrauma patients presenting to the emergency department during the study period were included in the analysis. The overall mortality observed in the study population was 19%, with 81 patients surviving and 19 patients succumbing to their injuries. The distribution of demographic variables, injury characteristics, and trauma severity scores was analyzed in relation to patient outcomes.

The majority of patients were males, which reflects the higher exposure of males to road traffic accidents and occupational hazards. However, the difference in mortality between males and females was not statistically significant. Similarly, the area of residence did not significantly influence patient outcomes, indicating that once definitive trauma care was provided at a tertiary care facility, survival rates were comparable between urban and rural populations.

Blunt trauma was the most common mechanism of injury among the study population, followed by penetrating trauma, electrical injuries, burns, crush injuries, and drowning. Although some mechanisms such as drowning demonstrated relatively higher mortality proportions, the overall association between mechanism of injury and outcome was not statistically significant.

One of the most important determinants of mortality observed in the present study was the presence of head injury. All deaths occurred among patients who had associated head injuries, indicating a strong relationship between traumatic brain injury and mortality among polytrauma patients. This finding highlights the critical role of neurological injury in determining outcomes in trauma patients.

TABLE 1

Demographic Characteristics and Outcome Distribution (n = 100)

Variable	Category	Survived n (%)	Expired n (%)	Total
Outcome	Survived	81 (81.0)	—	81
	Expired	—	19 (19.0)	19
Sex	Male	60 (80.0)	15 (20.0)	75
	Female	21 (84.0)	4 (16.0)	25
Area of Residence	Rural	44 (81.5)	10 (18.5)	54
	Urban	37 (80.4)	9 (19.6)	46
Head Injury	Present	61 (76.3)	19 (23.7)	80
	Absent	20 (100.0)	0 (0)	20

Statistical significance

Sex vs outcome: $\chi^2 = 0.02$, $p = 0.883$
Residence vs outcome: $\chi^2 = 0.00$, $p = 1.000$
Head injury vs outcome: $\chi^2 = 14.8$, $p < 0.001$ (Highly significant)

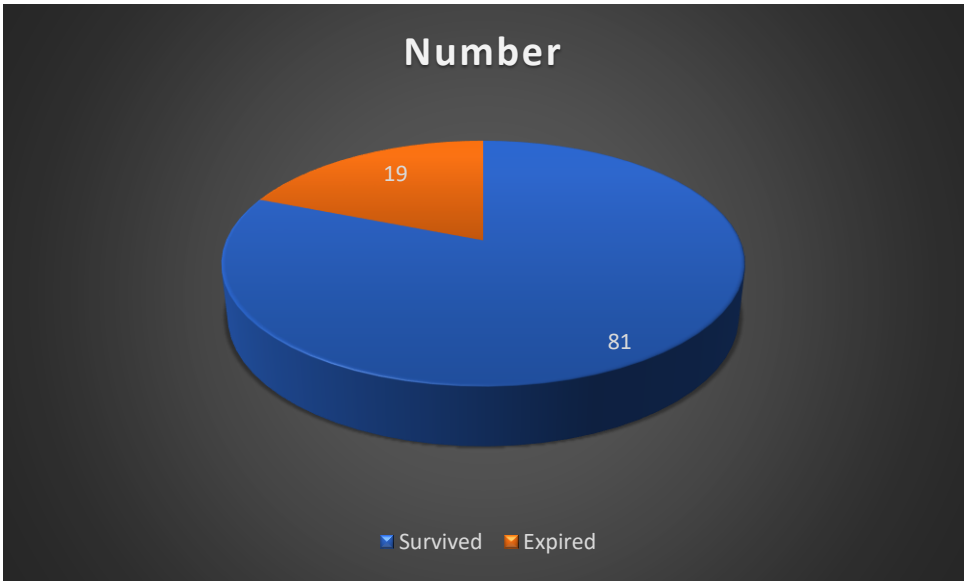

TABLE 2

Mechanism of Trauma and Patient Outcome

Type of Trauma	Survived (n)	Expired (n)	Total	Mortality %
Blunt Trauma	39	8	47	17.0
Penetrating Trauma	21	6	27	22.2

Type of Trauma	Survived (n)	Expired (n)	Total	Mortality %
Electrical Injury	9	1	10	10.0
Burn Injury	6	1	7	14.3
Crush Injury	4	1	5	20.0
Drowning	2	2	4	50.0
Total	**81**	**19**	**100**	**19.0**

Chi-square test: $\chi^2 = 6.32$
p = 0.276 (Not significant)

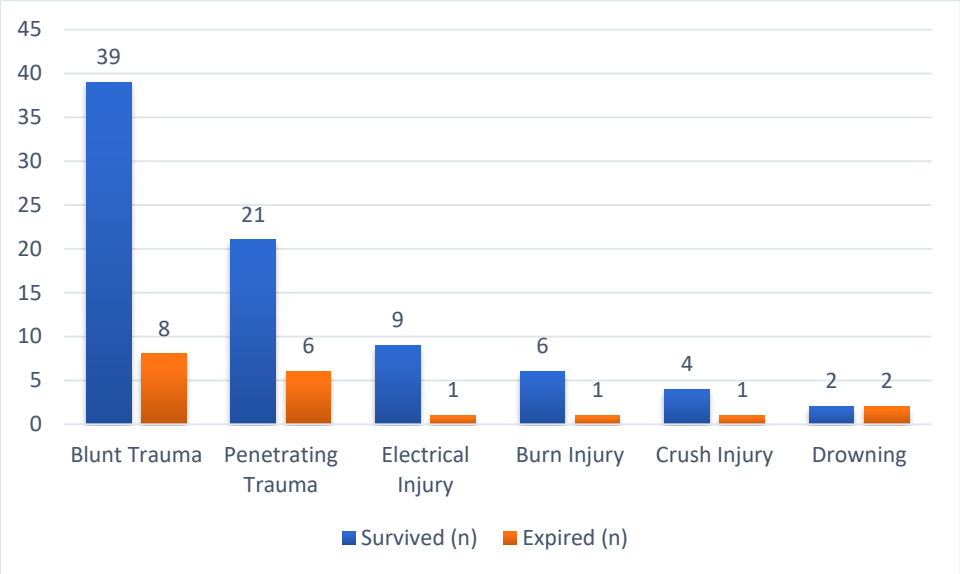

TABLE 3

Age Distribution Among Survivors and Non-Survivors

Outcome	Mean Age (years)	Standard Deviation	Minimum	Maximum
Survived	44.05	15.09	18	72
Expired	40.26	12.58	21	66
Total	**43.33**	**14.66**	—	—

Independent t-test

t = 1.08
p = 0.28 (Not significant)

TABLE 4

Comparison of Trauma Scoring Systems Between Survivors and Non-Survivors

Trauma Score	Survivors Mean ± SD	Non-Survivors Mean ± SD	t value	p value
ISS	22.96 ± 9.41	28.74 ± 10.02	2.18	0.032
NISS	26.64 ± 9.90	33.84 ± 11.01	2.51	0.014
RTS	6.82 ± 0.71	4.96 ± 1.23	7.12	<0.001
TRISS	0.87 ± 0.11	0.52 ± 0.18	8.63	<0.001

Higher ISS and NISS scores were associated with mortality, while higher RTS and TRISS values were associated with survival.

TABLE 5

Injury Severity Score Categories and Mortality

ISS Category	Survivors (n)	Expired (n)	Total	Mortality %
<16	22	2	24	8.3
16–25	38	8	46	17.4
>25	21	9	30	30.0
Total	**81**	**19**	**100**	**19.0**

Chi-square test

$\chi^2 = 7.73$
p = 0.021 (Significant)

This table demonstrates a progressive increase in mortality with increasing ISS category, indicating a clear severity–mortality relationship.

DISCUSSION

The demographic distribution in the present study showed a predominance of male patients. Males constituted approximately three-fourths of the study population. This observation is consistent with previous trauma studies that have reported a higher incidence of trauma among males. The predominance of male trauma victims is often attributed to greater exposure to outdoor activities, occupational hazards, and vehicular accidents. Similar findings were reported by Jain et al., who observed that young adult males represented the majority of trauma victims in their study of trauma epidemiology in India[3].

In the present study, no statistically significant association was observed between sex and patient outcome. Although mortality was slightly higher among males, the difference did not reach statistical significance. This finding suggests that sex alone does not independently influence mortality in trauma patients and that injury severity and physiological status play more important roles in determining outcomes.

The area of residence was also evaluated in relation to patient outcome. Although it is often assumed that rural patients may experience delays in reaching tertiary care centers and therefore have poorer outcomes, the present study did not demonstrate a statistically significant difference between rural and urban patients. Once patients received definitive trauma care at the tertiary hospital, survival outcomes were comparable between both groups. This observation highlights the importance of timely and effective hospital-based trauma management.

With regard to mechanism of injury, blunt trauma was the most common type of injury observed in the study population. This finding is consistent with global trauma epidemiology, where road traffic accidents and blunt injuries constitute the majority of trauma cases. Studies conducted by Mantu Jain et al. and Halvachizadeh et al. similarly reported blunt trauma as the predominant mechanism of injury among polytrauma patients[3,4]. Although some injury mechanisms such as drowning showed relatively higher mortality proportions in the present study, the overall association between mechanism of injury and mortality was not statistically significant.

One of the most important findings of the present study was the strong association between **head injury and mortality**. All deaths in the study occurred among patients who had associated head injuries. Traumatic brain injury has long been recognized as one of the most significant predictors of mortality in polytrauma patients. Gupta et al. reported that head injuries accounted for more than **65% of trauma-related deaths** in their comparative study of trauma scoring systems[5]. Severe brain injury often leads to secondary complications such as intracranial hypertension, cerebral edema, and systemic inflammatory responses, which significantly worsen patient outcomes.

Age distribution among survivors and non-survivors did not show a statistically significant difference in the present study. Although older age is generally considered a risk factor for increased mortality in trauma patients due to reduced physiological reserve and higher prevalence of comorbidities, the present study did not demonstrate a significant age-related effect on outcome. Similar findings were reported in some trauma studies where injury severity was found to be a stronger determinant of mortality than age alone[6].

Trauma scoring systems represent an important advancement in trauma care because they provide objective tools for quantifying injury severity and predicting patient outcomes. In the present study, four trauma scoring systems were evaluated: Injury Severity Score (ISS), New Injury Severity Score (NISS), Revised Trauma Score (RTS), and Trauma and Injury Severity Score (TRISS).

The Injury Severity Score is one of the most widely used anatomical trauma scoring systems and is derived from the Abbreviated Injury Scale. In the present study, the mean ISS value among non-survivors was significantly higher than among survivors. This finding indicates that increasing anatomical injury burden is strongly associated with increased mortality. Several previous studies have demonstrated a similar association between ISS and mortality. Yadav et al. reported that ISS had good discriminative ability for predicting mortality among trauma patients, particularly in cases of severe blunt abdominal trauma[7].

The New Injury Severity Score was introduced as an improvement over ISS because it considers the three most severe injuries regardless of their anatomical location. In the present study, NISS values were also significantly higher among non-survivors compared to survivors. This finding suggests that NISS may provide a more comprehensive representation of injury burden in polytrauma patients. Garg et al. reported

similar findings, demonstrating that NISS showed stronger correlation with mortality than ISS in trauma patients[1].

Physiological scoring systems assess the patient's physiological response to trauma rather than anatomical injury patterns alone. The Revised Trauma Score incorporates parameters such as Glasgow Coma Scale, systolic blood pressure, and respiratory rate. In the present study, RTS values were significantly lower among patients who expired. Lower RTS values indicate greater physiological instability and have been consistently associated with poor outcomes in trauma patients. Verma et al. demonstrated a strong negative correlation between RTS and mortality in polytrauma patients[8].

The Trauma and Injury Severity Score represents a combined scoring model that integrates both anatomical and physiological parameters along with patient age and injury mechanism. In the present study, TRISS demonstrated a strong association with patient outcomes. Non-survivors had significantly lower TRISS values compared to survivors, indicating a lower probability of survival. Similar findings have been reported in several studies evaluating trauma scoring systems. Yadolahi et al. reported that TRISS demonstrated the highest predictive accuracy among trauma scoring systems evaluated in their comparative study[9].

The findings of the present study highlight the importance of using multiple trauma scoring systems in clinical practice. Anatomical scoring systems such as ISS and NISS provide valuable information about the structural extent of injuries, while physiological scores such as RTS reflect the patient's physiological status at presentation. Combined models such as TRISS integrate both types of information and therefore provide more comprehensive prognostic predictions.

In tertiary care trauma centers where patient volumes are high and rapid decision-making is critical, trauma scoring systems can significantly improve triage accuracy and resource allocation. These scoring systems allow clinicians to identify high-risk patients early, anticipate complications, and optimize patient management strategies.

CONCLUSION

The present study evaluated the prognostic value of various trauma scoring systems in polytrauma patients presenting to a tertiary care hospital. The study demonstrated that trauma scoring systems are effective tools for assessing injury severity and predicting outcomes among trauma patients.

LIMITATIONS OF THE STUDY

The study was conducted at a single tertiary care center, and therefore the findings may not be generalizable to all healthcare settings. The sample size of 100 patients, although adequate for observational analysis, may limit the statistical power for detecting smaller differences between scoring systems. Additionally, prehospital variables and long-term functional outcomes were not evaluated in this study.

Future studies with larger multicentric cohorts and inclusion of additional trauma scoring models may provide a more comprehensive understanding of trauma outcome prediction.

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