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Analysis of Revised Trauma Score with 24-Hour Mortality in Trauma Patients Presenting to Casualty: A 1-Year Retrospective Study at A Single Tertiary Care Center

Ms. Subashree Kumaresan

Assistant Professor, Emergency Medical Technology, The Apollo University

ABSTRACT

Purpose: The Revised Trauma score (RTS) has been extensively used as an early physiological indicator of injury severity and outcome prediction in trauma patients. However, evidence regarding its correlation with 24-hour mortality among trauma patients presenting to casualty in tertiary care center remains scarce in the literature.

Methods: This retrospective cohort study included 108 trauma patients presenting to the emergency department of a single tertiary care center between January 2019 and January 2020. Data were collected from patient's medical records at admission (age, Gender, trauma mechanism, vital signs, Glasgow Coma Scale [GCS], Revised Trauma Score [RTS] and at discharge (survival or death).

Results: The trauma patients who experienced mortality within 24-hour were predominantly male 56.4 % with an average age of 21-30 years. Motar Vehicle collision constituted the most common trauma mechanism 53.7%, followed by polytrauma 30.6%. Most critically ill patients had Revised Trauma Score (RTS) values between 2-3. Lower RTS demonstrated a significant correlation with 24-hour mortality (P=0.008). Mortality was significantly higher among patients with RTS $\leq$ 3 compared to those with RTS >3. Specifically, (70.8%) with RTS $\leq$ 3 died, whereas only(29.1%) with RTS >3 died. Conversely, survival was higher in patients with RTS>3,(58.3%) than in those with RTS $\leq$ 3, (41.6%). The finding was statistically significant (P=0.004), indicating that lower RTS is strongly associated with increased in-hospital mortality .Although gender did not directly correlate with mortality they played a confounding role

Conclusions: The findings of this study can inform initial clinical management strategies for trauma patients presenting to casualty. Prompt assessment and intervention must be prioritized for patients with low revised trauma score (RTS), particularly those with RTS < 5, to reduce mortality within 24-hour. Early identification of high-risk patients with RTS can help for triage, resuscitation, and resource allocation in trauma centers.

Keywords: Multiple Trauma; Glasgow coma scale; Mortality; Survival rate; Emergency treatment

INTRODUCTION

Background

Trauma is a major global public health problem requiring immediate attention from the emergency and

trauma care community. Injuries account for a substantial proportion of morbidity and mortality world wide [1]. In India, road traffic accidents remain a leading cause of trauma -related deaths, disabilities and socioeconomic burden [2]. The Epidemiology of trauma continues to develop with urbanization and changing lifestyles [3]. At our institution, trauma patients contribute a significant proportion of emergency department (ED) admissions across all age categories.

Effective trauma care demands early identification of critically injured patients, since delays in diagnosis and response are directly related with poor outcomes[4].The Revised Trauma Score (RTS), based on Glasgow Coma Scale, systolic blood pressure, respiratory rate is a widely used physiological scoring systems for rapid trauma assessment and mortality prediction. RTS plays an important role in prioritizing patient care, activating trauma teams, and guiding early resuscitation strategies [5,6]

Studies have shown a strong association between lower RTS score and increased mortality in trauma patients [7,8]. However most available evidence focuses on overall in-hospital mortality and studies evaluating the predictive value of RTS specifically for early mortality within the first 24 hours of hospitalization remain limited, particularly in the Indian tertiary care setting [9].

However, trauma patients often present with Vast differences in clinical presentation, and the severity of anatomical injury may not necessarily correlate with initial vital signs, contributing to errors in triage and early decision making. Early mortality in trauma are predominantly due to hemorrhagic shock and severe head injury, highlighting the importance of early physiological scoring in predicting emergency outcomes[10]

Objectives: This study aims to analyze the association between the Revised Trauma Score (RTS) and early mortality in trauma patients within the first 24 hours of hospitalization and to evaluate its effectiveness in guiding triage prioritization.

METHODS

Ethics statement

The study protocol was reviewed and approved by the Institutional Ethics Committee of Chettinad Academy of Research and Education, Chettinad Super- speciality Hospital (No. .743/IHEC/12-19), The requirement for informed consent was waived due to the retrospective nature of the study. This study was conducted in compliance with the principles outlined in the Declaration of Helsinki.

Study design and setting

This analytical observational study employed a retrospective cohort design was conducted at Chettinad Academy of Research and Education, Chettinad Superspeciality Hospital, Kelambakkam, Chennai, India.

Participants

The participants in this study were trauma patients who fulfilled the predefined inclusion and exclusion criteria. All trauma patients aged above 10 years, with an polytrauma, within 24 hours of hospitalization who were treated at Chettinad Academy of Research and Education, Chettinad Superspeciality Hospital between January 2019 and January 2020 were included. Trauma patients with any of the following were excluded : (1) Age below 10 years; (2) Dead on arrival; (3) Transfer from another hospital; (4) More than 24 hours of hospitalization; (5) Superficial Trauma; (6) Discharge against medical advice. Patient follow-up was conducted by retrieving data recorded upon admission and discharge from medical records.

Variables

The primary Variables analyzed in this study were Revised Trauma Score and in-hospital mortality with-

in 24 hours of hospitalization. The RTS was calculated using Glasgow Coma Score, Systolic Blood pressure and Respiratory rate recorded at the time of arrival to the Emergency department. Potential confounding variables recognized which includes age, trauma mechanism, comorbidities.

Data Sources and Measurement

All data for this study were retrospectively collected from patient medical records (secondary data source) of trauma patients who presented to the emergency department of tertiary care center during the 1-year study period. Data were extracted using a structured data collection proforma.

The Revised Trauma Score (RTS) was derived using the Physiological parameters obtained at the time of admission, including the Glasgow Coma Scale (GCS), systolic blood pressure (SBP), and respiratory rate (RR). These values were obtained from emergency department triage records and casualty charts.

The Primary outcome variable, 24 hour mortality was determined from emergency department records, inpatient case sheets, and discharge/death summaries, based on death occurring within the first 24 hours of hospital admission. Additional clinical and demographic parameters, including age, sex, mechanism of injury, type of trauma, comorbidities and immediate surgical, airway interventions, were collected to account for potential confounding factors.

Bias

To minimize potential bias, we adhered to our institution's research protocol and developed a detailed checklist for data collection.

Study size

A total of 108 patients met the study's inclusion and exclusion criteria

Quantitative variables

Quantitative variables were initially used in the descriptive analyses and subsequently transformed into categorical data for proportional analysis

Statistical Analysis

All statistical analyses were performed using IBM SPSS ver. 30.0. Continuous variables were expressed as standard deviation, While categorical variables were presented as frequencies and percentages. The Chi-square test was used to assess associations between categorical variables and 24-hour mortality. The nonparametric Mann - Whitney U-test was applied for ordinal data that was not normally distributed. Multiple logistic regression analysis was conducted to identify independent predictors of 24-hour mortality and to control for potential confounding variables, and spearman rank correlation was employed to evaluate correlations between confounding variables . A P- value of less than 0.05 was considered statistically significant

RESULTS

Participants

Between January 2019 and January 2020, a total of 108 trauma patients met the eligibility criteria for inclusion in this study, comprising 60 patients who survived within 24 hours and 48 patients who died within 24 hours of hospitalization (Fig 1)

Clinical Characteristics of trauma patients

Among trauma patients who died within 24 hours of hospitalization , the mean age was 34.4 years with the majority of patients belonging to the 21-30 year age group (36.1%). No patients aged > 70 years were included in the study. Male patients who died represented a larger proportion of the overall study sample (35 of 108 patients, 32.4%) than female patients who died (13 of 108 patients, 12.03%). Among

mortality cases, the most common trauma mechanism was Road traffic accidents, accounting for 28 cases (58.3%). Regarding the site of injury, poly trauma is the most frequent pattern, observed in 15 cases (31.25%), and hypertension was the most frequently reported comorbidity, identified in 15 cases (31.2%). Alcohol consumption at the time of injury was documented in 15 cases (31%) and 12 patients (25%) were unconscious on arrival at the emergency department. The most frequent RTS score range upon ED admission among the patients who died was 0 to 4 (20 patients, 41.6%), indicating severe physiological compromise(Table 1)

Association of Revised Trauma Score with 24 hour mortality

Statistical analysis using the Chi - Square test demonstrated a significant association between revised trauma score and 24 hour mortality (P = 0.008) P<0.05 (Table 2). In sub group analysis patients with higher RTS values predominantly survived beyond 24 hours to 3 months, whereas those with lower RTS scores were more likely to die within 24 hours of hospital admission. Among mortality cases, the most frequent RTS range on emergency department admission was 2-3, indicating severe physiological derangement. Patients with moderate RTS values 4-6 showed intermediate survival outcomes, while those with Severly reduced RTS score 0-4 accounted for majority of early deaths. Overall, lower RTS at presentation was strongly associated with increased risk of 24-hour mortality among trauma patients presenting to the emergency department. Mortality was significantly higher among patients with RTS ≤ 3 compared to those with RTS >3. Specifically, 34 of 48 patients (70.8%) with RTS ≤ 3 died, whereas only 14 of 48 patients (29.1%) with RTS >3 died. Conversely, survival was higher in patients with RTS>3, 35 of 60 patients(58.3%) than in those with RTS ≤ 3, 25 of 60 patients (41.6%). The finding was statistically significant (P=0.004), indicating that lower RTS is strongly associated with increased in-hospital death (Table 3).

Confounding factors influencing the association between Revised Trauma score and 24-hour mortality

Multiple logistic regression analysis evaluating the association between Revised trauma score, potential confounding factors, and 24-hour mortality indicated a significant association between RTS and early mortality (P= 0.008). Lower RTS values have showed the highest odds ratios for 24 hour-mortality, indicating a strong predictive effect. Patients with RTS 0-1 (OR=8.17; 95% Cl: 1.32-50.4) and RTS 2-3 (OR=9.95; 95% Cl :2.10-47.1) had significantly higher odds of death within 24 hours compared with those having RTS 7-7.84(Table 4).

Confounder correlation analysis using spearman's rank correlation revealed a moderate negative correlation between RTS and age (ρ=-0.38; p<0.001), indicating lower RTS values among older patients. A strong positive correlation was observed between Revised Trauma Score and Glasgow Coma Score (ρ= 0.72; p<0.001), confirming the close relationship between neurological status and trauma severity. RTS also demonstrated moderate negative correlation with the mechanism of injury (ρ= -0.25 ; p=0.01) and A weak negative correlation with alcohol consumption (ρ=-0.19 ; p=0.048), while the correlation with comorbidities did not reach the statistical significance (ρ=-0.17 ; p=0.061) (Table 5)

This analysis was adjusted for the age, mechanism of injury, comorbidity. Alcohol consumption, After adjustment RTS remained a significant predictor of 24-hour mortality.Over all these findings suggest that RTS is an independent predictor of 24-hour mortality, even after controlling for major confounding factors.

DISCUSSION

The characteristics of trauma patients included in this study reflect the broader epidemiological pattern of injury observed in low and middle income countries, particularly India. According to the World health organization especially road traffic injuries remain a leading cause of morbidity and mortality worldwide, disproportionality affecting economically productive age groups [1]. Consistent with national data reported, the majority of trauma patients in this study were middle- aged adults, with a male predominance, likely due to increase exposure to high - risk activities such as road traffic travel and Occupational hazards [2]. Similar demographic trends have been documented in earlier epidemiological analyses of trauma burden [3]

Road traffic accidents were the most prevalent mechanism of injury, which corresponds with prior Indian and international literature showing vehicular trauma as the leading contributor to injury-related deaths [4]. The Predominance of blunt trauma explains the frequent involvement of Several physiological systems, Underlining the necessity for quick and reliable physiological scoring systems at the time of casualty presentation [5].

This study revealed a substantial connection between Revised Trauma score and 24-hour mortality, highlighting the relevance of RTS as an early predictor of short term outcomes in trauma patients. Patients who died within the first 24 hours of admission had markedly lower RTS values suggesting serious derangement in physiological parameters such as Glasgow Coma Scale (GCS), systolic blood pressure (SBP), and respiratory rate (RR). These findings are consistent with the original work by champion et al [5], who emphasized RTS as a sensitive tool for assessing immediate physiological compromise and predicting early mortality.

The strong relationship between lower RTS and early mortality documented in this study supports its role in early triage and risk classification .Similar observations were reported by Galvagno et al. [8], who established a substantial inverse relationship between RTS and mortality, underlining its relevance in both prehospital and emergency department settings. Furthermore, Gupta et.al [9] found that Revised Trauma score demonstrates predictive performance comparable to more complex scoring systems, including ISS and TRISS for early mortality, especially in resource-limited health care settings.

Trauma, including both accidental and intentional injuries, leads to higher mortality than cancer or heart disease [10]. Among the components of RTS, GCS emerged as a substantial contributor of early mortality, consistent with earlier data .Patients presenting with significant neurological impairment (GCS≤8) demonstrated a considerably greater rate of mortality within 24 hours. This observation is in line with findings by Kondo et al. [11], who underlined the predictive value of neurological status in early trauma outcomes. Despite known inter-rater variability in GCS evaluation, studies have shown acceptable reliability when applied by trained emergency professionals by Gill M et al [12]

Although comorbidities were not directly considered in the RTS analysis , their existence may have affected early outcomes. Previous study findings have indicated that pre-existing comorbid conditions influence trauma survival, especially in individuals with boderline physiological reserve[13]. However, the focus of RTS on real-time physiological parameters allows it to serve as a useful bedside tool, irrespective of detailed medical history, which is typically unavailable during initial casualty evaluation.

Hypertension at presentation, reflected by reduced systolic blood pressure scores within the RTS, was also strongly associated with early mortality. This finding is consistent with the accepted notion that traumatic bleeding and shock remain significant cause of preventable trauma fatalities , particularly

during the golden hour following injury[14]. Early diagnosis of physiological deterioration via RTS may consequently permit rapid resuscitative measures and enhance survival

The findings of this study highlight the significance of RTS as a simple, rapid and effective scoring systems for predicting 24 hour mortality in trauma patients. Given its ease of application and reliance on routinely assessed clinical variables, RTS is particularly valuable in emergency departments and resource constrained settings. These results support existing field triage and emergency care guidelines advocating the use of physiological scoring systems to identify high -risk trauma patients early in the course of care [15]

Limitations

This study has several potential limitations. First, its retrospective design and the absence of a consistent trauma- specific registry at our institution may have introduced biases in data collection.Second, the relatively small number of participants, limited study duration (1year), and single -center design may not fully reflect broader trends among trauma patients. Finally, as Revised trauma score (RTS) parameters were only assessed only at the time of casualty admission, dynamic physiological changes during resuscitation were not evaluated, which may have provided additional Prognostic insight.

Conclusions

The present study demonstrates that the Revised Trauma score is significantly associated with 24- hour mortality among trauma patients presenting to the casualty department. Lower RTS values at admission were highly indicative of early mortality, highlighting the score's utility as a rapid physiological evaluation tool in acute trauma setting.

These findings underscore the importance of early RTS- based risk classification to facilitate rapid decision-making, set priorities of care, and optimal resource allocation in emergency departments. Integrating RTS into standard trauma assessment may aid health care professionals in identifying high-risk patients who require aggressive and timely intervention

Subsequent Prospective, multicenter studies with larger sample sizes, standardized trauma registries, and the incorporation of pre-hospital variables are necessary to further validate the predictive accuracy of RTS and to examine its integration with other trauma scoring systems for enhanced early mortality prediction.

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