Correlation of Revised Trauma Score with Mortality Rate of Traumatic Patients within the First 24 hours of Hospitalization

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Article information	Abstract
 *Corresponding author: Department of Nursing, Faculty of Nursing and Midwifery, Zahedan University of Medical Sciences, Iranshahr, Iran. E-mail: sharifi9879@yahoo.com	**Background**: Trauma is a major health problem throughout the world, leading to death and disability especially in the first four decades of victims' life. In Iran also, accident-related death has a critical situation with an increasing rate of 10-15% per year. The aim of this study was to determine the relationship between revised trauma score and mortality rate of traumatic patients within the first 24 h of hospitalization. **Materials and Methods**: A prospective cross-sectional study was conducted to investigate the association between revised trauma score and the mortality rate of traumatic patients within the first 24 h of hospitalization on 240 traumatic patients admitted to Khatam al-Anbia hospital. The obtained data were analyzed with SPSS software-15, using logistic regression, chi-square, and descriptive statistics. **Results**: Seventy four point tow percent of patients were referred due to accident, of which 38.3% had multiple traumas. Fifty point eight percent of traumatic patients died within the first 24 h of hospitalization. The minimum and maximum revised trauma score in injured patients were 7 and 12, respectively. Also, 80% of mortality was seen in victims with a score of 9-10. Both the χ^2 test and logistic regression showed a significant relationship between the first revised trauma score and the mortality rate of traumatic patients within the first 24 h of hospitalization (p=0.001). **Conclusion**: The results of this study indicate that the revised trauma score can be used as a tool to predict the mortality rate of traumatic patients.

Introduction

Trauma is a major health problem throughout the world, leading to death and disability especially in the first four decades of victims' life [1]. The most frequent cause of under 24 years old people death is attributed to brain damages which impose an annual cost of several billions Rials to healthcare system [1, 2]. Traffic accidents accounted for the second leading cause of illness and premature death next to AIDS among 15-24 years old men in 2000. The World Health Organization has announced that road traffic accidents will become the third leading cause of disease in the world in 2020 [3]. Each year, 1.2 million people are killed in road accidents and more than 50 million people are injured or disabled. 85% of deaths and 90% of disabilities occur in developing countries [4]. In Iran also, accident-related death has a critical situation with an increasing rate of 10-15% per year. Accidents are the second cause of death in Iran which is in the first rank of accident in the world [5]. Early intervention is the fundamental principle in reducing the rate of mortality and disability caused by trauma [6]. Among these interventions, specific measures to estimate the injury severity and dynamism and stability of patients can be cited which have important role in determining the type of provided care and deceasing mortality rate [7]. The application of Revised Trauma Score began in early 1989 (Table 1). This is a physiological scoring system, with high inter-rater reliability and demonstrated accuracy in predicting death. It is scored from the first set of data obtained on the patient, and consists of Glasgow Coma Scale, Systolic Blood Pressure and Respiratory Rate. These indices are scored between zero (worst status) and four (best status). The final score of this scale is in the range of 0-12. The patients with a score less than 3 have very little chance of survival; score 3-10 requires immediate intervention; score 11 requires intervention but the patient can wait for some time, score 12 includes delayed care [8, 9]. Results of some studies suggest that this scale is helpful in the triage of traumatic patients and predicting their mortality rate [10, 11]. In this context, a study entitled "the value of trauma scores: predicting discharge after traumatic brain injury," was performed in 1999. The results of this study showed that of 378 patients with an acute hospitalization period following traumatic brain injury and under treatment at level 1 trauma center between September 1997 and May 1998, 17.46% died, 2.62% were referred to nursing homes and 20.37% to rehabilitation centers, 7.67% received welfare services, and 51.85% were discharged from the hospital without need to handle. In this study it was determined that the revised trauma score and injury severity score can be used as predicting criteria after acute hospitalization period and that they are useful measures in terms of rehabilitation services requirement [12]. In 2004, a study was also conducted in Pakistan to

assess the revised trauma score in patients with multiple injuries. In this study, the revised trauma score of 30 young patients with multi-system injuries caused by traffic accidents and who were undergone advanced cardiopulmonary resuscitation, was estimated and compared with their status at discharge. Twenty six point sixty six of patients died and most of deaths were associated with the revised trauma score 6. These results showed that the revised trauma score is a reliable predictor in status prediction of patients with multiple trauma, thus it can be used in emergency triage area [13]. Due to the high statistics of accidents and subsequent death in Iran, preventability of most accident-related deaths, the need for application of precision tools for faster triage of traumatic patients, and the lack of a tool for predicting and determining of in-hospital traumatic patients mortality, the researchers decided to conduct a study to show the relationship of revised trauma score and mortality of traumatic patients within the first 24 h of hospitalization.

Table 1. The application of revised trauma score

Glasgow Coma Scale (GCS)	Systolic blood pressure (SBP)	Respiratory rate (RR)	Coded value
13-15	>89	10-29	4
9-12	76-89	>29	3
6-8	50-75	6-9	2
4-5	1-49	1-5	1
3	0	0	0

Materials and Methods

A prospective cross-sectional design was used to conduct this study. The research environment was Khatam Al-Anbia hospital which is supervised by Zahedan University of Medical Sciences. The study population was traumatic patients referred to the emergency of Khatam Al-Anbia hospital in Iranshahr. Based on injury severity scoring system (ISS), those patients with moderate and severe trauma who required hospitalization and monitoring were entered to the study. The exclusion criteria included patients with mild and superficial trauma, victims who required monitoring and hospitalization less than 24 h, and those referred to other hospitals for continuation of treatment. Considering mortality rate of 3%, sample size was calculated 240 patients. Therefore, 240 victims who had the inclusion criteria were selected from casualties referred to Khatam Al-Anbia Hospital in Iranshahr. To collect the required data, a three partite questionnaire was used including demographic data, questions related to the revised trauma score, and mortality determination of patient within the first 24 h after hospitalization. The validity of revised trauma score which is one of the most practical measures in the field of traumatic patients study, has been confirmed in many studies [14, 15]. To determine the reliability of the scale, the test-retest method was performed on 20 traumatic patients and the Cronbach's alpha coefficient of 0.86 confirmed the reliability of the scale. This scale consists of three sub-categories including Glasgow Coma Scale, respiratory rate, and systolic blood

pressure. All three indices are calculated in five states between zero (worst case) and four (best case). The final score of this scale is in the range of 0-12. According to this scoring system, the respiratory rate of 10-29 scores 4, more than 29 scores 3, 6-9 scores 2, and lack of breathing scores zero. Glasgow Coma Scores 3, 4-5, 6-8, 9-12, and 13-15 received scores zero, 1, 2, 3, and 4, respectively. To rank blood pressure, scores zero, 1, 2, 3, and 4 was given to no palpable blood pressure, and blood pressures 10-49 mmHg, 50-75 mmHg, 76-89 mmHg, and greater than 89 mmHg, respectively. The final score was calculated for each variable from zero to 12. To determine the first revised trauma score, the data collecting questionnaire was used in the emergency department while mortality follow-up after 24 hours was continued in the ward where the patient was admitted. These wards included women and men surgery, and intensive care unit. Statistical analyzes were performed using SPSS-15. Descriptive statistics of frequency distribution, mean, and standard deviation were used. To investigate the relationship between the revised trauma score and mortality rate of traumatic patients, the χ^2 test and logistic regression were used. Alpha level of 0.05 was considered significant. In this context, ethical codes of Ethics Committee of Zahedan University of Medical Sciences were observed.

Results

According to the results of this study, the minimum and maximum age of samples were 5 and 93 years, respectively with a mean of 26.54 and a standard deviation of 13.12 years. The age range frequency was 48.8% in 0-23 years, 44.2% in 24-47 years, 5.8% in 48-71 years, and 1.3% in 72-95 years. Ninety point eight percent of patients were male and 9.2% were female. The cause of injuries was traffic accidents (74.2%), fall (12.1%), strife (7.5%), burns (1.3%), and others (5%) such as home accidents and accidents caused by children playing with dangerous objects. Eighty six point six percent of traumas were related to traffic accidents and falls. Thirty eight point eight percent of victims had multiple trauma, 22.9% damage to the lower extremities, 20.4% head and neck injuries, 12.1% upper extremities injuries, 2.5% abdominal trauma, 1.7% damage to thorax, and 1.2% spinal cord injuries. Five point eight percent of the patients died within the first 24 h of hospitalization. Twenty point eight percent of them were transported to hospital by emergency ambulance, and 3 patients transported by emergency medicine, died in the first 24 h of hospitalization. In this study, the minimum and maximum revised trauma scores (RTS) in injured patients were 7 and 12, respectively, with a mean of 11.66±0.729. The revised trauma score was 7-8 in 0.8%, 9-10 in 4.2%, and 11-12 in 95%. All victims with revised trauma score of 7-8 had multiple traumas. Patients with revised trauma score of 9-10 had head and neck injuries in 30%, abdominal injuries in 10%, and multiple traumas in 60%. Patients with revised trauma score of 11-12, had head and neck injuries in 20%, chest injuries in 1.8%, spinal cord injuries in 2.2%, abdominal injuries in 2.2%, upper

extremity injuries in 12.7%, lower extremity injuries in 24.1%, and numerous injuries in 36.8%. 60% of patients with multiple traumas, 20% with head and neck injuries, and 20% with abdominal injuries died. No significant relationship was observed between the site of trauma and mortality within the first 24 h of hospitalization (p=0.18). Analysis of the components of trauma scoring scale showed that in 3 out of 5 died patients, GCS was 3-8, in 1 GCS was 11-12, and in 1 GCS was 15. Chi-square test showed a significant relationship between GCS score and mortality rate of victims (p=0.001, df=10, χ^2 =142.192). While no significant correlation was seen between age and blood pressure difference of accident scene and emergency with mortality rate of victims.

In addition, there was a significant correlation between the first trauma revised score with mortality of traumatic patients within the first 24 h of hospitalization (p=0.001, df=2, χ^2 =97.838). Twenty percent of deaths were occurred in patients with RTS score of 7-8 and 80% in victims with RTS score of 9-10. A logistic regression analysis was performed in which death was a dependent variable while systolic blood pressure, respiratory rate, GCS score, and trauma score were considered as predictor variables. The logistic regression results also indicated that a significant inverse relationship existed between mortality rate within the first 24 hours of hospitalization and the revised trauma score (B=-3.82, p<0.05, exp; 68%, 95% CI [56-82%]). The revised trauma score compared with its subsets including Glasgow Coma Scale, respiratory rate, and systolic blood pressure were valuable in prediction of mortality in traumatic patients in the first 24 hours of hospitalization; p=0.02, exp;62%, and 95% CI [51-69%] for GCS and p=0.03, exp; 51%, and 95% CI [38-59%] for systolic blood pressure. Using Binormal ROC Curve Analysis the sensitivity and specificity of this instrument for prediction of mortality in traumatic patients were determined as 88% and 90%, respectively.

Discussion

The results of this study indicate that the revised trauma score can be used as a tool to predict the mortality rate of traumatic patients. The revised trauma score has universal application in pre-hospital fields and provides a snapshot of the physiological state of traumatic patients. Several studies indicate the reliability of the revised trauma score in prediction of the subsequent consequences of accidents. One important application of such a scale is the prediction of mortality rate in traumatic patients and selection of more critical patients for treatment in specialized trauma centers. In the present studies, the relationship of revised trauma score with mortality within the first 24 h of hospitalization was assessed in traumatic patients. The obtained results showed a significant relationship between the first revised trauma score and mortality within the first 24 h of hospitalization in traumatic patients. It was also found in this study that most of victims mortality was seen in revised trauma score of 9-10 (sensitivity 88% and specificity 90%).

Several studies have examined the relationship of trauma grade with mortality throughout the world with more or less similar results. The findings of Jin et al. study showed that 10% of traumatic patients experienced a fatal trauma despite a revised trauma score of 11-12 [16]. The cause may be attributed to the type, location, and severity of trauma despite the first revised trauma score. On the other site, only the relationship of revised trauma score with mortality within the first 24 h of hospitalization was examined. Measuring the revised trauma score within more than 24 h may lead to more results. In addition, higher mortality in patients with higher revised trauma score showed that although the revised trauma score was associated with mortality in traumatic patients, it is not enough as the only tool used in triage of traumatic patients and prediction of their mortality and may be beneficial if used along with other triage tools.

This finding was also approved in the study of Giannakopoulos about the unreliability of revised trauma score as the only triage tool in Helicopter Emergency Medical Services in Netherlands. Their results showed that the revised trauma score alone is not a reliable tool for Helicopter Emergency Medical Services, resulting in insufficient triage (unrealistic) of traumatic patients [17]. Another finding of the present study which was confirmed by logistic regression is the ability of revised trauma score to predict the mortality of traumatic patients. This scale has a greater mortality predictive value compared to its subsets (Glasgow coma scale, respiratory rate, and systolic blood pressure). Jin's study also showed that the revised trauma score is a tool to differentiate lethal trauma from other types of trauma and is applicable to determine the survival rate of patients following traumatic events. In this study, patients with revised trauma score of less than 7 were treated faster than other traumatic patients and showed the highest mortality. Other findings of this study indicate the possibility of error and delay in beginning of treatment due to use of this scale in emergency department and resulting in unrealistic triage of patients [16]. In the present study, sensitivity and specificity of the revised trauma score in predicting mortality of traumatic patients were 88% and 90%, respectively. Jin reported a sensitivity of 85% and a specificity of 93% in the revised trauma score [16].

According to these results, it can be stated that the revised trauma score is helpful in classification of traumatic patients and prediction of their mortality especially when efficient use of emergency resources is necessary. But a sensitivity of 88% of the revised trauma score can lead to error and treatment delay. Findings of the study of Roorda et al. showed the poor performance of this index in comparison to previous studies, and the absence of severe trauma was stated as the cause by the authors [18]. Based on the results of this study and the previously mentioned studies, it can be stated that the revised trauma score is helpful in classification of traumatic patients and prediction of their mortality especially when efficient use of emergency resources is necessary.

In other words, the revised trauma score can act as a triage tool to predict mortality and prioritize the care of traumatic patients with different intensities especially when dealing with lack of resources, but it is not enough as the only used tool. Application of other tools may improve the value of mortality prediction in traumatic patients and minimize the possibility of error in prioritizing and care of patient. The usage of only the first revised trauma score and measurement of mortality within the first 24 h of hospitalization were two limitations of this study. It is suggested to measure the revised trauma score along with disabilities remained from trauma and mortality rate of more than 24 h or after discharging from hospital in future studies.

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Authors' Contributions

All authors had equal role in design, work, statistical analysis and manuscript writing.

Conflict of Interest

The authors declare no conflict of interest.

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