RESEARCH ARTICLE

The effect of the use of trauma scoring systems on prognosis of patients with multiple traumas: A cross-sectional study

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Abstract

Objective: To examine the effects of the use of trauma scoring systems on prognosis in patients with multiple traumas.

Methods: This cross-sectional study was conducted from June 2012 to September 2014 at the Mugla Sitki Kocman University Training and Research Hospital, Mugla, Turkey, and comprised mentally healthy patients aged 18 or more treated at the emergency department for trauma to at least two body parts or who had more than one long bone fractureData was collected using the patient information form and the patient follow-up form. SPSS 18 was used to analyse the data.

Results: Of the 70 patients, 55(78.6%) were male and 15(21.4%) were female. The overall mean age was 40.97±1.94 years. A statistically significant difference was determined between the first and fourth days ($p<0.05$) for all scoring systems for patients who died and those who survived.

Conclusion: Trauma scoring systems used for multiple trauma patients were able to determine the physiological status and mortality of the patient.

Keywords: Multiple traumas, Prognosis, Trauma scoring systems. (JPMA 68: 1048; 2018)

Introduction

Trauma is one of the main health problems in every country regardless of the level of socio-economic development.[1] It continues to be a significant health problem that increases mortality and morbidity rates due to developments in technology, accidents and incidents of violence.[2] Trauma is the top third cause of death in all age groups following cancer and cardiovascular diseases, and the top cause of death in the 1-44-year-old age group.[3] According to World Health Organisation (WHO) data, 3.5 million people worldwide lose their lives due to trauma every year.[4,5] Research has shown that 25-50% of trauma-related deaths can be prevented.[3] Trauma scoring systems (TSS) were developed in order to obtain data related to trauma patients accurately and easily and ensure that the data is expressed using common terms both nationally and internationally. Scoring systems for trauma patients have been used for nearly 30 years in developed countries and these systems are constantly being improved in order to manage the diagnosis and treatment of trauma patients more efficiently.[5,6]

The current study was planned to examine the effects of the use of TSS on prognosis in patients with multiple traumas.

Patients and Methods

This cross-sectional study was conducted from June 2012 to September 2014 at the MuglaSitkiKocman University Training and Research Hospital, Mugla, Turkey. The population of the study comprised male and female patients who were treated at the emergency service for multiple traumas, were 18 years or older, mentally healthy, had no visual, hearing or speech impairments, spoke Turkish, had suffered trauma to at least two body parts (head-neck, chest, abdomen and extremities) or had more than one long-bone fracture, were brought to the emergency room from the accident scene and agreed to participate inthestudy.

The number of samples was determinedby power analysis.The sample size was determined as at least 64 with $\alpha = 0.05$, one-way hypothesis, a power of 80% and an effect size of 0.3.[7,8] The number of samples was set at 70 to facilitate data analysis.[7,8] Patients were selected by convenience sampling method.

Data was collected using predesigned patient information form (PIF) and the patient follow-up form (PFF). The PIF consisted of 16 variables: date, file number, age, gender, education, occupation, time of trauma, time of first contact with the emergency

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services, time elapsed between trauma and treatment, body part affected by trauma, cause of trauma, trauma mechanism, vital signs, haemogram result, duration of stay in emergency room(ER) and alcohol level. The PFF contained variables such as the patient's clinic, duration of stay in intensive care unit (ICU), clinical diagnosis, invasive interventions, duration of mechanical ventilation, operation dates and duration of stay in hospital. It also indicated which vital signs, haemogram results, Glasgow Coma Score (GCS), Revised Trauma Score (RTS), Abbreviated Injury Score (AIS), Injury Severity Score (ISS), Trauma Score (TS) and Trauma and Injury Severity Score (TRISS) were measured and recorded on the first, second, third and fourth days. PIF and PFF were first created and applied to five patients and the data collection process began after necessary modifications were made. Vital signs, oxygen saturation and haemogram results for multiple trauma patients were recorded within the first hour after the patient was first treated at ER.

Patients' GCS, RTS, AIS, ISS, TS and TRISS scores were also measured and recorded in the first hour. The patients who were admitted to the hospital were visited on the second, third and fourth days. Vital signs, oxygen saturations and haemogram results were measured again and trauma scores were calculated and recorded. Data collection was completed by following up with patients until they were either discharged, transferred or they died.

SPSS 18 was used to analyse the data. Numeric data was expressed as mean ± standard deviation. Other data was defined in the form of frequency and percentage. The relationships between the TSSs of patients who died and who survived were compared using the Mann Whitney U test. The relationships between TSSs and prognosis indicators first day - fourth day were identified using Pearson correlation analysis. The limit of significance was $p<0.05$ for all tests.

Permission was obtained from the institutional review committee and from the Non-invasive Clinical Research Ethics Board, Faculty of Medicine, Adnan Menderes University, Turkey.

Results

Of the 70 patients, 55(78.6%) were male. The overall mean age was 40.97±1.94 years (range: 19-77 years), 31(44.3%) patients were elementary school graduates and 4(5.7%) patients were university graduates. Occupationally, 33(47.1%) patients were labourers, while government employees were just 2(2.9%).

The most common cause of trauma was In-Vehicle

Table-1: The distribution of the correlations between trauma scoring systems and prognosis indicators on day one.

Prognosis Indicators	GCS r / p value	RTS r / p value	AIS r / p value	ISS r / p value	TS r / p value	TRISS r / p value
Duration of stayin hospital (day)	-0.22 / 0.073	-0.15 / 0.220	0.16 / 0.179	0.21 / 0.076	-0.20 / 0.102	0.28 / 0.017
Duration of stay in ICU(day)	-0.32 / 0.007	-0.27 / 0.025	0.23 / 0.052	0.29 / 0.015	-0.32 / 0.008	0.41 / 0.000
Duration of stayin MV (day)	0.56 / 0.092	0.38 / 0.274	-0.39 / 0.260	-0.23 / 0.529	0.33 / 0.356	-0.07 / 0.859
Intubation	0.74 / 0.000	0.76 / 0.000	-0.65 / 0.000	-0.71 / 0.000	0.75 / 0.000	-0.85 / 0.000
Haemogram Result	-0.01 / 0.953	-0.44 / 0.716	-0.21 / 0.080	-0.06 / 0.598	-0.05 / 0.713	-0.01 / 0.929
Erythrocyte Transfusion	-0.45 / 0.000	-0.43 / 0.000	0.56 / 0.000	0.49 / 0.000	-0.45 / 0.000	0.50 / 0.000
Death	-0.58 / 0.000	-0.71 / 0.000	0.59 / 0.000	0.72 / 0.000	-0.68 / 0.000	0.81 / 0.000

GCS = Glasgow Coma Score, RTS = Revised Trauma Score, AIS = Abbreviated Injury Score, ISS = Injury Severity Score, TS = Trauma Score, TRISS = Traumaand Injury Severity Score.

Table-2: The distribution of the correlations between trauma scoring systems and prognosis indicators on day four.

Prognosis Indicators	GCS r / p value	RTS r / p value	AIS r / p value	ISS r / p value	TS r / p value	TRISS r / p value
Duration of stay in hospital (day)	-0.39 / 0.001	-0.34 / 0.004	0.22 / 0.068	0.30 / 0.011	-0.29 / 0.015	0.42/0.000
Duration ofstay in ICU (day)	-0.49 / 0.000	-0.44 / 0.000	0.29 / 0.015	0.38 / 0.001	-0.40 / 0.001	0.53 / 0.000
Duration of stay in MV (day)	-0.21 / 0.553	0.03 / 0.935	-0.28 / 0.442	-0.03 / 0.929	0.07 / 0.845	0.28 / 0.432
Intubation (day)	0.90 / 0.000	0.92 / 0.000	-0.69 / 0.000	-0.77 / 0.000	0.88 / 0.000	-0.92 / 0.000
Haemogram Result	0.35 / 0.003	0.48 / 0.000	-0.57 / 0.000	-0.56 / 0.000	0.50 / 0.000	-0.49 / 0.000
ErythrocyteTransfusion	-0.45 / 0.000	-0.45 / 0.000	0.59 / 0.000	0.52 / 0.000	-0.45 / 0.000	0.49 / 0.000
Death	-0.70 / 0.000	-0.85 / 0.000	0.64 / 0.000	0.79 / 0.000	-0.87 / 0.000	0.88 / 0.000

GCS = Glasgow Coma Score, RTS = Revised Trauma Score, AIS = Abbreviated Injury Score, ISS = Injury Severity Score, TS = Trauma Score, TRISS = Traumaand Injury Severity Score.

Table-3: The distribution of data regarding the comparison between the trauma scoring systems of patients who died and who survived.

TSS Day 1	Died (Mean ± SS) n=6	Survived (Mean ±SS) n=64	U / p value
GCS	3.83±2.04	12.44±3.53	15.000 / 0.000
RTS	2.12±1.67	6.80 ± 1.29	7.000 / 0.000
AIS	17.50±3.02	10.20±2.85	18.000 / 0.000
ISS	51.17±10.55	19.72±8.41	3.000 / 0.000
TS	4.50±2.43	13.41±2.78	7.000 / 0.000
TRISS	92.53±12.04	11.31±17.05	1.000 / 0.000
TSS Day 1	**Died (Mean ± SS) n=6**	**Survived (Mean ±SS) n=64**	**U / p value**
GCS	**3.00±0.00**	**13.73±3.20**	**6.000 / 0.000**
RTS	**2.14±0.81**	**7.42±0.94**	**.500 / 0.000**
AIS	**18.17±2.86**	**9.39±3.04**	**9.500 / 0.000**
ISS	**58.50±7.56**	**19.22±8.85**	**.000 / 0.000**
TS	**4.67±1.97**	**14.88±1.60**	**.000 / 0.000**
TRISS	**97.50±2.04**	**6.68±14.25**	**.000 / 0.000**

GCS = Glasgow Coma Score, RTS = Revised Trauma Score, AIS = Abbreviated Injury Score, ISS = Injury Severity Score, TS = Trauma Score, TRISS = Traumaand Injury Severity Score, TSS Trauma Scoring Systems.

Traffic Accident (IVTA) 23(32.9%) patients, while firearm injury was the least common cause, 1(1.4%) patient. As for trauma mechanism, 64(91.4%) patients had blunt trauma and 6(8.6%) had penetrating trauma. It was found that 31(44.3%) of the patients had suffered a trauma between 06.00-11.59, 21(30.0%) had suffered a trauma between 12.00-17.59, 16(22.9%) between 18.00-23.59 and 2(2.9%) between 00.00-05.59 hours. Besides, 1(1.4%) patient was admitted to ER between 00.00-05.59 and an equal distribution was shown for other time intervals 23(32.9%). Further, 51(72.9%) patients had suffered head and vertebra injuries, 45(62.9%) had suffered abdominal injuries, 43(61.4%) had suffered injuries to an upper extremity, 42(60.0%) had suffered injuries to a lower extremity and/or face, 35(50.0%) had suffered pelvic injuries, 15(21.4%) had suffered damage to thegenito-urinary system and 7(10.0%) had suffered neck injuries. Abrasions or lacerations in varying degrees were identified on the body surfaces of all patients.

While there was a positive, significant and weak correlation between duration of stay in hospital and TRISS ($p<0.05$), a correlation between duration of stay in hospital and GCS, RTS, AIS, ISS and TS could not be found ($p>0.05$). There was a statistically significant difference between duration of stay in ICU and GCS, RTS, ISS, TS and TRISS ($p<0.05$), but a correlation between duration of stay in ICU and AIS could not be found ($p>0.05$). Duration of mechanical ventilation (MV) and haemogram result did not have a statistically significant relationship with GCS, RTS, AIS, ISS, TS and TRISS ($p>0.05$). Intubation and erythrocyte had a statistically significant relationship with GCS, RTS, AIS, ISS, TS and TRISS ($p<0.05$). A statistically significant difference was found between death and GCS, RTS, AIS, ISS, TS and TRISS on day one ($p<0.05$). There was a negative, medium and significant correlation between death and GCS; a negative, strong and significant correlation between death and RTS; a positive, medium and significant correlation between death and AIS; a positive, strong and significant correlation between death and ISS; a negative, medium and significant correlation between death and TS; and a positive, strong and significant correlation between death and TRISS (Table-1).

On day four, there was a statistically significant difference between duration of stay in hospital and GCS, RTS, ISS, TS and TRISS ($p<0.05$), but a correlation between duration of stay in hospital and AIS could not be found ($p>0.05$). A statistically significant difference was found between duration of stay in ICU and GCS, RTS, AIS, ISS, TS and TRISS ($p<0.05$).There was no statistically significant difference between duration of MV and GCS, RTS, AIS, ISS, TS and TRISS ($p>0.05$). A statistically significant difference was found between intubation and GCS, RTS, AIS, ISS, TS and TRISS ($p<0.05$). There was a positive, very strong and significant correlation between intubation and GCS; a positive, very strong and significant correlation between intubation and RTS; a negative, medium and significant correlation between intubation and AIS; a negative, strong and significant correlation between intubation and ISS; a positive, strong and significant correlation between intubation and TS; and a negative, very strong and significant correlation between intubation and TRISS. A statistically significant difference was found between haemogram results and GCS, RTS, AIS, ISS, TS and TRISS ($p<0.05$). A statistically significant difference was found between erythrocyte transfusion and GCS, RTS, AIS, ISS, TS and TRISS ($p<0.05$). A statistically significant difference was found between death and GCS, RTS, AIS, ISS, TS and TRISS on day four as well ($p<0.05$). There was a negative, strong and significant correlation between death and GCS; a negative, strong and significant correlation between death and RTS; a positive, medium and significant correlation between death and AIS; a positive, strong and significant correlation between death and ISS; a negative, strong and significant correlation between death and TS; and a positive, strong and significant correlation between death and TRISS (Table-2).

There was a statistically significant difference in all TSSs on the first and fourth day of patients who died and who survived (p<0.05) (Table-3).

Discussion

The average age of our patients (40.97±16.27) was similar to other studies in the literature.[9] In terms of gender, men suffer from trauma more frequently than women.[1] Durdu et al.reported that 75.4% of trauma patients were male and Kondo et al. reported that 68.9% were male in their respective studies.[10,11] The most common causes of trauma are motor vehicle accidents, falls, firearms, sharp objects and burns.[12] In their study, Heydari-Khayat reported the causes of multiple trauma as 74.2% from traffic accidents, 12.1% from falls, 7.5% from physical assaults and 1.3% from burns.[13] Wongsirisuwan reported 47.7% as arising from motorcycle accidents, 16.9% from car accidents and physical assaults, and 7.7% from firearm injuries.[14] 32.9% of our patients had had an In-Vehicle Traffic Accident (IVTA), 31.4% had had a motorcycle accident, 12.9% had had an Out-Vehicle Traffic Accident (OVTA), 10.0% had had a work accident, 5.7% had fallen from a high place and had sharp object injuries and 1.4% had firearm injuries. In other studies, the most common cause of trauma has been reported to be motor vehicle accidents and this ratio was found to be fairly high in our study as well.[11,13] Schluter et al. reported 97% blunt trauma and 3% penetrating trauma in their study.[15] Our results regarding trauma mechanisms are similar to those in other studies in the literature.

In a study on the effect of heart defects in multiple trauma cases and their relationship to trauma severity, Karakus reported a positive, weak and significant correlation between total duration of stay in hospital and ISS and a negative, weak and significant correlation between total duration of stay in hospital and GCS.[16] In their study,Orhon et al. reported a positive, weak and significant correlation between duration of stay in hospital and ISS and a negative, weak and significant correlation between duration of stay in hospital and RTS.[17] In our study, a positive, significant and weak correlation between duration of stay in hospital and TRISS was found on days one and four.

Ünlü et al. reported a statistically significant relationship between duration of ventilation and GCS, RTS and TRISS values.[18] In their study, Orhon et al. found a negative, medium and significant correlation between duration of MV , while a correlation between duration of MV andISS could not be found.[17] In our study, a statistically significant difference between duration of MV and GCS, RTS, AIS, ISS, TS and TRISS could not be found on days one and four. In light of these results, it can be suggested that the relationship between the scoring systems and prognosis indicators increased on days when the patient follow-up was carried out. A statistically significant difference was found between death and GCS, RTS, AIS, ISS, TS and TRISS on days one and four.It can be said that TSS are effective in predicting the death rate.

Yagmur et al. reported that the average GCS was 14.41±1.71 for patients who survived in hospital, 12.75±3.13 for patients who survived in an ICU and 6.67±3.81 for patients who died in anICU.[8] In our study, the average GCS on day one was 3.83±2.04 for patients who died, 12.44±3.53 for patients who survived and a statistically significant difference was found. In our study, the average GCS on day four was 3.00±0.00 for patients who died, 13.73±3.20 for patients who survived and a statistically significant difference was found. Even though the average GCS was found to be consistent in similar studies performed with patients who survived, it was found to be significantly lower for patients who died.

Siritongtaworn and Opasanon reported that the average RTS value was 5.21±1.53 for patients who died, 7.73±0.45 for patients who survived and there was a statistically significant difference.[19] In our study, the average RTS on day one was 2.12±1.67 for patients who died, 6.80±1.29 for patients who survived and a statistically significant difference was found. The average RTS on day four was 2.14±0.81 for patients who died, 7.42±0.94 for patients who survived and a statistically significant difference was found. In our study, the average RTS on day four was found to be ≤3.36 for all patients who died. RTS is an important physiological scoring system that shows survival and there was a positive, significant and very strong correlation between GCS and RTS on day one and four. The two of them together have an important role in predicting the risk of mortality and survival.

Siritongtaworn and Opasanon reported that the average ISS value was 32.53±11.28 for patients who died, 9.13±6.54 for patients who survived and there was a statistically significant difference.[19] In our study, the average ISS on day one was 51.17±10.55 for patients who died, 19.72±8.41 for patients who survived and a statistically significant difference was found. The average ISS on day four was 58.50±7.56 for patients who died, 19.22±8.85 for patients who survived and a statistically significant difference was found.

Ihtiyar et al. reported that the average TS value was 11.5 for patients who died while being treated in the emergency room and 15.4 for patients who were discharged.[20] In our study, the average TS on day one was 4.50±2.43 for patients who died, 13.41±2.78 for patients who survived and the average TS on day four was 4.67±1.97 for patients who died, 14.88±1.60 for patients who survived and a statistically significant difference was found.Contrary to the study conducted by Ihtiyar et al.,[20] the average TS value of patients who died on days one and four was found to be significantly lower in our study. The average TS value for patients who survived was also found to be lower compared to other studies. As a result of our study, the average TS value for patients who died was found to be significantly lower compared to the average TS value for patients who survived.

Eryilmaz et al. reported the average TRISS value to be 87.9±11.4 for patients who died and 20.4±23.9 for patients who survived, and Okasha et al.reported the average TRISS value to be 69.21±32.43 for patients who died and 40.01±26.86 for patients who survived.[21,22] In our study, the average TRISS on day one was 92.53±12.04 for patients who died, 11.31±17.05 for patients who survived and a statistically significant difference was found. Our study is not consistent with other studies in terms of TRISS results. In our study, the average TRISS on day four was 97.50±2.04 for patients who died, 6.68±14.25 for patients who survived and a statistically significant difference was found. Ünlü reported that there was a statistically significant relationship between the average TRISS values of patients and mortality.[2] Similarly, a positive, significant and strong correlation between death and TRISS was found in our study as well.

A statistically significant difference was found in averages of all TSSs for patients who died and survived. It can be said that these scoring systems had a significant role in the prognoses of patients.

Conclusion

TSS used for multiple trauma patients was important in the determination of the physiological status and mortality of the patient. TSSs can be used effectively in patient follow-up and nursing management.

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