ORIGINAL ARTICLE

https://doi.org/10.1590/1806-9282.20230035

Predictors of mortality in patients with geriatric trauma in the emergency service

Hakan Hakkoymaz[1*], Muhammed Semih Gedik[1], Ali İhsan Kilci[2], Ramazan Azim Okyay[1], Yavuzalp Solak[3]

SUMMARY

OBJECTIVE: In our study, it was aimed to compare the power of trauma scores (Glasgow Coma Score, Revised Trauma Score, Abbreviated Injury Scale, Injury Severity Score, and Trauma Score-Injury Severity Score) in order to predict mortality in patients with geriatric trauma and to determine the predictive values of these scores in mortality.

METHODS: Demographic data, clinical features, etiological causes, laboratory results, and trauma scores of the patients were statistically analyzed. SPSS 20 for Windows was used for this evaluation.

RESULTS: It was determined that as the Glasgow Coma Score value of the patients increased, the Abbreviated Injury Scale and Injury Severity Score scores decreased and the Trauma Score-Injury Severity Score score increased. Abbreviated Injury Scale and Injury Severity Score values increased and Revised Trauma Score and Trauma Score-Injury Severity Score values decreased as the lactate levels of the patients increased. It was determined that the Abbreviated Injury Scale and Injury Severity Score scores of the patients hospitalized in the intensive care unit were significantly higher, while their Trauma Score-Injury Severity Score scores were lower.

CONCLUSION: Glasgow Coma Score, Revised Trauma Score, Trauma Score-Injury Severity Score, Abbreviated Injury Scale, and Injury Severity Score scores and blood lactate levels are important parameters that can be used in the emergency department for the early detection of high-risk patients in geriatric trauma and the evaluation of the prognosis of geriatric trauma patients.

KEYWORDS: Geriatrics. Trauma. Injury. Mortality.

INTRODUCTION

The elderly population is gradually increasing due to the increase in living standards in our country, as in all developed and developing countries[1,2]. Patients over 65 years of age constitute 28% of trauma-related deaths. For patients over the age of 65 years, traffic accidents and falls are the most common causes of trauma. High morbidity and mortality are observed in geriatric patients. Many scoring methods are used in order to understand the severity and consequences of trauma that are inconsistent with the clinical picture in the early period and to reduce the deaths due to this inconsistency[1-4].

The following five trauma scores were used in our study: Glasgow Coma Score (GCS), Revised Trauma Score (RTS), Injury Severity Score (ISS), Abbreviated Injury Scale (AIS), and Trauma Score-Injury Severity Score (TRISS).

The GCS is used to evaluate the state of consciousness. GCS scores ranging from 3 (fatal) to 15 (minor) indicate the patient's level of consciousness, and scores of 8 and below indicate that the patient is in a coma[3]. RTS is the combination of respiratory rate, systolic blood pressure, and GCS. The AIS is a glossary in which trauma is scored from 1 (minor) to 6 (fatal). ISS is calculated as the sum of the squares of the AISs of the three most severely injured regions of these organs (head, neck, face, thorax, abdomen, extremities, and others). The score ranges from 1 (minor) to 75 (fatal). ISS indicates 16 or more major traumas. The trauma and injury severity score (TRISS) is a combined scoring system that evaluates the probability of survival of a trauma patient based on RTS, ISS, AIS, and the patient's age (1–4 years).

In our study, it was aimed to compare the power of trauma scores (GCS, RTS, AIS, ISS, and TRISS) in order to predict mortality in patients with geriatric trauma and to determine the effectiveness of the hospitalization decision/prognosis and the epidemiological and clinical characteristics.

[1]Kahramanmaraş Sütçü İmam University, Emergency Medicine – Kahramanmaraş, Turkey.
[2]Adana State Hospital, Public Health – Adana, Turkey.
[3]Keçiören District Health Directorate, Public Health – Adana, Turkey.
*Corresponding author: hakkoymaz@ksu.edu.tr
Conflicts of interest: the authors declare there is no conflicts of interest. Funding: none.
Received on April 05, 2023. Accepted on April 27, 2023.

METHODS

Patients aged 65 years and older and 295 volunteer patients who presented to the Emergency Department of Kahramanmaraş Sütçü İmam University (KSU) Faculty of Medicine due to acute trauma or complications in 2018–2019 were evaluated in this descriptive study.

Clinical features, etiological causes, laboratory results (hemogram and biochemical parameters), and trauma scores of the patients were statistically analyzed. After the emergency follow-up of the patients, sociodemographic information; the occurrence and mechanism of trauma; the place where the trauma occurred; trauma sites in the body and other accompanying injuries prognostic factors, such as hospitalization status (service, intensive care) and length of stay; and referral to another center were determined from the hospital automation program and examined.

SPSS 20 for Windows was used for this evaluation. Categorical variables were expressed using numbers and percentages. The Kolmogorov-Smirnov analysis was performed to evaluate the normal distribution of quantitative data based on measurement. Pearson chi-square test was used for the statistical analysis of categorical data, and Mann-Whitney U test, Kruskal-Wallis test, and post hoc Tamhane's T2 test were used for the statistical analysis of quantitative data. A value of $p<0.05$ was considered statistically significant.

Ethics committee approval was obtained from the KSÜ Clinical Research Ethics Committee with resolution number 12 in session 2019/07 on April 17, 2019. The study is consistent with the principles of the Declaration of Helsinki.

RESULTS

Age, gender, social security, comorbid diseases, trauma site, type of trauma, and prognosis information of the 295 patients included in our study were evaluated. A need for intensive care in 34 patients (%11.5) was detected. The prognosis of 295 patients was evaluated: recovery/discharge in 181 patients (61.4%), sequelae in 107 patients (36.3%), and exitus in 7 patients (2.4%). Age (76.53±8.44 years), length of stay in the emergency department (3.26±3.58 h), length of stay in intensive care (6±6.81 day), heart rate (80.53±12.86/min), respiration rate (17.12±3.16), and systolic blood pressure (139.58±25.98 mmHg) were detected in patients included in our study. No significant correlation was found between the gender, educational status, trauma sites, trauma type, presence of comorbidities, site of the accident, fever degrees, hemoglobin and hematocrit values, and prognosis of the patients included in our study. Sequelae and mortality rates were found to be higher in patients with a median age of over 76 years. Sequelae and mortality rates were found to be higher in high-energy traumas. Sequelae and mortality rates were found to be higher in patients with surgical fractures. The death rate was found to be higher in patients with a high heart rate. Sequelae and mortality rates were found to be higher in patients with a higher respiratory rate. The prognosis of the only patient with a low respiratory rate resulted in death.

GCS values, lactate values, and trauma scores (AIS, ISS, RTS, and TRISS) of the patients were detected: AIS (2.44±1.74), ISS (5.89±7.59), RTS (11.93±0.55), TRISS (96.25±9.18), GCS (14.90±0.78), and lactate (1.69±1.29).

No significant correlation was found between intensive care hospitalization and GCS, admission lactate level, RTS score values, and the length of stay in the emergency department (Table 1). While the AIS and ISS scores of the patients hospitalized in the intensive care unit were found to be significantly higher, the TRISS scores were significantly lower.

The evaluation of trauma scores predicting prognosis is shown in Table 2.

The comparison of trauma scores is shown in Table 3.

DISCUSSION

In the study conducted by Yousefzadeh-Chabok et al., falls and motor vehicle accidents are the most common causes of trauma in the elderly population[5]. In the study conducted by Ümit İ. Güneytepe et al., the first cause of trauma in the elderly population was motor vehicle accidents (62%), followed by falls (31%). In the same study, fall-related injuries occupied the first place among those aged 75 years and over. In addition to changes in bone mass, the inability to absorb fall and fall energy adequately due to muscle strength and coordination problems plays a role in the formation of fractures due to falls in the elderly. Furthermore, there may be balance problems due to metabolic endocrine disorders such as syncope, seizures, and sodium imbalances that pave the way for falls in the geriatric population. In the literature, it was demonstrated that the areas injured after trauma were mostly the head region and extremities in the elderly population[1]. In the patients included in our study, it was determined that 70.8% of traumas occurred due to falls in the home environment, followed by traffic accidents. In our study, the head and neck region was the most common injury site, and the lower extremities were the second most common injury site, which supports the literature.

It is possible to detect high-risk patients in geriatric traumas in the early period and to prevent mortality by better stabilizing these patients with appropriate treatment[6]. Various studies

Table 1. Evaluation of the prognosis of intensive care patients according to trauma scores.

	Intensive care hospitalization		p-value Z
	Yes Median (min–max) Mean ± Std. Dev	No Median (min–max) Mean ± Std. Dev	
Age (years)	82.5 (65–89) 80.11±7.79	75 (65–109) 76.07±8.43	0.004 -2.914
GCS	15 (11–15) 14.82±0.75	15 (3–15) 14.91±0.79	0.221 -1.223
Lactate	1.35 (0.3–4.1) 1.72±1.03	1.4 (0.1–13.9) 1.69±1.32	0.831 -0.214
AIS score	3 (1–12) 3.52±2.07	2 (0–13) 2.30±1.64	0.000 -4.322
ISS score	9 (1–54) 10.32±9.33	4 (0–75) 5.32±7.15	0.000 -4.964
RTS score	12 (11–12) 11.94±0.23	12 (3–12) 11.93±0.58	0.402 -0.839
TRISS score	96.75 (41.03–98.31) 94.87±9.68	97.84 (1.85–98.44) 96.43±9.11	0.000 -4.728
Length of stay in the Emergency Department	3.5 (1–12) 3.64±2.42	3 (0–48) 3.21±3.71	0.126 -1.529

Mann-Whitney U test was used.

Table 2. Evaluation of trauma scores predicting prognosis.

	Prognosis			p-value χ^2
	Recovery median (min–max) Mean±Std. Dev	Sequelae median (min–max) Mean±Std. Dev	Exitus median (min–max) Mean±Std. Dev	
Age (years)	75 (65–109) 75.64±8.41	78 (65–98) 77.82±8.05	77 (66–104) 80.14±12.53	0.053 6.097
GCS	15 (12–15)[a] 14.97±0.24	15 (11–15)[a] 14.94±0.43	15 (3–15)[b] 12.71±4.42	0.000 44.078
Lactate	1.3 (0.1–6.5)[a] 1.56±0.94	1.5 (0.3–4.2)[a] 1.67±0.92	3.4 (1.2–13.9)[b] 5.44±4.88	0.003 11.709
AIS Score	1 (0–7)[a] 1.82±1.15	3 (1–12)[b] 3.15±1.56	6 (4–13)[c] 7.42±3.95	0.000 84.131
ISS Score	2 (0–25)[a] 3.32±3.35	9 (1–54)[b] 8.51±6.78	25 (8–75)[b] 32.42±23.07	0.000 95.873
RTS Score	12 (11–12)[a] 11.98±0.10	12 (11–12)[a] 11.95±0.21	12 (3–12)[b] 10.28±3.30	0.000 37.728
TRISS Score	98.16 (88.68–98.44)[a] 97.81±1.02	96.75 (41.03–98.31)[b] 95.90±6.34	88.68 (1.85–97.01)[b] 61.35±43.52	0.000 82.950
Length of stay in the Emergency Department	2 (0–27) 2.85±2.47	3 (0–48) 3.98±4.92	2 (1–6) 2.85±1.86	0.007 9.871

Kruskal Wallis test and post hoc Tamhane T2 test were used. There is a significant correlation between those with different letters.

have revealed that the mortality rate in the elderly trauma population varies between 10 and 34%[7]. In the study by Ümit İ. Güneytepe et al., this ratio was reported to be 9.6%[1]. In our study, this ratio was 2.4%, which was quite low compared to the literature. The hospital where the study was conducted is a tertiary-level university hospital where advanced examinations and treatments are performed. We believe that the mortality rate is low since our study is up-to-date, our hospital is more equipped in terms of technology and information, advanced examinations and treatments can be performed in

Table 3. Comparison of trauma scores.

	Age	GCS	Lactate	AIS Score	ISS Score	RTS Score	TRISS Score	Length of Stay in the Emergency Department
Age (years)	1							
GCS	-0.195**	1						
Lactate	0.247**	-0.606**	1					
AIS	0.138*	-0.394**	0.289**	1				
ISS	0.141*	-0.413**	0.409**	0.842**	1			
RTS	-0.208**	-0.914**	-0.603**	-0.432**	-0.438**	1		
TRISS	-0.154**	0.690**	-0.600**	-0.613**	-0.819**	0.725**	1	
Length of stay in the Emergency Department	0.146*	0.036***	0.025***	0.009***	-0.020***	0.041***	0.046***	1

*p<0.05, **p<0.01, ***p>0.05.

our hospital, and physicians who are experts in their fields are easily accessible.

GCS, RTS, AIS, ISS, TRISS scores, and blood lactate level are parameters that can be helpful in predicting conditions such as triage and prognosis in geriatric trauma patients[2,8]. GCS is a physiological scoring system and is used to evaluate the severity of critical neurological status and traumatic brain injury. However, only the severity of head trauma can be evaluated with GCS in multiple trauma patients, and the measurement of other physiological parameters is insufficient, especially in multiple trauma patients. Therefore, AIS, ISS, RTS, and TRISS scoring systems overcome the GCS. On the contrary, these scoring systems also include the GCS during measurement.

In the study by Seda et al., the mortality rate was found to be higher in the group with low RTS scores[2]. While it was observed in the study by Akkose that GCS, RTS, and ISS scores were lower in exitus patients, it was observed in the study by Orhon that RTS and TRISS scores were significantly lower in patients with mortality[9,10]. In the study in which Watt et al. investigated the effects of trauma scores on predicting mortality and length of hospital stay in geriatric patients, it was demonstrated that ISS and RTS were better predictors of mortality than predicted ones; however, they had a limited correlation with the length of hospital stay[11]. Eryılmaz et al. found that the RTS values were lower in exitus patients compared to living patients[12]. RTS is an important physiological scoring system in showing survival when it is used alone, and RTS provides a high rate of observation and compliance in predicting the risk of mortality and associating it with survival[13].

In our study, AIS and ISS scores of the patients hospitalized in the intensive care unit were found to be significantly higher; however, their TRISS scores were significantly lower. The Glasgow coma scores of the patients whose prognosis resulted in exitus were found to be significantly lower compared to those with sequelae and discharge. Patients with exitus had significantly higher lactate levels at admission compared to patients with sequelae and discharge. The AIS and ISS scores of the patients who died were found to be significantly higher compared to those who resulted in sequelae and discharge. The RTS and TRISS scores of the patients who resulted in exitus were found to be significantly lower compared to the patients who were discharged and/or resulted in sequelae. It was determined that the AIS, ISS, and blood lactate levels increased as the Glasgow coma score decreased. The value of the TRISS score also increased as the Glasgow coma score increased. As the patients' admission lactate levels increased, the AIS and ISS values increased; however, RTS and TRISS values decreased. As the AIS scores of the patients increased, the ISS scores also increased; but the RTS and TRISS scores decreased. RTS and TRISS scores decreased as ISS scores increased. As the RTS scores of the patients increased, the TRISS scores also increased significantly.

It was observed that the prognosis of patients with high blood lactate level and high AIS and ISS scores was poor and that the morbidity/mortality rate was high. It was determined that the prognosis was poor and the morbidity/mortality rate was high in patients with low GCS, RTS, and TRISS scores.

CONCLUSION

GCS, RTS, TRISS, AIS, ISS scores, and blood lactate levels are important parameters that can be used during admission

to the emergency department for early detection of high-risk patients in geriatric trauma, the prevention of mortality by better stabilizing these patients with appropriate treatment, and the evaluation of the condition/prognosis of patients with geriatric trauma. We think that the use of trauma scores in geriatric trauma patients will contribute to the triage, diagnosis, follow-up, treatment, and prognosis of the patients.

AUTHORS' CONTRIBUTIONS

HH: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **MSG:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **RAO:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **AİK:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing. **YS:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

REFERENCES

1. Ümit İG, Şule AA, Şehsuvar G, Halil Ö, Gökhan O, Hikmet A. Yaşlı Travma Olgularında Mortaliteye Etki Eden Faktörler ve Skorlama Sistemleri. Uludağ Üniversitesi Tıp Fakültesi Dergisi. 2008;34(1):15-9.
2. Fidan S, Celık GK, Özhasenekler A, Şener A, Tanrıverdi F, Günaydın GP, et al. Evaluation of revised trauma score in geriatric trauma patients. Ankara Med J. 2020;20(3):578-87. https://doi.org/10.5505/amj.2020.24993
3. Atik D, Cander B, Dikmetaş C, Bulut B, Sert E, Kaya H, et al. Trafik Kazası ile Gelen Pediatrik Hastalarda, Kaza Oluş Şekilleri ile Travma Skorlarının Değerlendirilmesi. Uludağ Tıp Derg. 2020;46(1):47-52. https://doi.org/10.32708/uutfd.655843
4. Orhon R, Eren SH, Karadayı S, Korkmaz I, Coşkun A, Eren M, et al. Comparison of trauma scores for predicting mortality and morbidity on trauma patients. Ulus Travma Acil Cerrahi Derg. 2014;20(4):258-64. https://doi.org/10.5505/tjtes.2014.22725
5. Yousefzadeh-Chabok S, Hosseinpour M, Kouchakinejad-Eramsadati L, Ranjbar F, Malekpouri R, Razzaghi A, et al. Comparison of Revised Trauma Score, Injury Severity Score And Trauma And Injury Severity Score For Mortality prediction in elderly trauma patients. Ulus Travma Acil Cerrahi Derg. 2016;22(6):536-40. https://doi.org/10.5505/tjtes.2016.93288
6. Brooks SE, Peetz AB. Evidence-based care of geriatric trauma patients. Surg Clin North Am. 2017;97(5):1157-74. https://doi.org/10.1016/j.suc.2017.06.006
7. Richmond TS, Kauder D, Strumpf N, Meredith T. Characteristics and outcomes of serious traumatic injury in older adults. J Am Geriatr Soc. 2002;50(2):215-22. https://doi.org/10.1046/j.1532-5415.2002.50051.x
8. Ünlü A, Ülger F, Dilek A, Barış S, Murat N, Sarıhasan B. Yoğun bakımda izlenen travma hastalarında "Revize travma skoru" ve "Travma ve yaralanma şiddeti skoru"nun prognoz ile ilişkisinin değerlendirilmesi. Türk Anestezi ve Reanimasyon Dergisi. 2012;40(3):128-35.
9. Akköse Aydin S, Bulut M, Fedakar R, Ozgürer A, Ozdemir F. Trauma in the elderly patients in Bursa. Ulus Travma Acil Cerrahi Derg. 2006;12(3):230-4. PMID: 16850362
10. Orhon R, Eren SH, Karadayı S, Korkmaz I, Coşkun A, Eren M, et al. Comparison of trauma scores for predicting mortality and morbidity on trauma patients. Ulus Travma Acil Cerrahi Derg. 2014;20(4):258-64. https://doi.org/10.5505/tjtes.2014.22725
11. Watts HF, Kerem Y, Kulstad EB. Evaluation of the revised trauma and injury severity scores in elderly trauma patients. J Emerg Trauma Shock. 2012;5(2):131-4. https://doi.org/10.4103/0974-2700.96481
12. Eryilmaz M, Durusu M, Cantürk G, Menteş MO, Ozer MT, Cevik E, et al. Role of anatomic and physiologic trauma scoring systems in forensic cases. Ulus Travma Acil Cerrahi Derg. 2009;15(3):285-92. PMID: 19562553
13. Akça HŞ, Algın A, Özdemir S, Koçkara E, Eroğlu SE. Comparison of the efficacy of trauma scores in predicting prognosis and hospitalization. Cukurova Med J. 2021:46:1596-605.