



# Elderly trauma patients and the effect of trauma scores on hospitalization decision

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## ABSTRACT

**Objective:** Hospitalization, mortality and trauma scores are important in trauma patients aged  $\geq 65$  years. The present study aimed to investigate the use of trauma scores in the prediction of hospitalisation and mortality in trauma patients aged  $\geq 65$  years.

**Material and Methods:** Patients aged  $\geq 65$  years who presented to the emergency department with trauma over a one-year period were included in the study. Baseline data of the patients together with their Glasgow Coma Scale (GCS), Revised Trauma Score (RTS), Injury Severity Score (ISS), hospitalisation and mortality were analysed.

**Results:** A total of 2264 patients were included in the study, of whom 1434 (63.3%) were women. The most common mechanism of trauma was simple falls. Mean GCS scores, RTSs and ISSs of the inpatients were  $14.87 \pm 0.99$ ,  $6.97 \pm 0.343$  and  $7.22 \pm 5.826$ , respectively. Furthermore, a significant negative correlation was found between the duration of hospitalisation and GCS scores ( $r = -0.158$ ,  $p < 0.001$ ) and RTSs ( $r = -0.133$ ,  $p < 0.001$ ), whereas a positive significant correlation with ISSs ( $r = 0.306$ ,  $p < 0.001$ ) was observed. The ISSs ( $p < 0.001$ ) of the deceased individuals were significantly elevated, whereas their GCS scores ( $p < 0.001$ ) and RTSs ( $p < 0.001$ ) were significantly decreased.

**Conclusion:** All trauma scoring systems can be used to predict hospitalisation, but the results of the present study suggest that the use of ISS and GCS in making the decision regarding mortality is more appropriate.

**Keywords:** Emergencies, geriatrics, trauma, trauma scores

## INTRODUCTION

The risk of exposure to trauma in elderly individuals increases as the elderly population in contemporary societies increases, and the opportunities for the elderly to have a healthy and active life improves (1). Mortality rate due to trauma is high, hospitalisation period is longer and complications are higher and more severe in the elderly although the likelihood of serious injuries is lower compared to that in younger individuals (2).

The mechanism of trauma in the elderly is different from that in younger individuals. Accidents and falls are common in the elderly, resulting in more frequent fractures, complications, hospitalisation and death. Falls among the elderly may be associated with increased mortality, limitation of functions, loss of independence and reduced quality of life (3). Older age is also a factor that increases the risk of road accidents. Decreased peripheral vision or hearing contributes to an increased risk of pedestrian and road accidents among the elderly. Violent assaults constitute 6% of trauma admissions in the elderly, whereas the same rate is 25% in younger individuals (3,4). Recently observed notable injuries involve non-accident-related injuries, including those that are caused by the family or caregiver.

Scoring systems are used to evaluate triage, mortality and morbidity as well as for predicting prognosis. The present study aimed to assess trauma patients aged  $\geq 65$  years who presented to the emergency department and to investigate the usefulness of the most commonly used trauma scoring systems, i.e. Glasgow Coma Scale (GCS), Revised Trauma Score (RTS) and Injury Severity Score (ISS), in the decision regarding hospitalisation and prediction of mortality.

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## MATERIAL and METHODS

Geriatric patients aged  $\geq 65$  years who presented to the emergency medical clinic with trauma between January 2012 and December 2012 were included in our study upon approval of the local ethics committee. The patients were classified into groups based on the cause of the trauma as follows: simple fall, road accident (RA), pedestrian accident (PA), exposure to blunt trauma by assault (Battery) and others (falling from height, burn and penetrating injury). Baseline data together with GCS scores, RTSs, ISSs, hospitalisation and mortality of the patients were recorded. Patients  $\geq 65$  years of age with non-traumatic complaints and all the patients below 65 years of age, patients that left the hospital without being evaluated in the emergency department, patients who were examined but whose relevant files could not be accessed and patients with missing data were excluded from the study.

Statistical package for the social science (SPSS Version 21.0, IBM Corporation, Armonk, NY, USA) and MedCalc (Version 10.1.6.0, Ostend, Belgium) software package was used for data analysis.

Numerical data were expressed in mean  $\pm$  standard deviation, whereas qualitative data were expressed in percentage. Kolmogorov-Smirnov and Shapiro-Wilk normality tests were used to test the distribution of continuous variables. One-way analysis of variance was used to compare more than two independent groups. The relation between binary groups with continuous variables was investigated using the post hoc test. Categorical data were compared using the Chi-Square test (cross-tab). Pearson correlation test was used to determine the correlation. Binary logistic regression was used due to the two-category dependent variables. The enter method was used for the logistic regression analysis. A p value of  $<0.05$  was considered significant in all the analysis results.

## RESULTS

Out of 27.745 individuals aged  $\geq 65$  years who were admitted in the emergency medicine clinic throughout a one-year period, 2264 (8.16%) patients who presented to the emergency department with trauma were investigated (Table 1). Of these patients, 1434 (63.3%) were females. Patients' ages varied between 65 and 100 years, and their mean age was  $74.89 \pm 7.21$ .

**Table 1.** Basic data of the patients and pathologies

	Simple Fall	RA	PA	Battery	Other*	Mortality
<b>N (female/male)</b>	<b>2110 (1359/751)</b>	<b>17 (11/6)</b>	<b>90 (44/46)</b>	<b>30 (13/17)</b>	<b>17 (7/10)</b>	<b>16 (6/10)</b>
<b>Age (mean <math>\pm</math> SD)</b>	74.98 $\pm$ 7.3	76.29 $\pm$ 7.1	73.84 $\pm$ 5.5	70.97 $\pm$ 5.6	73.88 $\pm$ 8.1	75.81 $\pm$ 5.6
Upper extremity fracture	630-29.8	4-23.5	14-15.5	1-3.3	1-5.9	1-6.3
Fracture of lower extremity	232-10.9	1-5.8	17-18.8	-	1-5.9	1-6.3
Maxillofacial bone fracture	50-2.3	1-5.8	8-8.8	2 (6.6)	2-11.8	5-31.3
Vertebral fracture	37-1.7	-	4-4.4	1 (3.3)	3-17.6	2-12.5
Pelvic fracture	34-1.6	-	5-5.5	-	1-5.9	3-18.8
Costal fracture	21-0.99	1-5.8	2-2.2	1 (3.3)	2-11.8	2-12.5
Subarachnoid haemorrhage	7-0.33	-	4-4.4	1 (3.3)	2-11.8	8 (50)
Contusion cerebri	6-0.28	-	5-5.5	-	2-11.8	6-37.5
Subdural bleeding	5-0.23	-	3-3.3	1 (3.3)	1-5.9	4 (25)
Haemothorax	5-0.23	-	-	-	-	-
Intraparenchymal bleeding	3-0.14	-	1-1.1	-	-	3-18.8
Pneumothorax	3-0.14	-	-	-	-	-
Lung contusion	2-0.09	-	-	-	3-17.6	3-18.8
Epidural bleeding	1-0.04	-	2-2.2	-	-	3-18.3
Hospitalisation period	12.33 $\pm$ 37.09	13.88 $\pm$ 15.28	31.42 $\pm$ 83.76	21.87 $\pm$ 48.56	21.88 $\pm$ 26.97	85.31 $\pm$ 152.45
<b>Mortality</b>	8 (50)	-	4 (25)	-	4 (25)**	
<b>RTS</b>	7.113 $\pm$ 0.33	7.14 $\pm$ 0.33	7.10 $\pm$ 0.34	6.96 $\pm$ 0.18	6.64 $\pm$ 0.98	5.44 $\pm$ 1.32
<b>ISS</b>	7.84 $\pm$ 10.35	5.35 $\pm$ 2.78	8.07 $\pm$ 9.89	5.30 $\pm$ 5.77	13.59 $\pm$ 18.91	37.44 $\pm$ 25.27
<b>GCS</b>	14.97 $\pm$ 0.44	14.64 $\pm$ 1.68	14.76 $\pm$ 1.43	14.80 $\pm$ 0.76	13.41 $\pm$ 3.55	9.94 $\pm$ 4.1

RTSs: Revised trauma scores, ISSs: Injury severity scores, GCS: Glasgow coma scale, RA: Road accident, PA: Pedestrian accident, Battery: Exposure to blunt trauma by assault.

\*Other n (female/male): Falling from height= 10 (3/7), Burn= 3(2/1), Injury with Penetrating Tool= 4 (2/2).

\*\*Falling from height

**Table 2.** Comparison of Glasgow Coma Scale (GCS) scores, Revised Trauma Scores (RTSs), Injury Severity Scores (ISSs) of the hospitalised patients and deceased individuals

	Hospitalisation		p	Mortality		p
	Yes	No		Yes	No	
<b>n</b>	<b>589 (397/192)</b>	<b>1889</b>		<b>16 (6/10)</b>	<b>2248 (1428/820)</b>	
<b>RTSs</b>	6.97 ± 0.343	7.14 ± 0.34	<b>&lt;0.0001</b>	5.44 ± 1.32	7.11 ± 0.31	<0.0001
<b>ISSs</b>	7.22 ± 5.826	4.04 ± 3.37	<b>&lt;0.0001</b>	37.44 ± 25.27	4.64 ± 2.73	<0.0001
<b>GCS</b>	14.87 ± 0.99	14.98 ± 0.40	<b>&lt;0.0001</b>	9.94 ± 4.10	14.99 ± 0.30	<0.0001

RTSs: Revised trauma scores, ISSs: Injury severity scores, GCS: Glasgow coma scale.

A review of the trauma mechanisms indicated that there were 2110 simple falls, 90 pedestrian accidents, 17 road accidents, 30 assaults and 17 other injuries (including 10 falls from a height (3/7), 3 burn injuries (2/1) and 4 penetrating injuries (2/2).

Although the number of simple falls was significantly higher in women ( $p < 0.001$ ), the PA ( $p = 0.004$ ) and battery ( $p = 0.022$ ) cases were higher in men, whereas there was no difference in sex in terms of RA and other injuries.

Although the fractures found were mostly in the extremities, those involving multiple organs were also observed. In addition, a total of 16 patients died, including eight deaths associated with simple falls, four with PA and four with falling from a height. Subarachnoid haemorrhage (50%) and cerebral contusion (37.5%) were the most common injuries among the deceased individuals.

A total of 26% of the patients ( $n = 589$ ) included in the study were hospitalised, whereas 563 (24.9%) patients were referred to the Orthopaedics clinic, 14 (4%) to the intensive care unit (ICU), seven to the neurosurgery clinic, two to the thoracic surgery clinic, two to the general surgery clinic and one (0.26%) to the neurology clinic. The patients' mean duration of hospitalisation across all the groups was  $13.30 \pm 40.83$  hours, whereas patients in the PA group had the longest stay of  $31.42 \pm 83.76$  hours. The duration of hospitalisation of the deceased individuals was  $85.31 \pm 152.45$  hours. Mean GCS scores, RTSs and ISSs of the inpatients were  $14.87 \pm 0.99$ ,  $6.97 \pm 0.343$  and  $7.22 \pm 5.826$ , respectively. There was a significant difference in mean GCS scores, RTSs and ISSs of the patients who were hospitalised and of those who were discharged from the emergency department (Table 2). Furthermore, a significant negative correlation between the duration of hospitalisation and GCS scores ( $r = -0.158$ ,  $p < 0.001$ ) as well as RTSs ( $r = -0.133$ ,  $p < 0.001$ ) was observed, whereas there was a positive correlation between the duration of hospitalisation and ISS ( $r = 0.306$ ,  $p < 0.001$ ). Mean GCS scores, RTSs and ISSs of the 16 deceased individuals at the time of admission to the emergency department were  $9.94 \pm 4.10$ ,  $5.43 \pm 1.31$  and  $37.44 \pm 25.27$ , respectively. A significant difference was observed in mean GCS scores, RTSs and ISSs of the deceased individuals and of the

patients who were treated. GCS scores ( $p < 0.001$ ) and RTSs ( $p < 0.001$ ) were significantly decreased in the deceased individuals, whereas ISSs ( $p < 0.001$ ) were significantly elevated (Table 2). The results of binary logistic regression analysis to evaluate which variables were possible predictors for hospitalization and mortality are presented in Table 3.

## DISCUSSION

Although the characteristics of ageing vary based on socioeconomic and sociocultural constructs, it is largely associated with a decrease in mental activities; impaired perception; lack of attention; decrease in sensory functions, such as vision and hearing; delay in reflexes; general muscle weakness and movement disorders, all increasing the risk of exposure to trauma among the elderly (5).

The sex with the highest rate of admission for trauma varies. A retrospective study by Mc Gwin G et al. (6) on 401 geriatric trauma patients has emphasised that 76% of the patients were women. However, in another study by Demaria EJ et al., (7) 65.8% of the geriatric trauma cases have consisted of men. In the present study, the majority of geriatric trauma patients (63.3%) were women. Falling, the most common cause of trauma, may have accounted for the foregoing difference on the grounds that women had relatively less muscle tissue and were susceptible to a high incidence of postmenopausal osteoporosis and the fact that women were more exposed to falling and home accidents due to their more active living conditions at home. Falling is one of the most common causes of trauma in the elderly population, followed by road accidents (8). In the present study, simple falls ranked first among the causes of injury. Although the incidence of falling is higher in the elderly population, there are studies reporting that road accidents are traumatic injuries that are leading causes of death among the elderly (9,10). In the present study, 50% of the deaths were caused by falling-related injuries, whereas 25% were due to PA. Consistent with the studies by Day RJ and Hukkelhoven CW et al., head traumas have proven to be major factors leading to mortality (11,12). A review of sites of injury among the cases included in the study indicated that all the deceased individuals had suffered head trauma. Furthermore, complications associated with head trauma, in-

**Table 3.** Binary logistic regression results

		<b>B</b>	<b>SE</b>	<b>% 95 CI</b>	<b>Exp (B)</b>	<b>p</b>
Hospitalisation	Constant	1.213	3.637		3.364	0.739
	Age	-0.037	.008	0.948-0.980	0.964	<0.001
	Sex	0.472	0.121	1.215-1.952	1.540	<0.001
	GKS	2.262	0.251	5.864-15.709	9.597	<0.001
	RTS	-5.131	0.452	0.002-0.014	0.006	<0.001
	ISS	0.521	0.030	1.589-1.786	1.684	<0.001
R <sup>2</sup> (Cox-Snell)= 0.237 R <sup>2</sup> (Nagelkerke)= 0.347 Model: X <sup>2</sup> (2)= 611.177, p< 0.001						
Mortality	Constant	3.192	4.187		24.330	0.446
	Age	0.070	1.059	0.928-1.240	1.073	0.341
	Sex	-1.035	1.059	0.045-2.832	0.355	0.328
	GKS	-0.802	0.354	0.224-0.897	0.448	0.023
	RTS	0.391	0.043	0.165-13.260	1.478	0.727
	ISS	0.221	0.043	1.146-1.357	1.247	<0.001
R <sup>2</sup> (Cox-Snell)= 0.058 R <sup>2</sup> (Nagelkerke)= 0.725 Model: X <sup>2</sup> (2)= 136.311, p< 0.001						
GCS: Glasgow coma scale, RTS: Revised trauma scores, ISS: Injury severity scores.						

cluding fractures in the skull or facial bones, contusio cerebri or intraparenchymal haemorrhage, subarachnoid haemorrhage (SAH) and epidural or subdural haematomas were present in most of the deceased individuals.

Trauma scoring systems, such as RTS and ISS, are helpful in triage, prognosis, prediction and appropriate use of resources in trauma patients. However, different results have been obtained in terms of the use of the scoring systems in the elderly population. A study by Bagi H et al. (13) has analysed data from 228 trauma patients aged  $70.96 \pm 5.2$  years and reported that mean ISSs of hospitalised patients were  $11.12 \pm 4.20$ , whereas the same scores for the discharged patients were  $9.9 \pm 3.41$  and that there was a significant difference between the two groups. Consistent with the present study, Bagi H et al. (13) have found in the same study that ISSs were  $20.66 \pm 6.68$  in elderly deceased trauma patients and that the scores were significantly lower ( $10.55 \pm 3.92$ ) in surviving patients. Ozman et al. (14) have divided 161 trauma patients admitted to the ICU into two groups as patients aged  $>65$  years and  $<65$  years and found that ISSs were  $38.94 \pm 15.86$  in the  $<65$  years group and  $43.38 \pm 15.94$  in the  $>65$  years group, whereas ISSs did not differ between the two groups. Orhon et al. (15) have reported in their study on 633 trauma patients with a mean age of  $39.65 \pm 17.07$  years that ISSs of eight deceased individuals were  $24.37 \pm 12.85$ , whereas the same scores of the surviving patients were  $5.78 \pm 6.71$  and that there was a significant difference between the two. They have also reported a significant difference in ISSs between hospitalised and discharged patients. It has been suggested that

standard injury scoring systems, such as the ISS, might be less predictive in the elderly compared to younger patients (16). Besides, Perdue et al. (17) have found that mortality rate in the elderly patients was twice that of younger patients with equivalent ISSs. In the present study, ISSs significantly increased in the hospitalised and discharged trauma patients, and the sensitivity and specificity of ISS in predicting the hospitalisation decision and mortality were high.

Bagi H et al. (13) have reported in their study that there was no significant difference in RTSs between the hospitalised and discharged patients but there was a significant difference in the scores between deceased individuals and surviving patients. Orhon et al. (15) have found that RTSs of the eight deceased individuals were  $5.62 \pm 1.31$ , whereas the same scores in the surviving patients were  $7.75 \pm 0.46$  and that RTSs significantly decreased in the deceased individuals. They have also reported that the RTSs decreased significantly in the hospitalised patients. In the present study, both the deceased individuals and hospitalised patients had significantly lower RTSs at admission to the emergency department, and the specificity of RTS was higher in the deceased individuals.

In addition, there was a significant negative correlation between the duration of hospital stay and GCS scores and RTSs and a positive significant correlation with ISSs. Similar to the results of the present study, Orhon et al. (15) have found a positive correlation between the duration of hospital stay and ISSs and a negative correlation between the duration of hospital stay and RTSs.

GCS scores were very sensitive in predicting mortality in elderly trauma patients, whereas they were not sufficiently sensitive in predicting decisions regarding hospitalisation. The reason of the foregoing might be the fact that extremity fractures were more prevalent and the GCS scores were mostly 15 in the hospitalised patients. However, mortality rate was higher in patients with lower GCS scores at admission to the hospital.

## CONCLUSION

In conclusion, although due to simple fall reasons, severe injuries that require hospitalisation are more common in elderly individuals, and mortality rate is higher. All trauma scoring systems can be used to predict hospitalisation, but the results of the present study suggest that the use of ISS and GCS in making the decision regarding mortality is more appropriate.

## Limitations

There are various parameters affecting mortality in elderly trauma patients, including biochemical factors, comorbidity and the medications used. The major limitation of the present study is that these parameters were not considered as it was mostly based on triage practices.

**Ethics Committee Approval:** This study was approved by Bakırköy Dr. Sadi Konuk Training and Research Hospital Clinical Research Ethics Committee (Decision no: 2013/08/02, Date: 24.06.2013).

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**ORİJİNAL ÇALIŞMA-ÖZET**

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**Yaşlı travmalı hastalar ve travma skorlarının yatış kararına etkisi**Ramazan Gürgöze<sup>1</sup>, Dogaç Niyazi Özüçelik<sup>2</sup>, Mustafa Yılmaz<sup>3</sup>, Halil Doğan<sup>2</sup><sup>1</sup> Elazığ İl Sağlık Müdürlüğü, İlk ve Acil Yardım Ünitesi, Elazığ, Türkiye<sup>2</sup> Dr. Sadi Konuk Eğitim ve Araştırma Hastanesi, Acil Tıp Kliniği, İstanbul, Türkiye<sup>3</sup> Fırat Üniversitesi, Acil Tıp Anabilim Dalı, Elazığ, Türkiye**ÖZET**

**Giriş ve Amaç:** Acil servise başvuran 65 yaş ve üzeri travma hastalarının, hospitalizasyon ve mortalite tahmininde travma skorlarının kullanılmasının değerlendirilmesi amaçlandı.

**Gereç ve Yöntem:** Acil servise travma nedeniyle başvuran 65 yaş ve üstü hastalar değerlendirildi. Travma sebebine göre; basit düşme, araç içi trafik kazası (AİTK), araç dışı trafik kazası (ADTK), bir başkası tarafından künt travmaya maruz kalma (DARP) ve diğer hastalar (yüksekten düşme, yanık, delici kesici alet ile yaralanma) olarak gruplara ayrıldı. Hastaların temel verileri ve Glasgow Koma Skoru (GKS), *Revised* Travma Skoru (Gözden Geçirilmiş Travma Skoru) (RKS) ve *Injury Severity* Skoru (ISS), hastaneye yatış ve mortalite durumları analiz edildi.

**Bulgular:** Çalışmamıza alınan 2264 hastanın 1434'ü (%63,3) kadındı. Travma mekanizmalarından en fazla basit düşme olduğu saptandı. Hospitalizasyon oranı %26 bu hastaların 16'sı exitus olmuştur. En fazla tespit edilen ölüm nedeni subaraknoid kanamayı. Yatarak tedavi görenlerin GKS ortalaması: 14,87 ± 0,99, RTS ortalaması: 6,97 ± 0,343, ISS ortalaması: 7,22 ± 5,826 olarak bulunmuştur. Ayrıca hastanede kalma süresi ile GKS ( $r = -0,158, p < 0,001$ ) ve RTS ( $r = -0,133, p < 0,001$ ) ile arasında anlamlı negatif korelasyon, ISS ile ( $r = 0,306, p < 0,001$ ) pozitif anlamlı korelasyon saptandı. Eksitus olan hastalarda GKS ( $p < 0,001$ ) ve RTS ( $p < 0,001$ ) puanları anlamlı oranda azalırken, ISS ( $p < 0,001$ ) ise anlamlı oranda arttığı tespit edildi.

**Sonuç:** Hastaneye yatmayı öngörmek için tüm travma skorlama sistemleri kullanılabilir, ancak bu çalışmanın sonuçları mortalite ile ilgili karar vermede GCS'nin kullanılmasının daha uygun olduğunu göstermektedir.

**Anahtar Kelimeler:** Acil durumlar, geriyatri, travma, travma skorları

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