

Ferhat İÇME<sup>1</sup>  
Sinan BECEL<sup>1</sup>  
Asliddin AHMEDALİ<sup>1</sup>  
Akkan AVCI<sup>2</sup>  
Haldun AKOĞLU<sup>3</sup>  
Salim SATAR<sup>2</sup>

İletişim (Correspondance)

FERHAT İÇME  
Ankara Atatürk Eğitim ve Araştırma Hastanesi  
Acil Servis, Bilkent ANKARA

Tlf: 0312 291 25 25  
e-posta: ferhaticme@gmail.com

Geliş Tarihi: 14/05/2013  
(Received)

Kabul Tarihi: 03/12/2013  
(Accepted)

<sup>1</sup> Ankara Atatürk Eğitim ve Araştırma Hastanesi  
Acil Servis, Bilkent ANKARA

<sup>2</sup> Adana Numune Eğitim ve Araştırma Hastanesi  
Acil Servis, Seyhan ADANA

<sup>3</sup> Marmara Üniversitesi Tıp Fakültesi Acil Anabilim Dalı  
İSTANBUL



RESEARCH

## THE USE OF TRAUMA SCORING SYSTEMS IN ELDERLY PATIENTS WHO ARE ADMITTED TO THE EMERGENCY DEPARTMENT DUE TO FALLS

### ABSTRACT

**Introduction:** The aim of our study is to review demographic characteristics, management in concordance with trauma scoring systems, and the significance of trauma scoring systems in predicting the duration of hospital stay in geriatric patients who are admitted to the emergency department because of falling.

**Materials and Method:** This retrospective study reviewed the records of 1086 patients who were admitted to our emergency department because of falling, between February 1, 2011 and January 31, 2012. Age, gender, date and time of the admission, type of fall, diagnosis related to fall, requisition for radiological tests, requisition for consultations, and end treatment status were recorded for each patient. Glasgow Coma Score, Revised Trauma Score and Injury Severity Score were calculated.

**Results:** Fourteen point five percent of all patients were geriatric patients. The number of hospitalized patients was 248 (22.8%) and the hospitalization period was 6.9±4.6 days. Comparison of patients according to their outcome of treatment in the emergency department (discharge or admission) showed a significantly higher mean Revised Trauma Score and significantly lower mean Injury Severity Score in the of discharged patients subgroup.

**Conclusion:** Our results suggest that anatomic scoring systems (Injury Severity Score) are more accurate than physiological scoring systems (Revised Trauma Score, Glasgow Coma Score) in predicting the duration of hospitalization in patients with trauma due to falling. But these results may require to support by further prospective studies.

**Key Words:** Fall; Geriatrics; Severity of Illness Index; Predictive Value of Tests.



ARAŞTIRMA

## ACİL SERVİSE DÜŞME ŞİKAYETİYLE BAŞVURAN YAŞLI HASTALARDA TRAVMA SKORLAMA SİSTEMLERİNİN KULLANIMI

### Öz

**Giriş:** Bu çalışmada, acil servise düşme nedeniyle başvuran geriatrik yaş grubundaki hastaların demografik özelliklerinin, travma skorlama sistemleri eşliğinde yönetiminin ve hastaneye yatırılan hastalarda travma skorlama sistemlerinin hastanede kalış sürelerini tahmin etmedeki yerinin gözden geçirilmesi amaçlanmıştır.

**Gereç ve Yöntem:** Geriye dönük olarak planlanan bu çalışmaya acil servise 1 Şubat 2011 ile 31 Ocak 2012 tarihleri arasında düşme şikayetiyle başvuran 1086 hasta alındı. Çalışmaya alınan hastalar için düzenlenen formlarda, yaş, cinsiyet, acil servise geliş şekli, başvuru tarihi ve saati, düşme şekli, düşme sonrası gelişen tanılar, radyolojik tetkik istenip istenmemesi, istenilen konsültasyon(lar), ve hastanın işlemler sonundaki nihai durumu kayıt altına alındı. Glasgow Koma Skoru, Revize Travma Skoru ve Yaralanma Şiddet Skoru hesaplandı.

**Bulgular:** Geriatrik yaş grubundaki hastalar toplam hasta sayısının %14.5'i idi. Hastaların 248'i (%22.8) hastaneye yatırılırken yatış süresi 6.9±4.6 gün idi. Hastalar acil serviste sonlandırılmalarına göre (taburculuk ya da yatış) karşılaştırıldığında Revize Travma Skoru anlamlı olarak daha yüksekken, taburcu edilen hastaların Yaralanma Şiddet Skoru anlamlı olarak daha düşüktü.

**Sonuç:** Düşme gibi sıklıkla anatomik bozukluk yaratan hasta gruplarında hastaneye yatış ve hastaneye yatırılan hastalarda hastanede kalış süresinin uzunluğunu tahmin etmede anatomik skorlama sistemlerinin (Yaralanma Şiddet Skoru), fizyolojik skorlama sistemlerinden (Revize Travma Skoru, Glasgow Koma Skoru) daha ön planda kullanılması gerektiği kanısındayız. Fakat bu sonuçların prospektif çalışmalarla desteklenmesi gerekebilir.

**Anahtar Sözcükler:** Düşme; Geriatri; Travma Skorlama Sistemleri.



## INTRODUCTION

In the world's population, the ratio of the population aged 65 and older to the general population has been rapidly increasing due to the increase in life expectancy. The ratio of the elderly population is also increasing in our country. It is expected to be approximately 17.6% in the year 2050, whereas it was 5.7% in 2005 (1). Elderly people are at increased risk of trauma because of anatomical, physiological and endocrine changes due to old age. Falls are the most important causes of trauma and in the geriatric age group they are among the most frequently encountered causes of admissions to emergency departments (2). Falls are also important causes of morbidity and mortality for this age group (3).

Various trauma scoring systems, including physiologic scoring systems such as RTS and GCS and anatomical scoring systems such as ISS, were developed in order to evaluate, compare and define the severity of traumas. In these trauma scoring systems, although calculation of the RTS is too complicated to use in the emergency room, calculation of the GCS is a little easier. But also, although calculation of the ISS is relatively easy, must be known Abbreviated Injury Scale (AIS) score. These trauma scoring systems are utilized in evaluating multiple trauma cases for their ability to predict prognosis and especially mortality rates.

In our study we reviewed demographic characteristics, management according to trauma scoring systems and the significance of trauma scoring systems in predicting the duration of hospitalization in geriatric patients.

## MATERIALS AND METHOD

In this retrospectively cross sectional planned study we enrolled 1086 patients who were admitted to the Ankara Atatürk Training and Research Hospital Emergency Department between February 1, 2011 and January 31, 2012 because of trauma due to falls in patients over the age of 65. Ethical approval was obtained from the hospital ethics committee. Data was collected from the automated hospital information system, emergency department patient cards and hospitalization files and included age, gender, method of presentation to emergency department (via emergency ambulance system or outpatient), the date and time of admission, type of fall (falling from a height, falling at ground level, falling due to syncope, etc.), diagnosis related to falling, requisition for radiological tests, requisition for consultations, and the treatment status of the patients in the emergency department (dis-

charge, hospitalization or death). All patients admitted to the emergency department were included in the study.

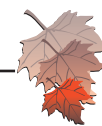
The physiological scoring systems GCS and RTS and the anatomical scoring system ISS were calculated according to the results of the first examination in the Emergency Department. The calculation of the RTS was performed according to the formula defined by Champion et al. "Weighted RTS" [RTS= (0.9368xGCS) + (0.7326xSystolic blood pressure) + (0.2908xRespiratory rate)] (4). On the GCS results, 14-15 points were accepted as mild, 9-13 points as moderate and 3-8 points as severe. (5). The AIS is a dictionary in which 1 (minor) to 6 (fatal) points are given to trauma. When calculating the ISS the body is divided into 6 regions (head and neck, face, thorax, abdomen, extremities, and other), and sum of the squares of the AIS scores from the three most seriously injured regions is calculated as the ISS score. ISS scores range from 1 to 75 and scores of 16 and above indicate major trauma (6).

## Statistical Analysis

Analyses of the data were performed using the SPSS for Windows Version 20.0 package program. The categorical variables were displayed as number and percentage and the numeric variables were summarized as mean±standard deviation, median and min-max. Normally distributed continuous variables were reported as the means and were compared using the Student's t test. Categorical data were assessed using Fisher's exact test. Normality analysis of the continuous variables were performed using the Kolmogorov-Smirnov and Shapiro-Wilks tests and Q-Q plots. If the variables were not normally distributed, the data were transformed (if applicable) or nonparametric tests were performed. To compare continuous variables and determine the significance between the subgroups of nominal and ordinal variables, t-test or Mann-Whitney U test were used. The point biserial correlation coefficient ( $r^{pb}$ ) was calculated for the quantification of the relationship between the nominal and scale variables. Otherwise, Pearson and Spearman coefficients were used as applicable. In this study, the maximum type I error was 0.05, and the level of significance was accepted as  $p < 0.05$ .

## RESULTS

A total of 115,445 patients were admitted to Emergency Department of our hospital during the one year period between February 1, 2011 and January 31, 2012; 16759



**Table 1—** Demographic Characteristics of the Patients.

Age (mean)	77.5±7.9	
male	76.7±7.4	
female	78.1±8.1	
Gender	n	%
male	405	37.3
female	681	62.7
Method of arrival to emergency department		
By emergency ambulance system	429	39.5
By their own facilities	503	46.3
Unknown	154	14.2

n: the number of the patients.

(14.5%) of these patients were in the geriatric age group. A total of 1086 of these geriatric patients were admitted to the emergency department because of trauma due to falls. Four hundred and five patients (37.3%) were male, 681 (62.7%) patients were female and mean age was 77.5±7.9 (min: 65, max: 103). The number of the women was significantly greater than the men ( $p < 0.01$ ) (Table 1).

The majority of the patients (84.4%) had fallen at ground level because of stumbling, whereas 86 patients (7.9%) had fallen from a height and 16 patients had fallen because of syncope. When falling types, RTS, and ISS scores were compared by gender, no statistically significant difference was detected ( $p > 0.05$ ).

With respect to the location of traumas evaluated, the most affected parts of the body were the extremities (245

**Table 2—** Radiological Examination.

	n	%
Direct radiography	679	62.5
Computed tomographies	104	9.6
Direct radiography + Computed tomographies	270	24.9
Other	33	3.0

n: the number of the patients.

patients, 22.5%). At least one radiographic examination was requested for every patient. The most requested examination was direct radiography for 949 patients (87.4%), and no pathology was found in 646 patients (59.5%) (Table 2).

Pathologies were identified in 440 patients (40.5%) and the most common pathology was femoral fracture for 168 patients (15.5%) (Table 3).

The most frequently consulted department was orthopedics with 420 patients (40%). While 249 patients (22.9%) were hospitalized for treatment, the mean duration of hospitalization was 6.9±4.5 days (min=1 max=32). The most common hospitalizations were in the orthopedics department, with 212 (19.5%) patients (Table 4).

In the first examination in the Emergency Department, the GCS was calculated as 15 for 1005 patients (92.5%), between 13-14 in 64 patients (5.9%), and below 12 in 17 patients (1.6%). The RTS was calculated as 7.84 in 1042 patients (95.9%), 7.10 in 24 patients (2.2%), 6.90 in 10 patients (0.9%) and 6:12 in 9 patients (0.8%). Descriptive

**Table 3—** Defined Pathologies Due to Falling.

FRACTURES								
Femur	Tibia	Fibula	Patella	Foot Bones	Humerus	Radius	Ulna	Hand Bones
168 (15.5%)	15 (1.4%)	3 (0.3%)	3 (0.3%)	4 (0.4%)	15 (1.4%)	32 (2.9%)	3 (0.3%)	2 (0.2%)
Clavicle	Pelvis	Skull	Spine	Nasal	Blowout	Costa		
2 (0.2%)	14 (1.3%)	8 (0.7%)	18 (1.7%)	7 (0.6%)	3 (0.3%)	15 (1.4%)		
DISLOCATIONS								
Shoulder	Hip	Patella	Finger					
8 (0.7%)	7 (0.6%)	1 (0.1%)	1 (0.1%)					
OTHER								
Intracerebra Hemorrhage	Subarachnoid Hemorrhage	Epidural Hemorrhage	Subdural Hemorrhage	Hemothorax	Hydrocephalus			
5 (0.5%)	8 (0.7%)	1 (0.1%)	5 (0.5%)	1 (0.1%)	1 (0.1%)			
Cerebro Vascular Disease	Cerebral Mass							
4 (0.4%)	2 (0.2%)							



**Table 4—** Consultations and Hospitalized Departments.

	Consultation		Hospitalization	
	n	%	n	%
Orthopedics	453	41.8	212	19.5
Brain surgery	65	6	16	1.5
General surgery	20	1.8	-	-
Ear, nose and throat diseases	14	1.3	-	-
Neurology	10	1	6	0.6
Other	41	3.7	3	0.3
Intensive care	-	-	11	1.0

n: the number of the patients.

statistical values of RTS are as follows: Mean:  $7,802 \pm 0,208$  (95% CI: 7,789-7,814); median 7,841 (range: 6,120-7,841). The ISS were calculated as  $\geq 16$  in 28 (2.5%) patients, between 4-16 in 213 (19.6%) patients and 1 in 845 (77.8%) patients. Descriptive statistical values of ISS are as follows: Mean:  $2.92 \pm 4.015$  (95% CI: 2.68-3.16); median 1 (range: 1-25). Comparison of patients according to their outcome of treatment in the emergency department (discharge or admission) showed a significantly higher mean RTS score (Admitted:  $7.7250 \pm 0.3735$  vs Discharged:  $7.8244 \pm 0.1129$ ;  $p < 0.001$ ; 95%CI of difference 0.099-0.024) and significantly lower mean ISS score (Admitted:  $9.3468 \pm 4.0862$  vs Discharged:  $1.0131 \pm 0.2950$ ;  $p < 0.001$ ; %95CI of difference: 7.8222-8.8451) in the of discharged patients subgroup.

A total of 248 patients (22.8%) were hospitalized and 838 (77.2%) patients were discharged as outpatients. Of the hospitalized patients, 237 (21.8%) were hospitalized in clinics and 11 (1%) were hospitalized in the intensive care unit. The general mean duration of hospitalization was  $6.9 \pm 4.6$  days. The mean duration of hospitalization was  $6.4 \pm 3.7$  days for patients who were hospitalized in clinics and  $16.7 \pm 5.9$  for patients who were hospitalized in the intensive care unit. Duration of hospitalization was significantly longer in patients who were hospitalized in the intensive care unit ( $p < 0.01$ ). No deaths occurred.

## DISCUSSION

Today, the increasing rate of growth in the elderly population necessitates the need for dealing more effectively with health problems of the elderly as well as the need for developing more specific approaches for every single problem, and using parameters specific to this approach.

In recent studies the reported rate of elderly patients admitted to emergency departments ranges between 12.3 and 15.4%, and the rate of falls in these admissions range between 5 and 7.3% (2,3,7,8). The results of our study are also in accordance with the literature, with a rate of elderly patients admitted to the emergency department of 14.5% and the rate of falls among these patients of 6.5%. In addition, 38.3% of these admissions were made via the emergency ambulance system. This ratio was higher than the average for our country (9). We attribute this difference to the distant location of our hospital, which is difficult to reach through personal means of transportation.

Recent studies reveal that approximately 1/3 of elderly patients fall at least once a year and most of these falls occur at ground level (2,10). In our study, consistently, the majority of falls was also caused by stumbling at ground level (84.4%).

The use of auxiliary modalities by doctors is 50% higher in elderly patients when compared to young patients because of conditions such as atypical course of the disease, symptoms occurring late, and probable emergence of serious problems under mild symptoms in elderly patients (11). In our study, at least one radiographic examination was requested for each patient and for 37.5% of the patients additional advanced imaging techniques were utilized.

No pathology was detected in 59.5% of the radiological examinations. The most frequently diagnosed pathologies were extremity fractures which were followed by head injuries. These results were consistent with the literature (2,12). In addition, consistent with the literature, we found that the most common extremity fracture was femoral fracture (2). Due to high rates of extremity injuries the number of consultations (41.8%) and hospitalization (19.5%) to the orthopedics clinic were high in our study.

The more complex clinical conditions in elderly patients and the need for consuming more resources makes the duration of treatment in the emergency department and hospitalization to be longer when compared to younger patients (13). The length of 6.9 days hospitalization is consistent with the literature (8,2). In addition hospitalization of 6 patients in the neurology clinic suggests the importance of differentiating whether the fall occurred due to syncope, or whether syncope occurred due to the fall in these patients.

In our study, we found a lower mortality rate than reported in the literature (7,8,12). This is because we excluded highly fatal causes of injury such as traffic accidents and penetrating injuries.

Various trauma scoring systems, as well as intensive care scoring systems, are used for the evaluation of patients with multiple trauma. In spite of some shortcomings these scoring



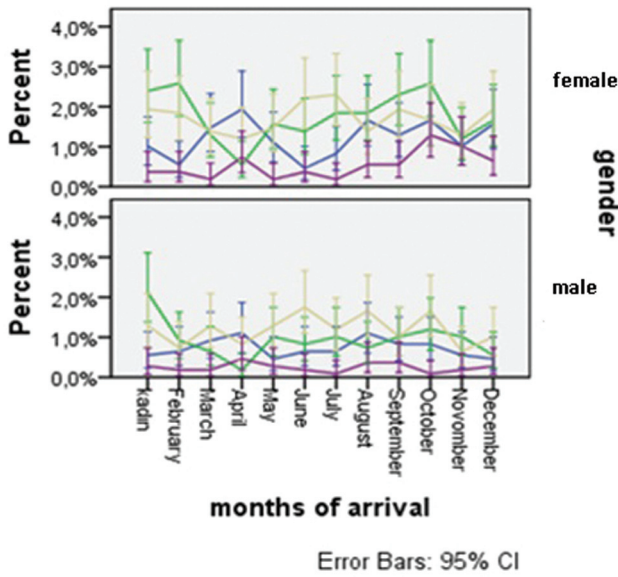


Figure 1— Comparison-of-hours-of-arrival-by-months.

systems are preferred particularly for their ability to predict the prognosis and mortality rates. However, the results of the studies evaluating trauma scoring systems in terms of predicting mortality in elderly trauma patients seems inconsistent. Güneytepe et. al. concluded that all of the systems (ISS, RTS, and GCS) are statistically significant in predicting mortality in elderly trauma patients. Osler and colleagues suggested that GCS is more effective in the elderly (14,15). In another study, ISS is suggested to be the most accurate scoring system for predicting mortality (16). In a study examining the significance of ISS in all age groups significant differences between the ISS scores and discharge from emergency department or hospital were found (12). In our study, Comparison of patients according to their outcome of treatment in the emergency department (discharge or admission) showed a significantly higher mean RTS score and significantly lower mean ISS score in the of discharged patients subgroup.

Consequently, we consider that for predicting prognosis and duration of hospitalization in cases of falls, which often cause anatomical disorders, anatomical scoring systems (such as ISS) could be preferred to physiologic scoring systems (e.g., RTS, GCS). But these results may require to support by further prospective studies.

**Financial Disclosure:** None declared

**Funding Support:** None declared

## REFERENCES

1. TurkStat. Elderly Statistics, Ankara, 2013. Publication number: 4158. [Internet] Available from: [http://www.tuik.gov.tr/Kitap.do?metod=KitapDetay&KT\\_ID=11&KITAP\\_ID=265](http://www.tuik.gov.tr/Kitap.do?metod=KitapDetay&KT_ID=11&KITAP_ID=265). Accessed: 21.12.2013.
2. Atilla ÖD, Tür FÇ, Aksay E, Doğan T, Eyler Y, Akın Ş. Clinical factors in geriatric blunt trauma. *Tr J Emerg Med* 2012;12(3):123-8.
3. Kandış H, Karakuş A, Katırcı Y, Karapolat S, Kara İH. Geriatric population and forensic traumas. *Turkish Journal of Geriatrics* 2011;14(3):193-8. (in Turkish).
4. Champion HR, Sacco WJ, Copes WS, Gann DS, Gennarelli TA, Flanagan ME. A revision of the Trauma Score. *J Trauma* 1989;29(5):623-9. (PMID:2657085).
5. Centers for Disease Control and Prevention: Vital Statistics. [Internet] Available from: <http://www.cdc.gov/nchs/vitalstats.htm>. Accessed: 22.11.2012.
6. Osler T. Injury severity scoring: Perspectives in development and future directions. *The American Journal of Surgery* 1993;165(2A Suppl):43-51. (PMID:8438999).
7. Satar S, Sebe A, Avcı A, Karakuş A, İçme F. Emergency department and the elderly patient. *Ç.Ü. Tıp Fakültesi Dergisi* 2004;29(2):43-50.
8. Taymaz T. Examination of geriatric patients hospitalized from the emergency department. *The Journal of Academic Geriatrics* 2010;2(3):167-75. (in Turkish).
9. Şahin S, Boydak B, Savaş S, Yalçın MA, Akçiçek F. Characteristics of patients aged 65 and over in the emergency department. *The Journal of Academic Geriatrics* 2011;3(1):41-6. (in Turkish).
10. Masud T, Morris RO. Epidemiology of falls. *Age Aging* 2001;30:3-7. (PMID:11769786).
11. Kunt MM. Urgent problems in old age. *Basic Geriatrics for the Primary Health*. 1<sup>st</sup> press, Algı Tanıtım, Ankara 2012, pp 66-73 (in Turkish).
12. Erdur B, Türkçüer İ, Ergin A, Kabay B, Serinken M, Yüksel A. A cohort analysis of Pamukkale University Medical Faculty Emergency Department trauma cases. *Turk J Emerg Med* 2007;7(1):25-30.
13. Yim VW, Graham CA, Rainer TH. A comparison of emergency department utilization by elderly and younger adult patients presenting to three hospitals in Hong Kong. *Int J Emerg Med* 2009;2(1):19-24. (PMID:19390913).
14. Güneytepe Üİ, Aydın ŞA, Gökgöz Ş, Özgüç H, Ocakoğlu G, Aktaş H. The factors influencing the mortality in elderly trauma patients and scoring system. *Uludağ Medical Journal* 2008;34(1):15-9 (in Turkish).
15. Osler T, Hales K, Baack B, et al. Trauma in the elderly. *Am J Surg* 1988;156(6):537-43. (PMID:3202269).
16. Knudson MM, Lieberman J, Morris JA, Cushing BM, Stubbs HA. Mortality factors in geriatric blunt trauma patients. *Arch Surg* 1994;129(4):448-53. (PMID:8154972).