ORIGINAL ARTICLE

Evaluation of the risk factors for falls in the geriatric population presenting to the emergency department

Eltaf Torun, M.D.,[1] Adem Az, M.D.,[2] Tarık Akdemir, M.D.,[2] Görkem Alper Solakoğlu, M.D.,[1] Kurtuluş Açıksarı, M.D.,[1] Bülent Güngörer, M.D.[3]

[1]Department of Emergency Medicine, Istanbul Medeniyet University, Faculty of Medicine, İstanbul-*Türkiye*
[2]Department of Emergency Medicine, University of Health Sciences, Haseki Training and Research Hospital, İstanbul-*Türkiye*
[3]Department of Emergency Medicine, University of Health Sciences, Etlik City Hospital, Ankara-*Türkiye*

ABSTRACT

BACKGROUND: We evaluated risk factors and frailty assessments to identify fall-prone geriatric patients in the emergency department (ED).

METHODS: This prospective study included 264 consecutive patients aged ≥65 years who presented to the ED. The participants were divided into those who had fallen or not. The patient groups were compared in terms of age, sex, presenting complaints (falls vs. others), comorbidities, medications, frailty assessment tools, and orthostatic hypotension (OH).

RESULTS: In total, 264 patients were included: 129 (48.8%) patients who had fallen and 135 (51.2%) who hadn't fallen. The mean ages of patients who had fallen and those who had not fallen were 80.48±8.38 and 79.42±7.94 years, respectively. In addition, 62.01% (n=80) and 51.85% (n=70) of patients were females. There were no statistically significant differences between the groups in terms of age or sex (P=0.290 and P=0.096, respectively). In total, 89.92% (n=116) of patients who had fallen had at least one chronic medical condition. There was a significant difference in the proportion of patients with OH between the groups. Frailty scores such as the Edmonton Frail Scale, Frail Non-Disabled Questionnaire, PRISMA-7 questionnaire, Identification of Seniors at Risk test, and Rockwood Clinical Frailty Scale scores were also significantly different between the groups. A higher PRISMA-7 score at admission was found to be an independent predictor of fall risk.

CONCLUSION: Falls occur more frequently in the older population and in females. In addition, the frailty assessment scores, except for the FRESH Frailty Scale, were associated with falls in geriatric patients. After elimination of non-significant variables in multivariate analysis, a high PRISMA-7 questionnaire score at admission was identified as an independent predictor of fall risk.

Keywords: Frailty; geriatrics; traumatology; wounds and injuries.

INTRODUCTION

The population is gradually aging due to improvements in healthcare and prolonged life expectancy. Consequently, the number of geriatric trauma patients presenting to the emergency department (ED) is increasing.[1] Falls are common in older individuals and are a leading cause of fatal and non-fatal injuries.[2] Falls are associated with severe complications, such as wounds, fractures, and hemorrhages, as well as reduced independence, need for long-term hospitalization and nursing home care, disability, and death.[3] Predicting the fall risk for geriatric patients and taking precautions can reduce mortality and morbidity.[4]

Frailty is an aging-related syndrome of physiological decline, which predisposes to adverse health outcomes, including falls, disability, hospitalization, and mortality.[5,6] In a 14-year-long prospective study of patients aged >70 years, Gill et al.[7] re-

Cite this article as: Torun E, Az A, Akdemir T, Solakoğlu GA, Açıksarı K, Güngörer B. Evaluation of the risk factors for falls in the geriatric population presenting to the emergency department. Ulus Travma Acil Cerrahi Derg 2023;29:897-903.

Address for correspondence: Tarık Akdemir, M.D.
University of Health Sciences, Haseki Training and Research Hospital, İstanbul, Türkiye
E-mail: tarikakdemir52@gmail.com

Ulus Travma Acil Cerrahi Derg 2023;29(8):897-903 DOI: 10.14744/tjtes.2023.07433 Submitted: 24.01.2023 Revised: 18.04.2023 Accepted: 23.04.2023

ported that the recovery from a severe fall correlated with prehospital functional status. In another prospective and cohort study of 9249 women aged >67 years, Valderrábano et al.[8] reported that older women with diabetes had a higher fall risk than the general population. Furthermore, Rupprecht et al. observed that advanced age in geriatric polytrauma patients is an independent and noteworthy risk factor, which significantly increases the likelihood of mortality.[9] In another study, Katipoğlu and Demirtaş recommended the use of the serum glucose-potassium ratio as a predictor for trauma patients.[10] Numerous risk factors have been identified for falls in elderly individuals, such as age, sex, comorbidities, medications, and environmental factors.[11] Further studies are necessary to identify the precise risk factors associated with falls in older adults presenting to the ED to improve fall prevention strategies and reduce fall-related injuries.

In the present study, we examined the risk factors that lead to falls among geriatric patients admitted to the ED and analyzed frailty assessments to identify individuals at a heightened risk for falling.

MATERIALS AND METHODS

Study Design and Sample

This prospective, single-center, and cross-sectional study was conducted in accordance with the 1989 Declaration of Helsinki and was approved by the Institutional Review Board of Istanbul Medeniyet University in Istanbul, Türkiye (no. 2019/0217). Written informed consent was obtained from study participants or their legal guardians and family members. Patients with impaired communication, such as those with severe dementia or loss of consciousness, who were unresponsive and had no legal guardian or family member available to provide consent, were excluded.

The study enrolled 264 consecutive patients aged ≥65 years who presented to the ED of our tertiary hospital between May 01, 2019, and November 15, 2019. The patients were categorized based on whether they had presented to the ED due to a fall or not.

Data Collection and Tools

We recorded demographic characteristics (age and sex), presenting complaints (falls or others), comorbidities (e.g., cancer, hypertension, diabetes mellitus [DM], coronary artery disease [CAD], dementia, and cerebrovascular disease), laboratory findings (e.g., hemoglobin [Hgb], sodium [Na], glucose, and blood urea nitrogen levels), frailty assessment scores (e.g., Edmonton Frail Scale [EFS], Frail Non-Disabled [FiND] questionnaire, FRESH Frailty Test, the PRISMA-7 Questionnaire, Identification of Seniors at Risk [ISAR] test, and Clinical Frailty Scale [CFS]), and the presence of orthostatic hypotension (OH).

OH was determined by measuring a decrease in systolic blood pressure of at least 20 mmHg or a decrease in diastolic blood pressure of at least 10 mmHg within 3 min of standing. Osmolarity was calculated to identify dehydration. Patients with osmolality levels higher than 295 mOsm/kg were considered to be dehydrated. The modified Medical Research Council (mMRC) scale evaluates dyspnea, and the associated degree of disability or dependence in the daily activities, of individuals with chronic respiratory diseases. The mMRC scale grades dyspnea from none (Grade 0) to complete incapacity (Grade 4).[12] Anemia was defined according to Hgb level. For male patients, Hgb levels >13, 11–13, 8–11, and <8 g/dL were considered to correlate with no, mild, moderate, and severe anemia, respectively. For female patients, Hgb levels >12, 11–12, 8–11, and <8 g/dL were considered to correlate with no, mild, moderate, and severe anemia, respectively.

Frailty Assessment Tools

The EFS is a multidimensional tool that evaluates 10 fields and 17 possible deficits. It includes questions related to the neurological status, general health, functional independence, social support, medication use, nutrition, psychological well-being, and daily performance. The cutoff EFS score for frailty is ≥12.[13]

The PRISMA-7 questionnaire includes seven yes/no answers related to the age, sex, general health, daily activities, and social support of patients. One point is assigned for each of the seven questions and a cutoff score of ≥3 points suggests frailty.[14]

The ISAR is a self-reported six-item questionnaire with a yes/no design and a cutoff score of >2 for frailty. It evaluates care requirements, hospital admissions, sight, memory, and polypharmacy.[15]

The FRESH Frailty Assessment Tool is used in the ED to quickly detect frailty. It includes five questions to assess the following: mobility, fatigue, fear of falls, need for assistance while shopping, and visits to the ED in the prior 12 months (three or more). The presence of two or more of the aforementioned factors indicates frailty.[16]

The Rockwood CFS is applicable to most clinical backgrounds and evaluates fitness, active disease, activities of daily living, and cognition of the patient. The score ranges from 1 (very fit) to 9 (terminally ill), and an included schematic diagram allows convenient assessment of frailty. CFS is operator-dependent and its score may change between evaluators.[17] In our study, patients with CSF score above 5 were considered frail.

The FiND questionnaire is a frailty assessment questionnaire that contains questions on physical disability, symptoms, and signs related to the frailty syndrome.[18]

Statistical Analysis

The Number Cruncher Statistical System 2007 (Kaysville, Utah, USA) program was used for statistical analysis. In addition to descriptive statistical methods (mean, standard deviation, percentages, and ratio), Student's t-test and Mann–Whitney U test were used to compare normally and non-normally distributed quantitative variables between the groups, respectively. The Pearson Chi-square, Fisher's exact test, and Fisher Freeman Halton test were used to compare qualitative data. Independent variables were analyzed using multivariate logistic regression analysis. A statistical alpha significance level was defined as P<0.05.

RESULTS

Table 1 presents the demographic and clinical characteristics of study patients. We categorized the patients based on whether they had fallen (n=129, 48.8%) or not (n=135, 51.2%). The mean ages of patients who had fallen and those who had not fallen were 80.48±8.38 and 79.42±7.94 years, respectively. In addition, 62.01% (n=80) of patients who had fallen and 51.85% (n=70) of patients who had not fallen were female. There were no statistically significant differences between the groups in terms of age or sex (P=0.290 and P=0.096, respectively). Overall, 89.92% (n=116) of patients who had fallen and 95.55% (n=129) of those had not fallen

Table 1. The demographic and clinical characteristics of study patients

		Group I (n=129)	Group II (n=135)	P*-value
Age, years (mean ± SD)	Total	80.48±8.38	79.42±7.94	0.290
	65–80 years, n (%)	55 (42.6)	64 (47.4)	
	≥ 80 years, n (%)	75 (57.4)	71 (52.6)	
Female/Male ratio		80/49	70/65	0.096
Comorbidities, n (%)	Total	116 (89.92)	129 (95.55)	0.077
	Osteoporosis	8 (6.20)	1 (0.74)	0.015
	Cerebrovascular disease	7 (5.43)	17 (12.59)	0.060
	Coronary artery disease	3 (2.33)	21 (15,56)	0.001
	Heart failure	15 (11.63)	39 (28.89)	0.001
	Dementia	6 (4.65)	3 (2.22)	0.314
	Hypertension	81 (62.79)	94 (69.63)	0.599
	Cancer	5 (3.88)	15 (11.11)	0.037
	Diabetes Mellitus	40 (31.01)	41 (30.37)	0.654
Orthostatic hypotension n (%)	Presence	10 (7.75)	4 (2.96)	0.049
	Absence	79 (61.24)	100 (74.07)	
Modified Medical Research Council (mean±SD)		4.86±0.58	4.74±0.83	0.321
Anemia, n (%)	Absence	57 (44.19)	58 (42.96)	0.997
	Mild	38 (29.46)	41 (30.37)	
	Moderate	29 (22.48)	31 (22.96)	
	Severe	5 (3.88)	5 (3.70)	
Dehydration, n (%)		10 (7.75)	17 (12.59)	0.632
History of fall, n (%)		80 (62.02)	65 (48.15)	0.024
Clinical outcome, n (%)	Discharged	81 (62.80)	87 (64.44)	0.432
	Hospitalized	44 (34.11)	41 (30.37)	
	Deaths	1 (0.78)	4 (2.96)	

Group I, patients who had fallen; Group II, patients who hadn't fallen. Data are expressed as numbers (n), percentages (%), mean, and standard deviation (SD). * Student's t-test and Mann-Whitney U test were used to compare normally and non-normally distributed quantitative variables between the groups, respectively. The Pearson chi-square, Fisher's exact test, and Fisher Freeman Halton test were used to compare qualitative data.

had at least one chronic medical condition. No statistically significant differences were found between the groups in terms of chronic medical conditions (P=0.077 and P=0.414, respectively). However, the history of osteoporosis was significantly higher in patients who had fallen compared to those who hadn't fallen (P=0.015). Moreover, the presence of OH was significantly higher in patients who had fallen compared to those who had not fallen (P=0.049). There were no statistically significant differences between the groups in terms of mMRC score (P=0.321), anemia (P=0.997), or dehydration (P=0.632). The incidence of prior falls was significantly higher among patients who presented to the ED with falls than those who presented for non-fall-related reasons (P=0.024). Finally, 81 (62.8%) of patients who had fallen and 84 (64.4%) of patients who had not fallen were discharged from the ED. One patient in individuals who had fallen and four patients in those who had not fallen died. There were no statistically significant differences between the groups in terms of clinical outcomes (discharge, hospitalization, and death; P=0.432).

Table 2 presents the descriptive characteristics of patients according to the frailty assessment scores. According to the

Table 2. The descriptive characteristics of study patients according to the frailty assessment scores

Frailty tools	Group I n (%)	Group II n (%)	P*-value
Total	129 (100)	135 (100)	
Edmonton Frail Scale			
Non-frail	35 (27.4)	45 (33.3)	0.021
Vulnerable	12 (9.6)	28 (20.9)	
Mildly Frail	26 (20)	24 (17.8)	
Moderate Frail	26 (19.9)	25 (18.6)	
Severely Frail	30 (23.1)	13 (9.3)	
Frail Non-Disabled Questionnaire			
Non-frail	31 (24.4)	39 (28.7)	0.001
Frail	14 (10.4)	31 (23.3)	
Disabled	84 (65.2)	65 (48.1)	
FRESH Frailty Test			
Non-frail	28 (21.5)	38 (27.9)	0.226
Frail	101 (78.5)	97 (72.1)	
PRISMA-7 Questionnaire			
Non-frail	36 (28.1)	69 (51.2)	0.001
High risk for frailty	93 (71.9)	66 (48.8)	
Identification of Seniors at Risk Test			
Non-frail	47 (36.3)	75 (55.8)	0.001
Frail	82 (63.7)	60 (44.2)	
Rockwood Clinical Frailty Scale			
Very fit	1 (0.7)	1 (0.8)	0.007
Fit	14 (10.4)	15 (10.8)	
Managing well	18 (14.1)	33 (24.8)	
Less frail	36 (28.1)	26 (19.4)	
Partially frail	12 (9.6)	21 (15.5)	
Frail	14 (10.4)	23 (17.1)	
Severely frail	34 (26.7)	16 (11.6)	

Group I, patients who had fallen; Group II, patients who had not fallen. Data are expressed as numbers (n) and percentages (%). *The Pearson Chi-square test was used to compare qualitative data.

Table 3. Multivariate logistic regression analysis to determine risk factors for fall

	P*-value	OR	%95 CI	
Sex (female)	0.121	1.521	0.896	2.582
Anemia (moderate and severe)	0.208	1.422	0.822	2.460
Dehydration (higher than 295 mOsm/kg)	0.882	1.047	0.575	1.905
Edmonton Frail Scale	0.515	0.767	0.345	1.707
Frail Non-Disabled Questionnaire	0.289	1.572	0.681	3.628
PRISMA-7 Questionnaire	0.009	0.376	0.180	0.783
Identification of Seniors at Risk Test	0.200	0.600	0.275	1.311
Rockwood Clinical Frailty Scale	0.509	1.367	0.541	3.450
Comorbidities (one or more medical condition)	0.229	0.521	0.180	1.505

OR: Odds ratio; CI: Confidence interval.

EFS, FiND, FRESH, and ISAR scores, 63.6% (n=82), 75.6% (n=98), 71.9% (101), and 63.7% (n=82) of patients were frail, respectively. In addition, the PRISMA-7 questionnaire score showed that 71.9% (n=93) of patients were at high risk for frailty. Finally, the CFS results showed that 28.1% (n=36), 9.6% (n=12), 10.4% (n=14), and 26.7% (n=34) of patients were less frail, partially frail, frail, and severely frail, respectively. Statistically significant differences were found between the patients who had fallen and those who had not fallen in terms of EFS (P=0.021), FiND (P=0.001), PRISMA-7 questionnaire (P=0.001), ISAR (P=0.001), and CFS scores (P=0.007). However, no statistically significant differences were observed between the patient groups in terms of FRESH score (P=0.226).

In multivariate analysis, after step-wise backward elimination of non-significant variables, a high PRISMA-7 questionnaire score at admission was found to be an independent predictor of fall risk, with an odds ratio of 0.376 (95% confidence interval: 0.180–0.783; P=0.009) (Table 3).

DISCUSSION

Falls are a common cause of mortality and morbidity in geriatric patients. The risk factors for falls in geriatric individuals include chronic diseases, unsteady gait, altered mental status, and decreased physical capacity. Risk assessment is crucial for primary interventions for fall prevention.[19] We investigated risk factors associated with falls in geriatric patients. Our key findings are summarized as follows. First, 62.01% of ED patients who experienced falls were female, and 89.92% of fall patients had at least one chronic medical condition. Second, there were significant differences between patients who had, and had not, fallen in terms of the presence of OH. Third, there were statistically significant differences between the groups in terms of EFS, FiND, the PRISMA-7 questionnaire, ISAR, and CFS scores. Finally, a high PRISMA-7 questionnaire score at admission was an independent predictor of fall risk.

A study conducted in the USA by Dunlop et al.[20] reported that females were 58% more likely to suffer a nonfatal fall than males. The CDC has reported that females fall more often than males.[21] In line with previous studies, 62.01% of our study patients who had fallen were females. However, there were no statistically significant differences between patients who had, and had not, fallen in terms of sex proportion, although the proportion of females was higher than males in both groups.

We did not observe any significant differences between the groups in terms of mMRC score, anemia, or dehydration. However, OH occurred more frequently in patients who had fallen compared to those who had not. OH is a common condition that usually affects individuals aged > 65 years. Gangavati et al.[22] investigated relationships between controlled and uncontrolled hypertension, OH, and falls, and reported that older adults with 1 min systolic OH and uncontrolled hypertension were at higher risk for falling compared to those with uncontrolled hypertension without OH. However, OH alone was not associated with falls. Further clinical studies are required to investigate relationships between uncontrolled hypertension, OH, and falls.

We found that certain chronic diseases, such as osteoporosis, were seen more frequently in patients who had fallen compared to those who had not. In a population-based longitudinal study of 749 adults aged 70 years and older who had fallen, Leveille et al.[23] reported that chronic musculoskeletal pain increased the fall risk. Furthermore, several studies have reported that the fall risk is increased in patients with DM and CVO.[23-25] By contrast, in our study, there were no significant differences between the groups in terms of CVO or DM. Furthermore, the history of dementia and hypertension did not differ significantly between the patients who had fallen and those who had not. In addition, heart failure and CAD were observed less commonly in patients who had fallen than those who had not. Our study was not planned as a popu-

lation-based study and consequently could not demonstrate the relationships between falls and chronic diseases.

In a study conducted by Tejiram et al., the utility of frailty assessment tools such as the FRAIL scale, CFS, and Trauma Specific Frailty Index (TSFI) were evaluated to determine the risk of falls among geriatric patients. The findings of the study revealed a strong correlation between an increase in frailty and heightened odds of a fall.[26] Moreover, in their study of 1217 geriatric trauma patients, Dingley et al. found that the ISAR scale may be useful in identifying populations at risk of falls.[5] Our data showed that all frailty assessment scores, except for the FRESH scale, were positively associated with falls in geriatric patients, in line with current literature findings. However, after eliminating non-significant variables, only a high PRISMA-7 questionnaire score at admission remained an independent predictor of falls. The PRISMA-7 questionnaire is easy to administer and not time-consuming and does not require clinical expertise or skill for administration. Our findings indicate that PRİSMA-7 questionnaire can be used by primary care workers to assess the fall risk in older individuals.

Our study had some limitations, including its small sample size and single-center design. Because it was not a population-based study, we did not include data from older individuals who were asymptomatic and had not presented to the ED. Therefore, there is a need for population-based studies to investigate risk factors associated with falls in geriatric individuals. Furthermore, there are no data on disease characteristics such as presenting complaints and diagnosis of patients who had not fallen, so the conclusions we can draw about specific comorbidities are limited. Another limitation of this study is the insufficient data to reveal the correlation between polypharmacy and frailty in the study population. Therefore, we could not draw any definitive conclusions about the potential impact of polypharmacy on frailty in this study population. Finally, the exclusion of unresponsive patients who had no legal guardian or family member available to provide consent may have an impact on the study results.

CONCLUSION

Falls occur more frequently in older individuals and females. In addition, frailty assessment scores, including EFS, FIND, PRISMA-7 questionnaire, ISAR, and CFS scales, were associated with falls in geriatric patients. In multivariate analysis, after eliminating non-significant variables, the PRISMA-7 questionnaire score at admission remained an independent predictor of falls. Primary care workers and health-care providers should evaluate and warn about the overall fall risk of elderly patients using PRISMA-7 questionnaire.

Ethics Committee Approval: This study was approved by the Istanbul Medeniyet University Göztepe Training and Research Hospital Clinical Research Ethics Committee (Date: 22.05.2019, Decision No: 2019/2017).

Peer-review: Externally peer-reviewed.

Authorship Contributions: Concept: E.T., G.A.S., K.A.; Design: A.A., TA; Supervision: G.A.S., K.A.; Resource: E.T., T.A., G.A.S.; Materials: E.T., T.A., G.A.S.; Data collection and/or processing: E.T., A.A., T.A.; Analysis and/or interpretation: A.A., G.A.S, K.A.; Literature search: E.T., A.A., T.A.; Writing: E.T., A.A., T.A.; Critical review: G.A.S., K.A.

Conflict of Interest: None declared.

Financial Disclosure: The authors declared that this study has received no financial support.

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ORİJİNAL ÇALIŞMA - *ÖZ*

Acil servise başvuran geriatrik hastalarda düşme risk faktörlerinin değerlendirilmesi

Dr. Eltaf Torun,[1] Dr. Adem Az,[2] Dr. Tarık Akdemir,[2] Dr. Görkem Alper Solakoğlu,[1] Dr. Kurtuluş Açıksari,[1] Dr. Bülent Güngörer[3]

[1]İstanbul Medeniyet Üniversitesi, Tıp Fakültesi, Acil Tıp Kliniği, İstanbul, Türkiye
[2]Sağlık Bilimleri Üniversitesi, Haseki Eğitim ve Araştırma Hastanesi, Acil Tıp Kliniği, İstanbul, Türkiye
[3]Sağlık Bilimleri Üniversitesi, Etlik Şehir Hastanesi, Acil Tıp Kliniği, Ankara, Türkiye

AMAÇ: Acil servise başvuran geriatrik hastalarda düşme risk faktörlerini ve kırılganlık indekslerini değerlendirdik.
GEREÇ VE YÖNTEM: Bu prospektif çalışma, acil servise başvuran 65 yaş ve üstü 264 ardışık hastayı içermektedir. Katılımcılar düşenler ve düşmeyenler olarak ikiye ayrıldı. Hasta grupları yaş, cinsiyet, başvuru şikayetleri (düşme ve diğerleri), komorbiditeler, ilaçlar, kırılganlık değerlendirme araçları ve ortostatik hipotansiyon (OH) açısından karşılaştırıldı.
BULGULAR: Çalışmaya düşen 129 (%48.8) ve düşmeyen 135 (%51.2) olmak üzere toplam 264 hasta alındı. Düşen ve düşmeyen hastaların ortalama yaşları sırasıyla 80.48±8.38 ve 79.42±7.94 idi. Ayrıca hastaların %62.01'i (n=80) ve %51.85'i (n=70) kadın idi. Gruplar arasında yaş ve cinsiyet açısından istatistiksel olarak anlamlı fark yoktu (sırasıyla, p=0.290 ve p=0.096). Düşen hastaların %89.92'sinin (n=116) en az bir kronik hastalığı vardı. Gruplar arasında OH'li hasta oranlarında anlamlı bir fark vardı. Edmonton Kırılganlık Ölçeği, Kırılgan Olmayan Engelli Anketi, PRISMA-7 anketi, Risk Altındaki Yaşlıların Belirlenmesi testi ve Rockwood Klinik Kırılganlık Ölçeği puanları gibi kırılganlık puanları da gruplar arasında anlamlı derecede farklıydı. Başvuruda daha yüksek bir PRISMA-7 skorunun, düşme riskinin bağımsız bir göstergesi olduğu bulundu.
SONUÇ: Düşmeler yaşlı popülasyonda ve kadınlarda daha sık görülür. Ayrıca, FRESH Kırılganlık Ölçeği dışındaki kırılganlık değerlendirme puanları, geriatrik hastalarda düşmelerle ilişkilendirilmiştir. Anlamlı olmayan değişkenlerin elenmesinden sonra çok değişkenli regresyon analizinde başvuru sırasındaki yüksek PRISMA-7 anket puanı, düşme riskinin bağımsız bir göstergesi olarak tanımlandı.
Anahtar sözcükler: Geriatri; travmatoloji; kırılganlık; yaralar ve yaralanmalar.

Ulus Travma Acil Cerrahi Derg 2023;29(8):897-903 DOI: 10.14744/tjtes.2023.07433