



Forensic Geriatric Trauma Cases

Adli Geriatrik Travma Olguları

Erдем HÖSÜKLER, Zehra Zerrin ERKOL

Bolu Abant İzzet Baysal University Faculty of Medicine, Department of Forensic Medicine, Bolu, Türkiye

ABSTRACT

Objective: This study aimed to evaluate the general characteristics of geriatric cases aged ≥ 65 years, who presented at the Forensic Medicine Clinic due to trauma, and the severity of injury using trauma scoring systems.

Methods: The study included all trauma cases over 65 years with a forensic report prepared in the Forensic Medicine Clinic between 2015 and 2021. Evaluations were made using the chi-square, Mann-Whitney U, and Kruskal-Wallis (post-hoc: Dunn-Bonferroni) tests. A value of $p < 0.05$ was considered statistically significant.

Results: Two-thirds of the cases were male (67.6%) and mean age was 73.23 ± 6.25 years. More than half of the cases were exposed to battery-related trauma (54%). There was an injury in more than one region in 37.4% ($n=52$) of the cases. The median injury severity score (ISS) of the cases was 2 (1.5) and the median new-injury severity score (NISS) was 3 (1.8). The scores of ISS and NISS in cases aged >75 years were higher than in those aged ≤ 75 years ($p < 0.05$). The score severity of ISS and NISS of the cases injured in traffic accidents and other accidents was higher than in those injured due to battery ($p < 0.001$). Almost half (48.1%) of the traffic accident-related cases were pedestrians, and it was seen that pedestrians suffered more severe trauma.

Conclusion: Increasing the necessary safety measures in traffic, especially pedestrian safety, and taking measures to make daily life easier for the elderly may help protect this vulnerable population from the effects of severe trauma.

Keywords: Elderly, trauma, forensic medicine, traffic accident

ÖZ

Amaç: Bu çalışmada, Adli Tıp Kliniği'ne travma nedeniyle başvuran ≥ 65 yaş üstü geriatrik olguların genel karakteristik özellikleri ve travma skorlama sistemleri kullanılarak yaralanma şiddetlerinin değerlendirilmesi amaçlanmıştır.

Yöntemler: 2015-2021 yılları arasında adli tıp kliniğinde travma nedeniyle adli rapor düzenlenen 65 yaş üstü tüm olgular çalışmaya dahil edildi. Gruplar ki-kare testi, Mann-Whitney U testi ve Kruskal-Wallis testi (post-hoc: Dunn-Bonferroni testi) ile karşılaştırıldı. P değeri $< 0,05$ istatistiksel olarak anlamlı kabul edildi.

Bulgular: Olguların üçte ikisi erkekti (%67,6). Yaş ortalaması $73,23 \pm 6,25$ 'ti. Olguların yarısından fazlası darp cebir nedeniyle (%54) travmaya maruz kalmıştı. Olguların %37,4'ünde ($n=52$) birden fazla bölgede yaralanma vardı. Olguların median yaralanma ciddiyeti skoru (ISS) 2 (1,5) ve median yeni-yaralanma ciddiyeti skoru (NISS) 3 (1,8) idi. Yetmiş beş yaş üzerindeki olgularda ISS ve NISS puanı, 75 yaş ve altı olgulara göre yüksekti ($p < 0,05$). Trafik kazasına bağlı yaralanan ve diğer kazalar sonucu yaralanan olguların ISS ve NISS puanı darp sonucu yaralananlara göre daha yüksekti ($p < 0,001$). Trafik kazası geçiren olguların yaklaşık yarısı (%48,1) yayaydı. Yayalar daha şiddetli travmaya maruz kalmıştı.

Sonuç: Özellikle yaya güvenliği başta olmak üzere trafikte gerekli güvenlik önlemlerinin artırılması, günlük yaşamı yaşlılar için kolaylaştıracak önlemlerin alınması ile yaşlı bireylerin şiddetli travmanın etkilerinden korunmasına yardımcı olabilir.

Anahtar Sözcükler: Yaşlı, travma, adli tıp, trafik kazası

Address for Correspondence: Erdem Hösükler, Bolu Abant İzzet Baysal University Faculty of Medicine, Department of Forensic Medicine, Bolu, Türkiye
E-mail: drerdemmakale@gmail.com **ORCID ID:** orcid.org/0000-0002-7736-748X

Received: 20.03.2023

Accepted: 12.12.2023

Cite this article as: Hösükler E, Erkol ZZ. Forensic Geriatric Trauma Cases. Bezmialem Science 2024;12(2):198-203



© Copyright 2024 by Bezmialem Vakıf University published by Galenos Publishing House.
Licensed by Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 (CC BY-NC-ND 4.0)

Introduction

As people get older, body resistance decreases, and thus less energy is required to cause serious injury (1). Although the elderly have a lower risk of trauma than the younger population as they spend less time outside, the morbidity and mortality rates following trauma are higher than for the younger (2). In a study by Burstow et al., (3) mortality resulting from both minor and major traumas was more than two-fold higher in cases aged ≥65 years compared to those aged <65 years. Trauma in the elderly causes longer hospital stays, higher hospital costs, long and grueling rehabilitation, and a higher risk of complications (4). The Turkish Statistics Institute has estimated that the elderly population, which was 8.6 million (10.2%) in 2023, will increase to 19.5 million (20.8%) in 2050 and 24.7 (27.7%) million in 2075 (5). Therefore, it is inevitable that elderly trauma cases will increase in parallel with the increasing proportion of the elderly in the population every year.

This study aimed to evaluate the general characteristics of geriatric cases aged ≥65 years, who presented at the Forensic Medicine Clinic due to trauma, and the severity of injury using trauma scoring systems.

Methods

This retrospective cohort study included a total of 139 cases for whom a forensic report was requested as a result of trauma between January 01, 2015 and December 31, 2021. Cases without traumatic injury or with incomplete data were excluded from the study. All information was collected retrospectively from the hospital automation system, forensic records, and patient files of the cases included in the study. Although the study was designed as a retrospective study and, thus, it was out of the scope of the informed consent doctrine, all procedures in the study were performed after obtaining ethical and scientific approval of Bolu Abant İzzet Baysal University Clinical Researches Committee Approval dated 26.04.2022, no: 2022/104, and compatible with the 1964 Helsinki Declaration including its later amendments.

The cases included in the study were evaluated in terms of the following parameters: “age, gender, injuries, injury site, location of traffic accident victims, safety belt, helmet and protective equipment, degree of forensic injury, and trauma scores [injury severity score (ISS) - new-injury severity score (NISS)]”. The ISS and NISS were calculated using the abbreviated injury scale (AIS) 2008 update.

Trauma scoring systems are handy tools in assessing the severity of injury (6). It is an anatomical-based coding system. It was first created by the AIS Association for the Advancement of Automotive Medicine in 1976 to classify the severity of injury, classifying each damage on a six-point scale according to body region. The ISS is basically a trauma system in which AIS is used and 6 body regions (head or neck, face, chest, abdomen and pelvis contents, extremity and pelvic girdle, external and other trauma) are evaluated. The ISS is calculated by adding the square of the AIS score of the body’s three most severely injured areas. $ISS = (AIS \text{ body region } 1)^2 + (AIS \text{ body region } 2)^2 + (AIS \text{ body$

$\text{region } 3)^2$] (7). NISS is the sum of the squares of the three most severe injuries, regardless of the injured body area. Therefore NISS can be equal to or higher than ISS (8). ISS and NISS are very helpful trauma scoring systems in showing trauma severity and predicting mortality (6).

Statistical Analysis

Statistical Package For Social Science (SPSS), version 21.0 (IBM Corp., SPSS Statistics for Window, Armonk, NY, USA) statistics program was used for data analysis of the study. The conformity of variables to normal distribution was investigated using visual (histograms plots) and analytical methods (Kolmogorov-Smirnov/Shapiro-Wilk test). Descriptive statistics were presented as mean, standard deviation, or median (interquartile range values for quantitative data, and as number (n) and percentage (%) for categorical variables.

Categorical variables were compared with the chi-square test. Non-parametric tests were conducted to compare data with non-normal distribution. Paired groups were evaluated with the Mann-Whitney U test, and more than two groups with the Kruskal-Wallis Test (post-hoc: Dunn-Bonferroni test). A value of $p < 0.05$ was considered to show a statistically significant result.

Results

The 139 cases included in the study comprised 94 (67.6%) males and 45 (32.4%) females with a mean age of 73.23 ± 6.25 years, of the majority (n=99, 71.2%) of cases in the 65-75 year age group. More than half of the cases were exposed to battery-related trauma (54%) (Table 1). Injuries were observed in more

Table 1. Characteristics of geriatric cases

		n	%
Age (years)	65-75 years	99	71.20
	>75 years	40	28.80
Forensic event	Battery	75	54.00
	Traffic accidents	52	37.40
	Other accidents*	12	8.60
Injury site	Head-neck	36	25.90
	Extremity	32	23.00
	Chest-abdomen	19	13.70
	Multiple	52	37.40
Accident cause	Falling	7	5.83
	Dog attack	2	1.67
	Sharp object injury	1	0.83
	Gunshot injury	1	0.83
	Injection neuropathy	1	0.83
Degree of forensic injuries	Cured by simple medical intervention	61	43.90
	Not cured by simple medical intervention	55	39.60
	Life-threatening	23	16.50

*Fall from height, work accident...etc.

than one body region in 37.4% (n=52) of the cases (Table 1). Soft tissue lesions were detected in 66 (47.5%), a bone fracture in 61 (43.9%), pulmonary contusion in 10 (7.2%), cerebral hemorrhage (subarachnoidal, subdural) in 10 (7.2%), a tendon-muscle laceration in 5 (3.6%), cerebral contusion in 4 (2.9%), liver laceration in 2 (1.4%), renal laceration in 2 (1.4%), nerve laceration in 1 (0.7%), larynx laceration in 1 (0.7%), and finger amputation in 1 (0.7%) of the cases.

The median ISS of the cases was 2 (1.5) and the median NISS was 3 (1.8). There was no significant difference in ISS and NISS severity between the genders ($p>0.05$) (Table 2). The severity score of ISS and NISS in cases aged >75 years was significantly higher than in those aged ≤ 75 years ($p<0.05$) (Table 2). The ISS and NISS severity scores of the cases injured due to traffic accidents and other accidents were statistically significantly higher than those injured due to battery (Kruskal-Wallis: $p<0.001$, post-hoc: $p<0.001$, $p<0.05$, respectively) (Table 2). The severity of ISS and NISS increased with the degree of forensic injury ($p<0.001$) (Table 2).

Of the cases involved in traffic accidents (n=52), 25 (48.1%) were pedestrians, 15 (28.8%) were drivers, and 12 (23.1%) were passengers. The seat belt was worn in 74.1% of cases (n=27). The ISS and NISS severity score was statistically significantly higher in out-of-vehicle traffic accidents (pedestrians) than in-vehicle traffic accidents ($p<0.01$) (Table 2).

Discussion

Gender

The vast majority (77.63%) of the elderly who experienced trauma in Japan between 2004 and 2017 were male (2). Javali et al. (8) reported similar results (male, 74%). In contrast, Gioffrè-Florio et al. (9) reported that more than two-thirds of 4554 trauma survivors were female. Most previous studies in Türkiye stated that males were exposed to trauma more than females in the elderly population (10-15). Consistent with the literature data, more than two-thirds of the cases in the current study were male. This situation may be due to the fact that male individuals in our society have a more social lifestyle and spend more time in traffic and outside.

Table 2. Distribution of ISS and NISS according to gender, age group, injury site, traffic accidents, degree of forensic injuries

		ISS			p-value
		Median	25 th per	75 th per	
Gender	Male	2.00	1.00	6.75	0.909 ¹
	Female	2.00	1.00	4.50	
Age group	65-75 years	2.00	1.00	5.00	0.019 ¹
	>75 years	4.00	2.00	9.00	
Traumatic forensic event	Battery	2.00	1.00	4.00	<0.001 ²
	Traffic accidents	5.00	1.00	13.75	
	Other accidents	4.00	4.00	5.00	
Traffic accidents	In-vehicle	1.00	1.00	9.00	<0.01 ¹
	Off-vehicle (pedestrian)	9.00	4.00	17.50	
Degree of forensic injuries	Cured by simple medical intervention	1.00	1.00	2.00	<0.001 ²
	Not cured by simple medical intervention	4.00	2.00	5.00	
	Life-threatening	18.00	13.00	22.00	
Median		NISS			p-value
		25 th per	75 th per		
Gender	Male	3.00	1.75	8.25	0.886 ¹
	Female	3.00	1.00	7.50	
Age group	65-75 years	3.00	1.00	6.00	0.032 ¹
	>75 years	4.00	3.00	10.50	
Traumatic forensic event	Battery	3.00	1.00	4.00	<0.001 ²
	Traffic accidents	5.50	2.25	21.00	
	Other accidents	4.00	4.00	6.00	
Traffic accidents	In-vehicle	3.00	1.00	9.00	<0.01 ²
	Off-vehicle (pedestrian)	12.00	4.00	24.50	
Degree of forensic injuries	Cured by simple medical intervention	2.00	1.00	3.00	<0.001 ²
	Not cured by simple medical intervention	4.00	3.00	6.00	
	Life-threatening	22.00	14.00	27.00	

¹Mann-Whitney U test, ²Kruskal-Wallis test, ISS: Injury severity score, NISS: New-injury severity score

Age

In a study by Yousefzadeh-Chabok et al., (4) the mean age of the cases was 71.55 years. In a few studies conducted in Türkiye, the average age of geriatric trauma victims was reported to be between 71.9 and 77.16 years (11-14,16), with the majority (60.4-70.3%) in the 65-75 years age group (13,16,17). In the current study, the mean age of the cases was 73.23±6.25 years, and the majority (n=99, 71.2%) were in the 65-75 years age group. The reason for this may be related to the fact that individuals >75 years are less exposed to trauma as they are less involved in social life with advancing age.

Cause of Trauma

Falls (71.49%) and traffic accidents (31.40%) have been reported to be the most common causes of injury in the elderly Japanese population (2). In a study from Türkiye, Söz and Karakaya (16) reported that elderly patients admitted to the emergency department with trauma injuries were most frequently injured due to falls (86%) and traffic accidents (7.3%). Yildiz et al. (11) stated that almost two-thirds of elderly trauma patients presented at the emergency department due to falls. In another study of 224 elderly patients admitted to the emergency department with trauma, the most common causes of trauma were reported to be traffic accidents (46.4%) and assault (43.7%) (10). In another study of 101 elderly forensic cases, the majority of the cases (82.1%) were exposed to trauma due to traffic accidents (13). However, in a study conducted in the Department of Forensic Medicine, more than half (51.6%) of elderly patients were injured as a result of physical trauma (14). Similarly, Kaya et al. (15) reported that 57% of the elder cases for which a forensic report was prepared, occurred due to assault. In this study, more than half of the cases in this study were exposed to trauma due to battery (54%). The reason for this difference between the studies from the emergency department and the forensic medicine departments might be that battered elderly individuals were not usually admitted to the hospital for superficial injuries such as soft tissue lesions, but they were sent to us for the preparation of a forensic report after complaining to the law-enforcement officers.

Injury Site

In a study conducted in an emergency room in Iran, the most common site of injury in the elderly population was the lower and upper extremities (93.5%) (4). A study in Japan reported the most common injury site to be the lower extremities (46.40%) and the head (36.91%) (2). In the study of Gioffrè-Florino et al., (9) 4554 elderly trauma victims were most frequently injured in the head region (31.4%). Söz and Karakaya (16) reported that the most common injury sites in elderly trauma patients were the extremities (58%) and head and neck (26.2%). Yildiz et al. (11) reported extremity injuries at a higher rate (56.3%), and Güler et al. (13) reported the most common injuries in the lower and upper extremities (45.5%). Kaya et al. (15) reported that the head and neck (37.2%) were the most frequently injured areas in geriatric cases for which a forensic report was prepared. In the current study, 32.7% of the cases (n=52) were injured in more

than one region, and the most frequent isolated injury site was the head and neck. This could be because more than half of the cases were injured due to battery.

Injury Type

A previous study stated that soft tissue lesions (40.4%) were detected most often in elderly trauma patients who presented at an emergency department (16). In a study by Kandış et al., (10) elderly patients presented at the emergency department most frequently with soft tissue lesions (49.1%). Şener and Baydemir Kılınc (14) reported that more than half (53.1%) of forensic geriatric cases had soft tissue lesions. In the current study, a soft tissue lesion was detected in almost half (47.5%) of the cases.

ISS/NISS

Male patients >65 years are more likely to be seriously injured and generally have a higher median ISS (3). Burstow et al. (3) calculated a median ISS score of 4 in 22,454 cases ≥65 years. In a study by Cevik et al., (18) the median ISS of elderly traffic accident victims was reported to be 4. In the current study, the median ISS of the cases was 2 (1.5) and the median NISS was 3 (1.8).

Miyoshi et al. (2) reported median ISS of 13 in elderly patients in the 65-79 years age group and the median ISS was 9 in individuals aged ≥80 years in a series of 131,088 geriatric trauma cases. In the current study, the ISS and NISS scores of the cases over 75 years old were higher than those of the cases aged ≤75 years (p<0.05). This showed that although individuals aged ≥75 years were exposed to less trauma, their trauma-related injuries were more severe. This may be due to the older age group being more vulnerable to trauma.

The mean ISS score of 371 elderly trauma survivors presenting at an emergency department in Bursa, Türkiye, was 9.3, and traffic accidents were significantly more fatal in the traumatized elderly population (12). Burstow et al. (3) reported that traffic accidents (motor vehicle accidents, pedestrian accidents, motorcycle accidents) had a significantly higher median ISS than other types of injury. In a study in Japan, traffic accidents and burns were the causes of the highest death rate among traumatized elderly patients (2). Şener and Baydemir Kılınc (14) demonstrated that injuries resulting from accidents (traffic accident, fall from height, work accident, etc.) were associated with higher ISS scores. The result of the current study showed that the ISS and NISS severity scores of the cases injured due to traffic accidents and other accidents (fall from height, work accident...etc.) were higher than those injured due to battery (Kruskal-Wallis: p<0.001, post-hoc: p<0.001, p<0.05, respectively). Remarkably, the elderly population is exposed to more severe trauma due to traffic accidents and other accidents, which can be prevented by measures to be taken. Therefore, it is necessary to increase and develop precautions and security measures for this population to prevent these accidents.

In a previous study, ISS and NISS were recommended as the best trauma-scoring systems that could be used to detect life-threatening injuries (19). The current study determined

that the degree of forensic injury and the severity of ISS and NISS increased in parallel ($p < 0.001$). Therefore, in the elderly population, this can be an useful method to determine the life-threatening and simple medical and intervention concepts specified in Turkish Penal Code.

Traffic Accidents

Pedestrians and very old adults (≥ 75 years) have a higher death rate in traffic accidents (20). In a study by Etehad et al., (21) 40.5% of 1306 elderly patients injured as a result of traffic accidents were pedestrians, 22.1% were passengers, 4.6% were drivers, 7.7% were cyclists, and 19.1% were motorcyclists. In the current study, 25 (48.1%) of the cases ($n=52$) were pedestrians, 15 (28.8%) were drivers, and 12 (23.1%) were passengers.

Generally, elderly pedestrians are exposed to more severe trauma due to traffic accidents, and most deaths are seen in pedestrians (22). In the current study, the ISS and NISS severity scores were higher in out-of-vehicle traffic accidents (pedestrians) than in-vehicle traffic accidents ($p < 0.01$).

In a study conducted in Athens, 73.7% of drivers and 85.9% of passengers injured in traffic accidents were not wearing a seatbelt at the time of the accident (23). Similarly, in a study conducted in an emergency room, 93.1% of the cases injured in traffic accidents were not wearing a seatbelt (24). However, in the current study, 74.1% of the cases injured in in-vehicle traffic accidents were wearing a seatbelt, which was a higher rate than in the literature. This may be related older individuals avoiding high risk actions and protecting themselves more.

Study Limitations

This study had some limitations, primarily the retrospective design. Moreover, it did not represent the entire elderly trauma population, as it was conducted in a single clinic and only included forensic cases. There were also elderly trauma cases that were not recorded as forensic cases.

Conclusion

The result of this study showed that forensic geriatric cases were frequently injured due to battery. Severe trauma in the geriatric age group was seen to be the result of traffic accidents and other accidents, especially involving pedestrians. Cases > 75 years were exposed to less but more severe trauma. Injuries to elderly individuals can be prevented by simple and small measures such as making arrangements to facilitate road-crossing in traffic, drivers being more attentive to elderly individuals, not leaving elderly individuals with insufficient mental-motor functions alone, taking measures to make daily life easier for the elderly and increasing the penalties for assault crimes committed against the elderly who are incapable of defending themselves compared to a young adult.

Ethics

Ethics Committee Approval: This study was approved by Bolu Abant İzzet Baysal University Clinical Research Committee with the approval dated 26.04.2022 and numbered 2022/104.

Informed Consent: Retrospective study.

Authorship Contributions

Surgical and Medical Practices: E.H., Z.Z.E., Concept: E.H., Z.Z.E., Design: E.H., Z.Z.E., Data Collection or Processing: E.H., Z.Z.E., Analysis or Interpretation: E.H., Z.Z.E., Literature Search: E.H., Z.Z.E., Writing: E.H., Z.Z.E.

Conflict of Interest: No conflict of interest was declared by the authors.

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

References

- Chiang W, Huang S, Chang W, Huang M, Chien D TC. Mortality Factors Regarding the Injury Severity Score in Elderly Trauma Patients. *Int J Gerontology* 2012;6:192-5.
- Miyoshi Y, Kondo Y, Hirano Y, Ishihara T, Sueyoshi K, Okamoto K, et al. Characteristics, injuries, and clinical outcomes of geriatric trauma patients in Japan: an analysis of the nationwide trauma registry database. *Sci Rep* 2020;10:19148.
- Burstow M, Civil I, Hsee L. Trauma in the Elderly: Demographic Trends (1995-2014) in a Major New Zealand Trauma Centre. *World J Surg* 2019;43:466-75.
- 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;22:536-40.
- Population Projections, 2013-2075. Turkish Statistical Institute News Release. No: 15844, 14 February 2013. Available at: <https://data.tuik.gov.tr/Bulten/Index?p=Nufus-Projeksiyonlari-2013-2075-15844#:~:text=N%C3%BCfus%202050%20y%C4%B1nC4%B1na%20kadar%20>
- Deng Q, Tang B, Xue C, Liu Y, Liu X, Lv Y, et al. Comparison of the Ability to Predict Mortality between the Injury Severity Score and the New Injury Severity Score: A Meta-Analysis. *Int J Environ Res Public Health* 2016;13:825.
- Reynolds P, Scattoloni JA, Gadepalli SK, Ehrlich P, Cladis FP, Davis PJ. Anesthesia for the Pediatric Trauma Patient. *Smith's Anesthesia for Infants and Children*. 9th Edition. Elsevier 2017:969-94.
- Javali RH, Krishnamoorthy, Patil A, Srinivasarangan M, Suraj, Sriharsha. Comparison of Injury Severity Score, New Injury Severity Score, Revised Trauma Score and Trauma and Injury Severity Score for Mortality Prediction in Elderly Trauma Patients. *Indian J Crit Care Med* 2019;23:73-7.
- Gioffrè-Florio M, Murabito LM, Visalli C, Pergolizzi FP, Famà F. Trauma in elderly patients: a study of prevalence, comorbidities and gender differences. *G Chir* 2018;39:35-40.
- Kandış H, Karakuş A, Katırcı Y, Karapolat S, Kara İH. Geriatric population and forensic traumas. *Turkish J Geriatr* 2011;14:193-8.
- Yıldız M, Bozdemir MN, Kiliçaslan I, Ateşçelik M, Gürbüz S, Mutlu B, et al Elderly trauma: the two years experience of a university-

- affiliated emergency department. *Eur Rev Med Pharmacol Sci* 2012;16 Suppl 1:62-7.
12. Akköse Aydın S, Bulut M, Fedakar R, Özgürer A, Özdemir F. Trauma in the elderly patients in Bursa. *Ulus Travma Acil Cerrahi Derg* 2006;12:230-4.
 13. Güler H, Kaya A, Şenolş E, Belpınar MS, Aktaş EÖ. Retrospective assessment of forensic reports prepared for 65 years of age and older cases. *Ege J Med* 2020;59:196-201.
 14. Şener MT, Baydemir Kılınc B. Forensic traumatic cases in the geriatric population. *Turk J Geriatr* 2020;23:35-41.
 15. Kaya K, Gülmen MK, Akgündüz E, Çelik EB, Hilal A. Geriatric traumas in the judicial reports of Adana, Türkiye. *Forensic Res Criminol Int J* 2018;6:183-5.
 16. Söz G, Karakaya Z. The evaluation of geriatric patients who presented with trauma to the emergency department. *Arch Med Sci* 2019;15:1261-8.
 17. Güneytepe Üİ, Akköse Aydın Ş, Gökğöz Ş, Özgüç H, Ocakoğlu G, Aktaş H. The Factors Influencing the Mortality in Elderly Trauma Patients and Scoring Systems. *J Uludağ University Med Fac* 2008;34:15-9.
 18. Cevik Y, Doğan NÖ, Daş M, Karakayalı O, Delice O, Kavalci C. Evaluation of geriatric patients with trauma scores after motor vehicle trauma. *Am J Emerg Med* 2013;31:1453-6.
 19. Fedakar R, Aydiner AH, Ercan I. A comparison of "life threatening injury" concept in the Turkish Penal Code and trauma scoring systems. *Ulus Travma Acil Cerrahi Derg* 2007;13:192-8.
 20. Ang BH, Chen WS, Lee SWH. Global burden of road traffic accidents in older adults: A systematic review and meta-regression analysis. *Arch Gerontol Geriatr* 2017;72:32-8.
 21. Etehad H, Yousefzadeh-Chabok Sh, Davoudi-Kiakalaye A, Moghadam Dehnadi A, Hemati H, Mohtasham-Amiri Z. Impact of road traffic accidents on the elderly. *Arch Gerontol Geriatr* 2015;61:489-93.
 22. Azami-Aghdash S, Aghaei MH, Sadeghi-Bazarghani H. Epidemiology of Road Traffic Injuries among Elderly People; A Systematic Review and Meta-Analysis. *Bull Emerg Trauma* 2018;6:279-91.
 23. Pikoulis E, Filias V, Pikoulis N, Daskalakis P, Avgerinos ED, Tavernarakis G, et al. Patterns of injuries and motor-vehicle traffic accidents in Athens. *Int J Inj Contr Saf Promot* 2006;13:190-3.
 24. Aygencel G, Karamercan M, Ergin M, Telatar G. Review of traffic accident cases presenting to an adult emergency service in Türkiye. *J Forensic Leg Med* 2008;15:1-6.