A 20 Years Analysis of Fatal Traffic Accidents in Elderly; Eskisehir Turkey

Eskişehir'de Yaşlılık Dönemi Ölümlü Trafik Kazalarının 20 Yıllık Analizi

[1]Kenan Karbeyaz, [1]Isılay Balci, [2]Umit Simsek

[1]Eskisehir Osmangazi University Medical School Department of Forensic Medicine, Eskisehir, Turkey
[2]Ministry of Justice Forensic Medicine Institute Sivas, Turkey

Abstract: Since the elderly are not included much in social life, they are more prone to traumas and accidents when compared with the young. However, when the elderly are exposed to traumas, the mortality and morbidity are more when compared with the young. In this study, the purpose is to evaluate the fatal traffic accidents in which the geriatric age group was involved in 20 years. With this study, the characteristics of the fatal accidents in our study will be determined, and possible precautions will be discussed in the light of these data. The autopsy reports of the elderly who were over the age of 65 and who died in traffic accidents were included in the study. The cases were investigated according to their ages, genders, accident scenes, accident types, accident time. In the period covered by the study, 413 elderly in Eskişehir were determined to have died as a result of traffic accidents. Mean age was 73.17 ± 6.46, 321 (77.7%) were male and 92 were female (22.3%). 65,1% (n=272) of the cases were pedestrians. High mortality rate of road traffic injuries in this group especially in pedestrians should be taken into consideration and strategies aimed at the road-user safety including periodic medical examination and improvement of road structure and facilities.
Keywords: elderly, traffic accident, forensic medicine.

Özet: Yaşlıların trafik kazalarına maruz kalma şekilleri ve kaza sonrası yaralanma özelliklerinin genç yaş grubundan ayrı değerlendirilmesi gerektiği düşünülmektedir. Bu kapsamda ilimizde 20 yıllık dönemde geriatrik yaş grubunu ilgilendiren ölümlü trafik kazası olgularının değerlendirilmesi amaçlandı. Bu çalışmada 1997-2016 arasındaki 20 yıllık dönemde adli nitelikli ölümlerden 65 yaş üstü olup ölüm nedeni trafik kazasına bağlı olan olgular çalışma kapsamına alınacaktır. Olgular, demografik veriler, olay yeri, kaza türü, ölenin kaza anındaki konumu ve ölüm sebeplerine göre incelendi. Çalışmanın kapsadığı dönemde Eskişehir'de 413 yaşlının trafik kazası sonucu öldüğü belirlendi. Yaş ortalamasının 73,17±6,46 olduğu, olguların 321'inin (% 77,7) erkek, 92'sinin kadın olduğu (% 22,3) belirlendi. Olguların % 65,1'inin (n=272) yaya olduğu ve 279 olguda ölümcül yaranın kafa bölgesinde olduğu (% 66,7) belirlendi. Bu yaş grubunda trafik kazasında ölenlerin yüksek oranda yaya oldukları göz önüne alındığında, trafik güvenliği ve yolların yaşlı güvenliği dikkate alınarak düzenlenmesi ve kontrol edilmesi gerektiği düşünülmüştür.
Anahtar Kelimeler: yaşlılık, trafik kazası, adli tıp.

ORCID ID of the authors: K.K. 0000-0001-6009-0739; I.B. 0000-0002-0092-2721; Ü.Ş. 0000-0003-4927-6916

Correspondence: **Kenan KARBEYAZ**- Eskisehir Osmangazi University Medical School Department of Forensic Medicine, Eskisehir, Turkey
e-mail: drkenankarbeyaz@hotmail.com

1. Introduction

It is known that the elderly have decreased perception and attention focusing ability, and move slowly and unattentively with the effect of the inadequacy in their sensory organs (1,2). Since the elderly are not included much in social life, they are more prone to traumas and accidents when compared with the young. However, when the elderly are exposed to traumas, the mortality and morbidity are more when compared with the young (3-6). Cope with trauma and affected by traumas different when compared with the young and elderly. Because of the balance and coordination problems, and the decrease in the functions of the sensory organs, the elderly are more vulnerable to accidents (1,2,6-9). One of the most frequently observed accidents is traffic accidents (2,4). Such accidents rank the second after falling in the elderly (10). There are no studies in which the traffic accidents involving deaths of the elderly are investigated in our city.

The Eskisehir province, where the study was conducted, is located in Western Anatolia and it is a university town with a high level of socio-culture compared to the other cities in our country. In Eskişehir, tramways are used extensively in urban traffic. The urban traffic signal and traffic lighting system is advanced. However, there are many intersections and pedestrian crossings. Some of these pedestrian crossings can be complicated, especially for the elderly people, because they combine multiple tramways and roads. There are also separate bicycle routes at many points in the city. People of all ages, including elderly people in our city, use the bicycles as a means of transportation. There are separate parking areas for the bicycles in front of the government agencies and private institutions.

The aim of this study is to evaluate the characteristics of fatal traffic accidents involving the geriatric age group in Eskişehir, to identify the related factors, to share this data in the literature and to present solutions suggestion.

2. Material and Method

The autopsy reports of the elderly who were over the age of 65 and who died in traffic accidents were included in the study. In this study, traffic accidents were analyzed between the dates January 1, 1997 and December 31, 2016.

The cases were investigated according to their ages, genders, accident scenes, accident types, accident time (month, year, hour), the position of the deceased at the moment of the accident; if the deceased was in a vehicle, the position in the vehicle, the issue of whether the deceased had a driver or not; if s/he was a passenger, the seat of him/her, whether s/he wore the seatbelt or not; if the deceased was a pedestrian, the type of the vehicle that hit /him/her, the injured body part, whether s/he was drunk or not, and the reason of death.

Data analysis was carried out with the SPSS Software, version 22. Descriptive statistics for the prevalence of events and quantitative variables were used and differences between demographic and injuries situation were calculated by chi square test and percent analysis. A p-value of <0.05 was considered statistically significant.

3. Findings

It was determined that in the 20-year period, post-mortem analyses were performed on 7512 judicial deaths, and 1439 (19,2%) of these were over the age of 65. It was also determined that 627 (43.6%) of the 1439 deaths in which the elderly were involved were accidents, and 413 (65,9%) of them were traffic accidents. In the same period, which the present study covered, 2851 people died because of traffic accidents. 413 (14,5%) of the people who died in traffic accidents were from the elderly group.

It was also determined that the cases were between 65 and 93 years of age, and the mean age was 73,17±6,46. It was also determined that 303 (73,4%) of the patients were between 65-74, and 110 (26,6%) were at and above the age of 75. In addition, 321 (77,7%) were

male, and 92 were female (22,3%); and the rate of male/female was 3,4. No significant relation were detected between the age group and gender (Table 1, P>0,05).

65,1% (n=272) of the cases were pedestrians. The distribution of the cases according to age groups is given in Table 2. It was observed that the cases that were pedestrians (P<0,05) and car drivers (p<0,01) were more in the 65-74 age group, and those that were front seat passengers in cars (P<0,0001), and back seat passengers in cars (P<0,05) were over the age of 75. No significant differences were detected according to the age groups in other positions in vehicles (P>0,05).

The distribution of the cases according to the hour, day and season is given in Table 3. It was determined that 39,7% (n=164) of the accidents happened between 06.00 and 12.00 (P<0,001), and 41,7% (n=172) happened in summer (P<0,001). No significant differences were determined between the days (P>0,05).

When the vehicles that hit the 272 cases who were pedestrians during the accidents were analyzed, it was determined that 137 (50,4%) of the accidents involved cars, and minivans and buses followed this with 84 cases (30,9%).

Table 4 shows the distribution of the accident positions of the cases according to the accident time. It was found that in 84.8% of the accidents occurred between 06.00-12.00 hours, the victims were the pedestrians; in the accidents occurred between 18.00-24.00 hours, 82.9% of the elderly people were inside the vehicle. There was no statistically significant difference in terms of days. It was determined that, in the fatal accidents occurred in summer, 63.3% of the elderly people were pedestrian and in 77.5% of the accidents occurred in winter the elderly people were inside the vehicle.

All of the users lost their lives in 7 moped accidents and 2 bicycle accidents. None of the users of the bicycle and moped wore helmets, and none of the moped riders had licenses. The mentioned ones are the motor bike-like vehicles with the small engine volumes and capability of low speeds. These vehicles are frequently used in our province, especially in towns and districts. Driving a bicycle requires a driving license. Driving license is not required for the bicycles.

The analysis of the fatal accident areas is given in Table 5. When the fatal accidents were analyzed, it was determined that 64,5% of the cases had head traumas, and 48% had chest traumas. Lethal traumas in all body regions were evaluated.

It was also determined that 301 cases (72,9%) died in the accident scene, 33 cases (8,0%) died on the way to hospital, and 79 cases (19,1%) died at hospital; and the case that stayed alive for the longest duration died 68 days after the accident. 55 of the cases that were treated at hospital were in the Brain Surgery Department, 14 were in the Chest Surgery Department, and 10 were in General Surgery Department.

It was determined that only 5 of the cases were drunk during the accidents, and the alcohol levels varied between 32 mg/dl and 102 mg/dl. No other substances like narcotics except for alcohol were detected in any of the cases. In the 5 cases in which alcohol was detected in the toxicological examination, it was the car driver who used alcohol. The legal limit for alcohol in non-commercial vehicles is 50 mg/dl in our country. Alcohol levels detected in the study are not at the level of poisoning. It was not determined whether these alcohol levels played a role in the accident.

It was determined that there were 123 cases in which there was no pedestrian and the cars having the safety belt equipment involved at the time of the accident. Only in 17 (13.8%) of these cases the safety belts were fastened. It was determined that in 14 (82.4%) of these 17 cases the isolated chest trauma occurred, in 3 (17.6%) of these 17 cases the chest and abdomen trauma occurred, and no head trauma occurred in the cases in which the safety belts were fastened.

Table 1. Distribution of age group by gender

Age Group	Gender				Total	
	Male		*Female*			
	n	%	n	%	n	%
Between 65-74	241	75,1	62	67,4	303	73,4
Above the age of 75	80	24,9	30	32,6	110	26,6
Total	321	100,0	92	100,0	413	100,0

$\chi^2 = 2,162$ $P>0,05$

Table 2. Distribution of age group by position in traffic and vehicle type

Position in Traffic	Age Group				Total		P value
	Between 65-74		Above the age of 75				
	n	%	n	%	n	%	
Pedestrian	210	69,3	62	56,4	272	65,9	**P<0,05**
Motorcycle driver	7	2,3	0	0	7	1,7	P>0,05
Bicycle driver	2	0,7	0	0	2	0,5	P>0,05
Car driver	40	13,2	4	3,7	44	10,7	**P<0,01**
Front seat passenger in cars	16	5,3	22	20,0	38	9,1	**P<0,0001**
Back seat passenger in cars	13	4,3	12	10,9	25	6,0	**P<0,05**
Truck / lorry driver	2	0,7	1	0,9	3	0,7	P>0,05
Truck / lorry passenger	1	0,3	1	0,9	2	0,5	P>0,05
Bus / minibus driver	4	1,3	1	0,9	5	1,2	P>0,05
Bus / minibus passenger	3	1,0	3	2,7	6	1,5	P>0,05
Tractor driver	4	1,3	2	1,8	6	1,5	P>0,05
Tractor passenger	1	0,3	2	1,8	3	0,7	P>0,05
Total	303	100,0	110	100,0	413	100,0	

Table 3. Distribution of the cases by hour, day of the week and season

Time of accident			Day of accident			Season of accident		
	n	%		n	%		n	%
00.01–06.00	40	9,7	Monday	59	14,3	Spring	98	23,7
06.01–12.00	164	39,7	Tuesday	51	12,3	Summer	172	41,7
12.01–18.00	98	23,7	Wednesday	52	12,6	Autumn	103	24,9
18.01–24.00	111	29,9	Thursday	57	13,8	Winter	40	9,7
			Friday	70	16,9			
			Saturday	61	14,8			
			Sunday	63	15,8			
Total	413	100,0	Total	413	100,0	Total	413	100,0
P<0,001			P>0,05			P<0,001		

Table 4. Distribution of cases according to causes of death

Injury causing death	n	%
Isolated head trauma	205	49,6
Isolated chest trauma	101	24,7
Isolated abdominal trauma	4	1,0
Head+Chest trauma	41	9,9
Chest+Abdominal trauma	40	9,8
Head+Chest+Abdominal trauma	10	2,4
Head+medulla spinalis trauma	7	1,4
Head+Chest+ Peripheral vascular injury	5	1,2

The Limitation of the Study

In the present study, the disease and conscious status of the elderly who were involved in the accidents not detected because not all of the elderly had hospital records, or the hospital records were inadequate.

4. Discussion

Traffic accidents are important among unnatural death reasons in old-age period (10-12). In a study that was conducted in Erzurum, Turkey, it was reported that traffic accidents ranked the first (n = 120, 53.80%) among the unnatural deaths in the elderly population (12). In a study that was conducted in Taiwan, it was reported that the second frequent reason of the accidents in the elderly population was traffic accidents (10). Akar et al. conducted a study in Ankara, Turkey and reported that traffic accidents were the second most frequent reason in the death of the elderly among the unnatural death reasons (n=153, 37,7%) (13). Hekimoğlu et al. conducted a study in Van and reported that 64.3% of the deaths in the people who were older than 65 years occurred as a result of accidents, and 72,2% of these were traffic accidents (14). Etehad et al. conducted a study in Iran and reported that 8,7% of all traffic accidents were caused by the elderly population (6). In another study, the deaths that occurred as a result of traffic accidents were analyzed in Diyarbakır in Turkey, and it was reported that 9.6% of those who died as a result of traffic accidents were over the age of 60 (15). It was determined that 14,5% of the deaths in 2851 traffic accidents involved the elderly in the study period. The reason why the rate of the elderly population is involved in traffic accidents is the fact that the rate of the elderly population is high in our city. According to the data of 2015, the rate of the elderly population was 8.2% in Turkey, and this rate is 10.5% in Eskişehir, which is located in Western Anatolia (16). We think that the reason for that the elderly traffic accident deaths are too much in our city is as follows; the inadequacy of the roads, traffic signs, and equipment in comparison with the population density, and inadequacy of

regulations especially for the elderly pedestrians.

In studies conducted on all age groups who are involved in traffic accidents, it is known that male population die more frequently in traffic accidents (1,2,5,16,17,18). In a study conducted in Egypt, it was reported that 53.8% of the cases who had traffic accidents over the age of 65 were males (1). Etehad et al. conducted a study in Iran and reported that 74.7% of the traffic accidents in which the elderly were involved consisted of males (6). In our study, it was determined that 77.7% of the individuals who were at and above the age of 65 and who died in traffic accidents were males, which is consistent with the literature. It is thought that the reason for this is the fact that the elderly men are more likely to participate in social life and spend more time outside.

It was reported that the elderly population is exposed to traffic accidents when they are pedestrians (1,6,19,20). Etehad et al. conducted a study and reported that 40.5% of the elderly who were injured in traffic accidents were injured when they were pedestrians (6). In a study which was conducted in Germany, it was reported that 57% of the cases that died in traffic accidents were pedestrians (21). In the present study, it was determined that 65.9% of the cases were pedestrians during the accidents. The reasons for this might be that the rate of the elderly use vehicles less frequently, and the elderly who have low vision experience difficulties in crossing the roads and have reduced coordinated movement abilities with reduced visual acuity.

It was reported in the literature that traffic accidents occurred mostly on holidays, in summer months and between 18.01-00.00 (14,19,21). In the present study, 39,7% (n=164) of the cases died between 06.00 and 12.00 (P<0,001); and 41,7% (n=172) died in summer, (P<0,001). No significant differences were detected between the days (P>0,05). Since the elderly go out more frequently in summer, only these data are similar to those reported in the literature. The lack of

significant difference between hours and days might be explained with the fact that the elderly are not involved in the working life. In the presented study, it is seen that the accident time is different from the literature. Elderly people living in our city do not choose the weekends and nights to go out. Because many of them do not actively work, they can go out any day and any hour. In our city especially the 06.00-12.00 hours are the morning prayer time, the elderly population usually having to go to morning prayer or to make an accident while returning. The winter months in Eskişehir are very cold. In parallel with this, it was found that in 77.5% of fatal accidents in winter the elderly people were in the car.

It was determined that the most frequent cause of deaths was head traumas (17, 22, 23). Bork et al. conducted a study and reported that 78.4% of the deaths that occurred in traffic accidents were as a result of head traumas (17). In the present study, it was determined that 49.6% of the cases had isolated traumas and 64.5% had fatal head traumas.

In our study, we found that 7 elderly moped drivers and 2 elderly bike drivers died. It was determined that in none of the cases the bicycle and moped drivers wore a helmet. In addition, it was determined that none of the 7 moped drivers had the driving license. Particularly in Eskişehir, where the study was conducted, moped and bicycles are used especially in rural areas without any protective measures by individuals who do not have licenses.

It is known that the elderly age group is different from the young group in terms of being exposed to traffic accidents and injuries. It was determined that the elderly were mostly involved in traffic accidents when they were pedestrians, and those who were in or on vehicles did not have any preventive measures helmets, seat belts, etc. The number of the vehicles and traffic intensity are increasing at a fast pace. The elderly cannot keep pace with these developments. For this reason, regulations must be made for the elderly especially for those who are pedestrians, the licenses of the elderly must be checked with certain intervals, the elderly who use moped and bicycles must be made to take precautions to reduce the death of the elderly in traffic accidents.

In general, the findings of our study were found to be consistent with the results reported in the literature about the accidents in which the elderly were involved. It was observed in our study that the elderly were involved in fatal traffic accidents more than the other age groups. We believe that by taking necessary precautions in traffic by local authorities to enable the elderly act comfortably, and if further precautions are taken for the elderly when the traffic signs and rules are designed and formed; and when police officers in traffic departments and other authorities are informed about the safety of the elderly in traffic, the death rates related with traffic accidents involving the elderly may be decreased.

REFERENCES

1. Abou-Raya, S, ElMeguid, L. A. Road traffic accidents and the elderly. *Geriatrics & gerontology international.* 2009; 9:290-97.
2. Tosato M, Zamboni V, Ferrini A, Cesari M. The aging process and potential interventions to extend life expectancy. *Clin Interv Aging* 2007; 2: 401–12.
3. Eser, M., Keten, A., Icme, F., et al. Investıgatıon Of Traffıc Accıdents In Gerıatrıc Age Group. *Turkish Journal Of Geriatrics*, 2013; 16, 277- 80.
4. Hefny AF, Abbas AK, Abu-Zidan FM. Geriatric fall-related injuries. Afr Health Sci. 2016;16:554-9
5. Markogiannakis H, Sanidas E, Messaris E, Koutentakis D, Alpantaki K, Kafetzakis A, et al. Motor vehicle trauma: analysis of injury profiles by road-user category. *Emerg Med J.* 2006;23:27-31.
6. 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.
7. Langford, J., Fitzharris, M., Koppel, S, Newstead, S. Effectiveness of mandatory license testing for older drivers in reducing crash risk among urban older Australian

drivers. *Traffic Injury Prevention*, 2004;5: 326–35.

8. Langford, J., Fitzharris, M., Newstead, S., Koppel, S. Some consequences of different older driver licensing procedures in Australia. Accident *Analysis and Prevention*, 2004;36: 993–1001.

9. Tay, R.. Ageing driver licensing requirements and traffic safety. *Ageing and Society*, 2012;32: 655–72.

10. Chien WC, Chung CH, Lai CH, Chou CH. A retrospective population-based study of injury types among elderly in Taiwan. *Int J Inj Contr Saf Promot.* 2014;21:3-8.

11. Yee W Y, Cameron P A, Bailey MJ. Road traffic injuries in the elderly. *Emerg Med J* 2006;23:42–46.

12. Timur O, Tasar PT, Ulusoy MG, et al Autopsies in the elderly: Erzurum study. *J Forensic Leg Med.* 2017;52:143-7.

13. Akar T, Karapirli M, Akcan R, et al Elderly deaths in Ankara, Turkey. *Arch Gerontol Geriatr.* 2014 ;59:398-402

14. Hekimoğlu Y, Kartal E, Etli Y, et al. Retrospectively Analysis of Deaths of Persons above 65 Years of Age Which Autopsied in Van City of Turkey among 2010 and 2014 Years. *Van Tıp Derg* 2017;24: 150-6.

15. Gören, S., Subaşı, M., Tıraşçı, Y., Kaya, Z. . Deaths related to traffic accident. Turkiye Klinikleri *Journal Of Forensic Medicine*, 2005;2: 9-13.

16. İstatistiklerle Yaşlılar. tuik.gov.tr. Access date:01.11.2017.

17. Bork T, Tokdemir M, Turkoglu A. Evaluation of traffic accidents for which autopsies were conducted in an Eastern Turkish City: a five-year study. *Journal of Turgut Ozal Medical Center.* 2016;23:375-83

18. Cardona AMS, Arango DC, Fernández DYB, Martínez AA, Mortality in traffic accidents with older adults in Colombia, *Rev Saude Publica.* 2017;51:21

19. Katayama Y, Kitamura T, Kiyohara K, et al. Factors associated with prehospital death among traffic accident patients in Osaka City, Japan: A population-based study. *Traffic Inj Prev.* 2018 ;19:49-53.

20. Zangooei Dovom H1, Shafahi Y, Zangooei Dovom M. Fatal accident distribution by age, gender and head injury, and death probability at accident scene in Mashhad, Iran, 2006-2009. *Int J Inj Contr Saf Promot.* 2013;20:121-33.

21. Heinrich D, Holzmann C, Wagner, Fischer A, Pfeifer R, Graw M, Schick S. What are the differences in Injury Patterns of young and elderly Traffic Accident Fatalities considering death on scene and death in hospital?, *International Journal of Legal Medicine.* 2017;131:1023-37

22. Karbeyaz K, Balcı Y, Çolak E, Gündüz T. Eskişehir ilinde 2002-2007 yılları arasında gerçekleşen ölümlü trafik kazalarının fatal özellikleri. *Türkiye Klinikleri J Foren Med.* 2009;6:65-73.

23. Cameron PA, Rainer TH, Mak P. Motor vehicle deaths in Hong Kong: opportunities from improvement. *Journal of Trauma* 2004;56:890-3.