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Medicolegal evaluation of geriatric deaths in Bursa, Türkiye

Selçuk Çetin[1], Erol Baduroğlu[2], Ertuğrul Gök[3], Recep Fedakar[4], Bedirhan Sezer Öner[5]

[1]Department of Forensic Medicine, Faculty of Medicine, Tokat Gaziosmanpaşa University, Tokat, Türkiye
[2]Bartın Branch of the Council of Forensic Medicine of the Ministry of Justice, Bartın, Türkiye
[3]Department of Forensic Medicine, Faculty of Medicine, Dicle University, Diyarbakır, Türkiye
[4]Department of Forensic Medicine, Faculty of Medicine, Uludağ University, Bursa, Türkiye
[5]Department of Forensic Medicine, Faculty of Medicine, Amasya University, Amasya, Türkiye

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ABSTRACT

Aim: Differentiation of natural and forced deaths observed in this age group is very important in the forensic medicine practice. According to the address based population registration system, population rate of 65 years and older has been 9.5% of the total population in 2020. In the present study, we aimed to medicolegal evaluation of demographic data and autopsy findings of judicial geriatric deaths in Bursa and around.

Material and Method: Autopsy reports of the cases who have been taken to Morgue Specialization Office of Council of Forensic Medicine Institution and at 65 years and over, crime scene and deceased examination reports and data in the prosecution documents were assessed retrospectively between 2003-2008 in our study.

Results: During 6-year period, totally 5155 autopsies have been investigated in Morg Specialization Office of Bursa Council of Forensic Medicine Institution. Among such cases, 870 (16.8%) were 65 years old and older. Cases who were 65 years old and older included 640 (73.6%) were male, 230 (26.4%) were female. In terms of death origin, 434 (49.9%) were natural deaths, 267 (30.7%) were accidents, 102 (11.7%) were suicides and 52 (6%) were homicides. Origin of death of the remaining 15 (1.7%) could not be detected. According to the information obtained from the statements of the witnesses in crime scene investigation and dead body examination reports, a previous disease existed in 336 (38.6%) cases before death. Diseases which have been existing before death includes cardiac diseases, hypertension, central nervous system pathologies, diabetes mellitus, respiratory system pathologies, undefined psychiatric disorders, gastrointestinal system pathologies and malignancies, respectively to frequency.

Conclusion: In line with prolongation of life expectancy and increase in the geriatric population, it is observed according to our outcomes that an increase is detected in judicial geriatric death cases due to neuropsychiatric disease, leading a solitary life and psychomotor imbalance.

Keywords: Forensic autopsy, death, elderly.

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INTRODUCTION

According to World Health Organization, 65 years is accepted as a limit for senility (1). Such increase detected in the geriatric population have brought different problems to the agenda. According to the address based population registration system, population rate of 65 years and older has been 9.5% of the total population in 2020 (2). In line with the increase in the geriatric population, multiple disease rates, multiple drug use, abuse and negligence become important. Especially, significant increase in frequency of patients with dementia bring many medical, social and judicial problems along. In conjunction with increased geriatric population, an increase in judicial deaths has also been observed in the group who were 65 years old and older. In a study presented by Collins et al. (3) and in the other study presented by Collins (4), most of the geriatric deaths have appeared due to natural causes whereas an increase in unnatural deaths have also been reported.

Except for cases of origin of death with an accident, suicide or homicide, cases with a recent history of trauma before death, injuries detected in external examination, contradictions and inconsistencies in the history, deaths in detention and prison, cases with accusations and allegations regarding the cause of death,

Corresponding Author: Selçuk Çetin, dr.scetin84@gmail.com
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cases with unknown identy and cases with suspicion in the determination of the cause of death are also defined as 'forensic cases'. However, it is also considered as a 'forensic case' in case of suspicion or claim of neglect and abuse, especially in the newborn, childhood and elderly deaths.

Differentiation of natural and forced deaths observed, detection of time of deaths and definite causes of deaths in this age group are very important in the forensic medicine practice. Determination of cause and origins of deaths contribute to exclude the factors causing to death or determine the possible preventions for the cause. Considering the fact that there was not any study conducted about geriatric deaths in Bursa and around before, to assess the demographic data and autopsy findings of judicial geriatric death cases in Bursa and around medico-legally.

MATERIAL AND METHOD

After obtaining ethics committee approval, parameters such as age, gender, date of death, cause and origin of death, event that has caused death, whether the deceased has drunk alcohol,taken hypnotic-drug and other toxicological analysis results, whether the deceased was unidentified person, place where the deceased was found dead, whether the deceased has been treated, presence of a disease before death, drugs used for such disease, people or partner who live with the deceased on geriatric cases who were 65 years old and older and taken to Morgue Specialization Office of Bursa Council of Forensic Medicine Institution between 2003-2008 were assessed retrospectively from electronic medical records and patient files (Date: 13.07.2010, Decision No: B.03.1.ATK.0.01.00.08/466). All procedures were carried out in accordance with the ethical rules and the principles of the Declaration of Helsinki.

Statistical Analysis: Statistical analysis were performed through SPSS for Windows ver.15.0 package program. Date were presented as mean ± Standard deviation or median and interval. Distribution characteristics of dependent variables were assessed via Kolmogorov-Smirnov and Shapiro-Wilk tests. Change of continuous variables according to the case groups were assessed by Student's T test; and comparison between categorical variables were assessed by Ki-square and Fisher's Exact tests. Continuous variables between the groups were assessed by one-way analysis of variance (ANOVA) and Student's T test. Statistically significance was accepted as $p<0.05$.

RESULTS

During the 5 year-period, totally 5155 autopsies have been performed in Morgue Department of Bursa Council of Forensic Medicine Institution. Among the cases, 870 (16.9%) have been 65 years old and older and they were accepted as geriatric death. Male cases were 640 (73.6%) , female cases were 230 (26.4%) and male – female ratio is 2.8:1. While age average of all cases was 73.45±6.26, age distribution varied between 65 and 93 in male patients and between 65 and 101 in female patients (**Table 1**). Average age of the male patients were detected 72.77±5.82 whereas it was 75.33±7.03 in female patients. Higher age average values in females than males was found significant ($p<0.001$, $t=5.411$). There was not any significant difference between genders of our cases in terms of years ($p=0.163$, $\chi2=7,886$) and months ($p=0.288$, $\chi2=13,081$). A significant difference was not detected in average of age in terms of months ($p=0.285$) and years ($p=0.178$).

Deaths of 870 geriatric individuals which was evaluated in terms of origin of death were detected as natural death by 49.9% (n=434), accident by 30.7% (n=267), suicide by 11.7% (n=102), homicide by 6% (n=52). Origin of death of the remaining 15 cases (1.7%) could not be determined according to the current data referred by prosecution offices.

Among the causes for natural deaths, cardiovascular system pathologies were in the first place (n 290, 66.8%). Respiratory system pathologies follow cardiovascular system diseases by 12.4% (n=54). Other causes for natural deaths included central nervous system pathologies (n=28, 6.5%), gastrointestinal system pathologies (n=14, 3.2%) and urinary system pathologies (n=6, 1.4%) according to the frequency. For remaining 42 (9.7%) cases, after exclusion of all external causes that might cause death, cause of deaths for such cases was considered natural. Detection of cardiovascular system pathologies which was the most common among natural causes of death frequent in males was found significant ($p=0.002$, $\chi2=10.030$).

Table 1. Age distribution according to the gender

	Age groups					Total n (%)
	65-69 n (%)	70-74 n (%)	75-79 n (%)	80-84 n (%)	85≤ n (%)	
Gender						
Female	57 (20.4%)	51 (21.2%)	56 (28.6%)	45 (41,3%)	21 (46.7%)	230 (26.4%)
Male	222 (79.6%)	190 (78.8%)	140 (71.4%)	64 (59,7%)	24 (53.3%)	640 (73.6%)
Total	279 (100%)	241 (100%)	196 (100%)	109 (100%)	45 (100%)	870 (100%)

According to the information obtained from the statements of the witnesses in crime scene investigation and dead body examination reports, a previous disease existed in 336 (38.6%) cases before death. Diseases which have been existing before death includes cardiac diseases, hypertension, central nervous system pathologies, diabetes mellitus, respiratory system pathologies, undefined psychiatric disorders, gastrointestinal system pathologies and malignancies, respectively to frequency. It was reported that 72 (8.3%) cases had not any disease known whereas there was not any information on 462 (53.1%) cases if they have any disorder previously. It was recorded among the cases who have died because of natural causes that 41.7% (n=181) of them have a previous disease, 41.7% (n=181) of them were unclear for any previous disease and 16.6% (n=72) of them had not any disease. Cardiovascular system pathologies which is the first in natural causes have been detected in 27.4% of the cases only whereas only 27.3% (n=79) of these cases have been treated because of their diseases. However, no data existed on 17.2% (n=34) of the cases who had a previous disease and have died due to natural causes if they have been treated for their current disease in crime scene investigation and deceased examination reports.

Blunt and penetrating traumas are the most common cause of forced deaths by 43.9% (n=187). Asphyxia cases follow this by 30.8% (n=131). Other causes of forced death include CO poisoning by 14.3 (n=61), burn by 5.6% (n=24), other intoxications (organic phosphate, drugs etc.) by 3.1% (n=13), hypothermia by 1.6% (n=7) and electric shock and lightning strike by 0.7%. Detection of deaths occurred as a result of CO poisoning and burn as more common in women was found significant ($p<0.001$, $\chi2==23.972$, $p<0.001$, $\chi2=14.909$, respectively).

For blunt and penetrating traumas which was the first cause of forced deaths included traffic accidents by 35.2% (n=66), falling by 27.8% (n=52), firearm injuries by 13.4% (n=25), sharp object injuries by 9.6% (n=18), crushing object injuries by 4.8% (n=9), pounding by 3.2% /n=6) and blunt trauma by 5.9% (n=11).

It was recorded for asphyxia cases which was the cause following blunt and penetrating traumas that 55% (n=72) have died because of hanging, 38.9% (n=51) have died due to drowning in water, 4.6% (n=6) have died because of smothering by hands or a tie and 1.5% (n=2) have died because of foreign body aspiration. It was detected in all cases who have died because of asphyxia as a result of hanging were suicide and 94.15 of the cases who have drowned in the water were accident ($p<0.001$, $\chi2==582.092$, $p<0.001$, $\chi2=102.465$, respectively). Detailed information about the cause for death and origin of death were showed in **Table 2**.

It was recorded that 427 (49.1%) cases have died at home or were found death. This is followed by being found death in open field with 156 (17.9%) cases, death during hospitalization by 107 (12.3%) cases, being found death in water (lake, river, sea etc.) by 52 (6%) cases and being found death on or near a road by 40 cases. Among the remaining cases, 30 (3.4%) cases have died in social spaces (thermal spring, hotel, café etc.), 27 (3.1%) have died in a vehicle, 18 (2.1%) cases have dies in the workplace and 12 (1.4%) cases have died in the senior house or jail. There was not any data detected about the place where remaining 1 (0.1%) case have been found death.

Table 2. Origins and manners of death

Manner of death	Origin of death					Total
	Natural	Accident	Suicide	Homicide	Undetermined	
Natural causes	434	-	-	-	-	434
Traffic accident	-	66	-	-	-	66
Falling from height	-	45	5	1	1	52
CO poisoning	-	60	-	-	-	60
Burning	-	23	1	1	-	25
Drowning	-	48	3	-	-	51
Hanging	-	-	71	-	-	71
Lightning attack, electrocution	-	4	-	-	-	4
Freezing, hypothermia	-	7	-	-	-	7
Drug intoxication	-	5	8	-	-	13
Firearm injury	-	-	14	11	-	25
Sharp object injury	-	-	-	18	-	18
Strangulation	-	-	-	6	-	6
Foreign body aspiration	-	2	-	-	-	2
Pounding	-	-	-	9	-	9
Crusher object injury	-	-	-	6	-	6
Other blunt traumas	-	7	-	-	6	13
Unknown	-	-	-	-	8	8
Total	434	267	102	52	15	870

It was detected that 217 (24.9%) cases have lived alone, 288 (33.1%) have lived with their families (spouse and/or children), 11 (1.3%) cases have lived with their friends and 11 (1.3%) have stayed in the jail or senior house during the death. It was detected that 3 (0.3%) cases have lived with their caregiver or helper whereas there was not any information about accompany of 340 (39.1%) cases. It was learned that 174 (20%) cases were married and lived with their spouses, 157 (18%) cases were widow, divorced or single and 8 (0.9%) cases have died in the same incident with their spouses. There is not any data about marital status of 531 (61%) cases.

While putrefaction findings in different stages were detected in 164 (18.9%) of the cases, it was detected that statistically significant majority of these cases have lived alone (n=87, 53%) ($p<0.001$, $\chi2=85.277$). Furthermore, it was detected that statistically significant majority of putrefacted cases have been found death at home (n=104, 63.4%) ($p<0.001$, $\chi2=16.615$). Besides, 52 (6%) of 871 autopsies were assessed as negative autopsy and deterioration in different stages were observed in 49 (94.2%) of them ($p<0.001$, $\chi2=205.435$).

Ethanol in different levels were detected in 58 (6.7%) of 870 cases. The highest blood level of ethanol detected was 320 mg/dl and data about blood ethanol level was presented in **Table 3**. Also, carboxyhemoglobin was detected in 65 (7.5%) cases including the highest level in 3.7% of the cases and the lowest in 81% of the cases (**Table 3**). Methanol was detected in 2 cases whereas formaldehyde was detected in 1 case and insecticides were detected in gastric content of 6 cases. Metabolites of benzodiazepine, tricyclic antidepressant and barbiturate group drugs were detected in 19 cases; opiate metabolites were detected in 5 cases; tetrahydrocannabinol (TCH), active agent of marijuana and amphetamine was detected in urine analysis of 1 case.

Table 3. Ethanol and carboxyhemoglobin levels detected in blood samples

Ethanol (mg/dl)	n (%)	COHb* (%)	n (%)
0-50	15(26.3%)	1-10	1 (1.5%)
51-100	23 (40.3%)	11-30	12 (18.5%)
101-150	12 (21.1%)	31-50	29 (44.6%)
151≤	7 (12.3%)	50≤	23 (35.4%)
Total	57(100%)	Total	65 (100%)

*COHb: Carboxyhemoglobin.

DISCUSSION

Majority of 870 geriatric death cases in our study consisted of males. The most common origins of death were natural causes. In association with medical histories and social life styles of the cases, crime scene investigation and dead body examination reports including first assessment data were quite insufficient. However, being found death at home and in open field because of neuropsychiatric problems such as dementia and Alzheimer's developed in line with loneliness and aging have significantly contributed to judicial situation of death case. On the other hand, it was detected that violence and abuse was substantially frequent in the geriatric population which becomes an easy target as well as emotional and physical incapacity.

According to Hilal et al. (5), the average expected life period has prolonged and a dramatic increase was observed in the geriatric population worldwide. Lachs et al. (6) and Kossberg et al. (7) reported that as a result of decreased fertility rates, increased socioeconomic level and prolonged life period, ratio of the geriatric population to the total population was reported as 11.4% in developed and as 3.9% in developing countries. However, different problems have appeared in this age group in line with developments. Changes in the family and social life styles and technological developments gradually doom geriatric population to loneliness. In parallel with this, Ince et al. (8) indicated that being found death at home and traffic accidents are the most common causes of death for geriatric population rebounded to the courts in the world as well as in our country.

It was detected in the study carried out in Istanbul by Ince et al. (8) that 7.8% of the autopsies evaluated were geriatric deaths, this rate was reported as 8.1% in the study conducted in Adana by Hilal et al. (5) whereas 12.4% in the study of Canturk et al. (9) in Ankara. Also Turkoglu et al. (10) reported this rate as 23.9%. In our study, 16.8% of 5155 judicial death cases consists of deaths over 65 years and over. This high rate detected may be explained by higher geriatric population rate to total population in the cities which are affiliated with Bursa Council of Forensic Medicine Institution. This rate was determined as 5.1% in Istanbul and affiliated cities, 6.3% in Ankara and affiliated cities and as 3.9% in Adana and affiliated cities. According to Address Based Population Registration System, ratio of the geriatric population to total population in specified regions was obtained through 2000 data (2). It was reported in a study carried out in USA by Shokrani et al. (11) that 772 medical autopsies have been performed and 23% of these autopsies consisted of cases who are 70 years old and over. Cause for high rate in such study is a hospital experience including medical autopsies.

In our study, results obtained on gender, age range and average were consistent with other studies conducted in Türkiye. Differently, it was reported in the study performed by Shokrani et al. (11) that 45% and 55% of 180 medical autopsies were male and female, respectively. In the study carried out in Istanbul by Uzun et al. (12), it

was specified that 69.2% of 77 suicide cases who were 60 years old and older were male and 30.8% of these cases were female. In a different study conducted in Austria by Berzlanovich at al. (13), 70.3% of 1886 cases who were 85 years old and older were female. High female rates obtained in the study may be explained due to the fact that average life expectancy is more in females and includes the age group at 85 years and over. On the other hand, higher male rates in judicial autopsies supports the idea that man is still dominant in the social life in the world and in our society in each period of life.

It was reported in two different studies carried out in Adana by Hilal et al. (5) and in Istanbul by Ince et al. (8) that natural causes were the first among causes of geriatric deaths whereas accidents were the second. In an other study presented by Akar et al. (14) 48.5% of presented elderly deaths were derived from unnatural causes, followed by natural deaths as 42.4% of cases. Also, in a study conducted in Ankara by Canturk et al. (9), it was reported on traumatic death cases that 21.6% of the cases originated from suicide, 18.1% of them were homicide and 60.2% were accident. In line with this, in our study, the first cause was detected as deaths due to natural causes and this was followed by accidents. In a large study conducted by Collins et al. (3) including 1985 and 2004, 70.5% of the death cases were natural, 16% were accident, 6.5% were suicide and 6% were homicide. In our study, a similar grading was detected as natural causes by 49.9%, accident by 30.7%, suicide by 11.7% and homicide by 6%. Since natural death causes were the first in judicial autopsy studies and information related with medical history of the deceased was insufficient in crime scene investigation and dead body examination reports, the first evaluation performed by physicians or prosecutors in geriatric deaths is especially important for deaths to have judicial dimension and autopsy decision ratios. From another point of view, this first evaluation should be performed carefully so that a forced death should not be missed in geriatric death cases.

According to the statistical data obtained in Portugal in 2006 (15), 62.8% of the geriatric population have lived with their spouses (only spouse or spouse and children), 20.7% have lived alone, 16.5% have lived with their children without their spouses. Timur et al. (16) reported that 82.95% of the decedents, had been living with family and 13.48% of the decedents lived alone. It was detected in our study that 24.9% of the cases (30% were female and 70% were male) have lived alone, 34.7% have lived with their spouses and/or children and 1.3% have stayed in senior house or jail. There was not any information about person who live together with the remaining 39.1% of the geriatric death cases. We believe that the difference between the values depends on including the geriatric population in the study conducted in Portugal and assessment of judicial cases in our study only and lack of information on 39.1% of the cases. However, living alone seems to be effective to provide death a judicial situation. It was reported in a study conducted in northern Portugal by Coelho et al. (17) that unlike the accepted fact in geriatric population, majority (45%) of the victims were married.

Ethanol was detected in 6.7% of our cases as a result of chemical analysis of blood samples collected from the deceased during autopsy. Similar with our study, ethanole was detected in 8% of the cases in the study conducted in Istanbul by Ince et al. (8) and 6.4% of the cases in the study carried out in Ankara by Canturk et al. (9). In the study carried out on geriatric homicides in USA by Collins et al. (3), it was reported that ethanol was detected in the blood in 17% of the cases as well as in 49% of the cases in the study reported by Coelho et al. (17) which included geriatric homicide cases in Portugal. Ethanol was detected in 3.8% of the homicide cases in our study. According to these data, we see that alcohol intake rate of geriatric population in our country is less than other communities. However, deterioration findings were detected in 58.6% of our cases whom alcohol was detected in blood samples. Bacterial activity which is the most important component of deterioration process as well as endogenous alcohol production is in question. Therefore, it should not be concluded that exogenous alcohol might not have been taken in each case whom alcohol was detected in onset of deterioration. On the other hand, in the studies conducted in such countries, evaluation of homicide cases only and high rates due to this evaluation may be one of the significant factors for selection of victims whether they were intoxicated by the attacker. Because, reduction in logical thinking and defense capabilities due to the alcohol makes the attacker's violence easier.

CONCLUSION

When studies conducted in our country and in the world are reviewed, place of the geriatric population during the daily life and against developments and reflection of these facts to the judicial death reports base on similar reasons. These causes include absence of elder people in the family concept defined by the modern life style, condemning geriatric population to live alone due to this definition, poor social relationships and increased neuropsychiatric pathologies. Consequently, it should be emphasized that crime scene investigation and deceased examination reports are insufficient in terms of content and this makes to interpret the findings obtained in the studies difficult.

ETHICAL DECLARATIONS

Ethics Committee Approval: The study was carried out with the permission of Ministry of Justice Forensic Medicine Institute Education and Scientific Research Commission (Date: 13.07.2010, Decision No: B.03.1.ATK.0.01.00.08/466).

Informed Consent: Because the study was designed retrospectively, no written informed consent form was obtained from patients.

Referee Evaluation Process: Externally peer-reviewed.

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