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Ethical Declaration

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EDITORIAL

Dear Forensic Scientists,

We are here with the secdond issue of the Bulletin of Forensic Medicine in 2020. The year 2020 is quite difficult for humanity, especially the pandemic.

In this issue of our Journal, we are happy to share 12 articles from different disciplines from forensic science. Our Journal is published in Turkish this year as well as in English. We also enjoy the citation of the articles by referring to them while clicking the website of our Journal from many countries. With our new issues, we hope to be able to share our crawl news of our Journal by important international databases. With the intense increase in the number of articles coming from our journal and from different disciplines, we are taking firm steps towards becoming the scientific platform of forensic medicine and forensic sciences.

Life continues to show us the importance of merit in the field of forensic sciences and how science is open to new horizons in the fields of literature and art.

We wish to raise the eligibility of our journal higher by being aware of the fact that being scientific is the only way to build up a future for forensic sciences, and we wish to continue to be a common platform sharing the latest studies in forensic medicine and forensic science areas...

Prof. Dr. Halis Dokgöz
Editor

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Research Article

Retrospective Evaluation of Forensic Medicolegal Childhood Deaths Among Children Aged 0-6 Years

Ali Yıldırım*, Erdoğan Polater, Celal Bütün

Abstract: **Objective:** The aim of this study was to analyze the epidemiological pattern and characteristics of forensic cases resulting in death among children aged 0-6 years and to discuss the solution offers in order to prevent such events that may result in death in 0-6 years of childhood.

Materials and Methods: 73 cases of medicolegal childhood death among children aged 0-6 years whose post-mortem examinations, dead body examinations and/or autopsies were performed at the morgue of the Cumhuriyet University Hospital in a 8-year period between January 1, 2008 and December 31, 2016 were included in the study group and retrospectively analyzed. In all statistics, the SPSS v.20 statistical software was used, and a p value of <0.05 was accepted as statistically significant.

Results: The study included 73 forensic cases resulted in death whose dead body examinations and autopsies were performed. Of the cases, 52.1% (n:38) were female and 47.9% (n:35) were male. When the age groups were compared, it was found that the highest mortality rate was in the 0-1 age group with 65.8%. When the manner of death was compared by age groups after autopsy and toxicology/histopathological examinations performed, it was found that the majority of deaths among children aged 0-1 years was due to sudden infant death syndrome with 35.4% (n:17), drowning in water was the most common cause of death between 2-3 years of age with 35% (n:7), followed by accidental deaths due to fall with 30% (n:6), and the deaths among children aged 4-6 years was due to traffic accident with 100% (n:5).

Conclusion: Since a considerable portion of deaths were due to preventable and/or treatable causes such as sudden infant death syndrome (SIDS), disease and traffic accidents in conclusion of our study, it is thought that putting legal sanctions regarding these causes into effect, taking preventive and therapeutic health measures, as well as developing awareness policies with education will significantly reduce the rate of childhood deaths.

Keywords: Forensic Medicine, Pediatric Deaths, Epidemiological Pattern, Cause of Death

Öz: **Amaç:** Bu çalışmada 0-6 yaş grubu çocukluk çağı ölümle sonuçlanan adli olguların epidemiyolojik paterninin ve özelliklerinin analizini ve 0-6 yaş arası çocukluk çağında ölümle sonuçlanabilen bu tür olayların meydana gelmesini önlemek amacıyla çözüm önerilerinin tartışılmasını amaçladık.

Gereç ve yöntem: Çalışma Cumhuriyet Üniversitesi Hastanesi morgunda 01.01.2008-31.12.2016 tarihleri arasındaki 8 yıllık sürede postmortem incelemeleri, ölü muayene ve/veya otopsileri yapılan 0-6 yaşlar arası 73 çocukluk çağı medikolegal ölüm olgusu çalışma grubuna dahil edilerek olgular retrospektif olarak incelenmiştir. Tüm istatistiklerde SPSS V.20 istatistik programı kullanılarak p<0.05 değeri anlamlı olarak kabul edilmiştir.

Bulgular: Çalışmaya ölü muayene ve otopsileri yapılan ölümle sonuçlanmış 73 adli olgu alındı. Olguların %52.1'i (n:38) kız, %47.9'u (n:35) erkek grubunda idi. Yaş grupları arasında karşılaştırma yapıldığında en fazla ölümle sonuçlanan olgunun %65.8 ile 0-1 yaş grubunda olduğu saptandı. Ölüm şekli yaş gruplarına göre karşılaştırıldığında yapılan otopsi ve toksikolojik-histopatolojik incelemeleri sonrası 0-1 yaş arası ölümlerin büyük bölümünün %35.4 (n:17) ile ani bebek ölümü sendromuna bağlı olduğu, 2-3 yaş arası ölümlerde %35 suda boğulma (n:7) en sık ölüm sebebi olduğu, bunu %30 ile düşmeye (n:6) bağlı kaza sonucu ölümlerin takip ettiği, 4-6 yaş ölümlerin ise %100 (n:5) trafik kazası sonucu olduğu saptanmıştır.

Sonuç: Bu çalışmamızda ölümlerin önemli bir bölümünün ani bebek ölümü sendromu (ABÖS), hastalık kaynaklı ve trafik kazası gibi önlenebilir ve/veya tedavi edilebilir nedenlerden oluşması nedeniyle bunlara yönelik yasal yaptırımların uygulamaya geçirilmesi, koruyucu ve tedavi edici sağlık önlemlerinin alınması, ayrıca eğitim ile farkındalık politikalarının geliştirilmesinin çocukluk çağı ölümlerini önemli ölçüde azaltacağı düşünülmektedir.

Anahtar Kelimeler: Adli Tıp, Pediatrik Ölümler, Epidemiyolojik Pattern, Ölüm Sebebi

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Ethical Declaration
The principles outlined in the Declaration of Helsinki were followed in our study, and since this is a retrospective research, no ethics committee approval was obtained.

This article is English version of the manuscript entitled as "0-6 Yaşlar Arası Adli Nitelikli Çocuk Çağı Medikolegal Ölümlerinin Retrospektif Olarak Değerlendirilmesi"

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1. Introduction

Childhood death is one of the most important criteria showing a healthy physiological, psychological and social development of children growing up in the society, as well as one of the components showing whether the individuals who are the future of societies are provided with special care and protection needs according to the Declaration of the Rights of the Child (1). It is necessary to determine the epidemiological pattern and characteristics of childhood deaths in order to better understand childhood deaths, to reduce the rate of these deaths which are a social tragedy and public health problem, to increase the measures for these deaths and to strengthen new policies. Trauma is one of the most important etiological factors responsible for childhood and adolescent deaths and is the primary cause of approximately 15000 deaths in the United States each year, more than 50% of which are pediatric deaths (2-3). In pediatric deaths, children become more vulnerable to traumas due to their poor physical structure and durability, small body volumes, lack of awareness of dangers, being exposed to environmental risks, being curious about finding and learning and deaths due to severe traumas occur more commonly (4). Especially children in the age group 0-6 years are more susceptible to events that may result in injury, especially trauma, than adults since they still do not possess sufficient developmental characteristic to protect themselves and have not yet completed their physical development (5). Therefore, pediatric forensic deaths represent a specific group in terms of their management and processes. In a study conducted in our country, it was indicated that the cause of death was an accident in a considerable portion of forensic deaths among children aged 0-18 years; traffic accidents ranked first among deaths due to accidents, followed by traumatic events such as falls, drowning in water, burns, poisonings and firearm injuries, although the order may vary (6-7). In the United States, accidents rank first in the etiology of childhood deaths, followed by drowning in water, burns, although the order may vary (8-9). In numerous studies, it has been observed that males are at a higher risk for trauma than females, and in terms of childhood, the age group 0-4 years and adolescent males aged 15-18 years are at a higher risk of trauma (10-11). Another specific group in childhood deaths is the cases of unexpected sudden infant death syndrome (SIDS), which usually occurs in infants with normal development aged between 1 week and 1 year, the rate of which is unknown in our country and which continues to be one of the most important problems in forensic medicine. SIDS is not a specific disease, but is a diagnosis made as a result of excluding the causes that are difficult to detect, such as metabolic diseases; however, it is difficult to exclude intentional and accidental deaths in this diagnosis, even if all conditions are met. The cause cannot be figured out in about 80% of unexpected sudden infant deaths under 1 year of age (12-13); however, mechanical asphyxia is known to be the most important cause of preventable deaths under 1 year of age (4).

In this study, it was attempted to explain the epidemiological pattern of pediatric medicolegal deaths in the 0-6 age group, risk factors associated with deaths, accidents that have an important place in childhood deaths and what can be done to reduce the rate of childhood deaths occurring due to preventable causes, such as unexpected sudden infant death syndrome, and the importance of raising awareness about this issue through preventive and interventionist education policies.

2. Materials and Methods

In this cross-sectional study, the cases of forensic childhood death occurred in the city center and whose postmortem examinations were performed, were retrospectively investigated. The postmortem examination of all cases was carried out by the chief public prosecutor's office at the morgue of the Cumhuriyet University, Faculty of Medicine Hospital with reference to a protocol between the Ministry of Justice and our university. After analyzing the forensic files along with dead body examination and autopsy reports of the forensic cases (n:73) aged 0-6 years whose dead body examinations and autopsies were performed by the Department of Forensic Medicine at the morgue of the Cumhuriyet University Hospital between 01.01.2008 and 31.12.2016, these cases were evaluated in terms of data such as gender, age, year, season, month, referred place, place of death, incident scene evidence, manner of death, cause of death, tests performed, manner of accident, site of injury and type of injury. The study groups were divided into 3 groups as 0-1, 2-3 and 4-6 years of age.

The data obtained from our study were loaded in the SPSS (version 22.0) software, and in the analysis of the data, the chi-square test was used for multi-way contingency table analysis, when the assumptions of the chi-square distribution could not be met in multi-way contingency table analysis, the chi-square value was calculated by Monte Carlo model from the chi-square exact tests and the margin of error was taken as 0.05. The data are presented as numbers and percentages.

Ethical Declaration

The principles outlined in the Declaration of Helsinki were followed in our study, and since this is a retrospective research, no ethics committee approval was not obtained.

3. Results

73 cases of medicolegal childhood death among children aged 0-6 years whose post-mortem examinations, dead body examinations and/or autopsies were performed in a 8-year period between 2008 and 2016 were included in the study group and retrospectively analyzed. When 73 pediatric deaths forming the study group were analyzed by years and gender, it was observed that the deaths most commonly occurred in 2009 and 2013, and of the deaths, 52.1% were female (n:38) and 47.9% (n:35) were male (Figure 1).

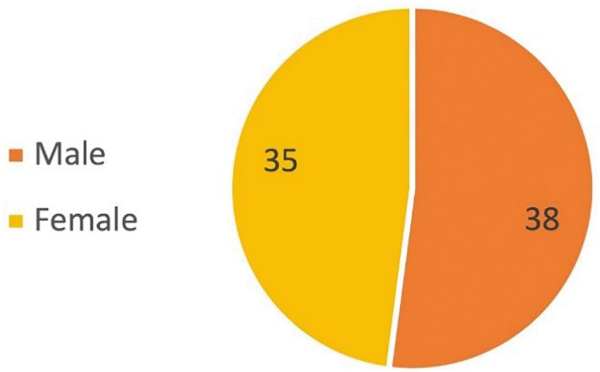

Figure 1. Distribution of pediatric deaths by gender

The male to female ratio was found as M/F: 1.08, and there was no significant difference in terms of gender distribution. When the distribution of pediatric death cases was analyzed by age range, it was found that the majority of cases were between 0-1 years of age with 65.8% (n:48), between 2-3 years of age with 27.4% (n:20), and between 4-6 years of age with 6.8% (n:5). When the manner of death was compared by age groups after autopsy and toxicology/histopathological examinations performed, it was found that the majority of deaths in children aged 0-1 years was due to sudden infant death syndrome with 35.4% (n:17), drowning in water was the most common cause of death among children aged 2-3 years with 35% (n:7), followed by accidental deaths due to fall with 30% (n:6), and the deaths among children aged 4-6 years was due to traffic accident with 100% (n:5). Figure 2 shows the distribution of pediatric deaths by age groups and manner of death. When the deaths were compared in terms of seasonal frequency, it was found that of the deaths, 20.3% occurred in winter, 33.8% in autumn, 32.4% in summer and 13.5% in spring; when compared by months, it was found that deaths most commonly occurred in September with 17.6%, in July with 14.9%, in August with 10.8% and in October with 10.8%. In conclusion, it was found that deaths more commonly occurred during the summer-autumn transition period. When compared in terms of location, the majority of deaths were found to be at home with 52.7% (n:39), followed by on the motorway with 12.2% (n: 9). Figure 3 shows the distribution of pediatric deaths by location.

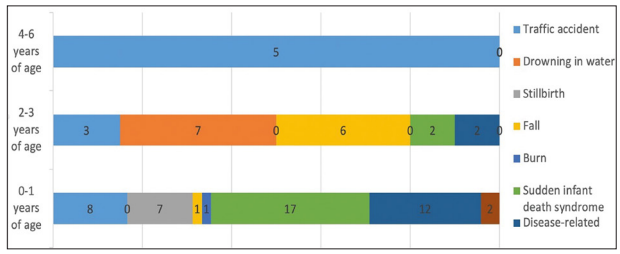

Figure 2. Cause of death and distribution by ages

Figure 3. Place/Location of death and number of deaths

In the comparison of deaths by age range regarding the most common season, it was found that the deaths among children aged 1-3 years most commonly occurred in the summer and the deaths among children aged 0-1 years most commonly occurred in the winter months. In the statistical analysis conducted on whether there is any trauma finding in the death cases, it was found that there were no (could not be found any) trauma finding in 79.2% of deaths in the 0-1 age group, trauma findings were found in 50% of deaths in the 2-3 age group, and trauma findings were observed in all cases in the 4-6 age group. Figure 6 shows the presence of trauma finding by age groups. When the rates of ordering test to determine the cause of death were compared by age groups, toxicology and histopathology tests were ordered in all cases in the 0-1 age group, as the cause of death could not be found in the external examination and autopsy series, while no test was performed in the 2-6 age group since the cause of death was obvious. When the causes of death were compared by age groups, the majority of deaths among children aged 0-1 years were due to natural causes with 64.6% (n:31), and the deaths among children aged

2-6 years were due to unnatural causes/forced deaths caused by trauma-accident. Figure 4-5 shows the causes of deaths and the distribution by age and gender groups.

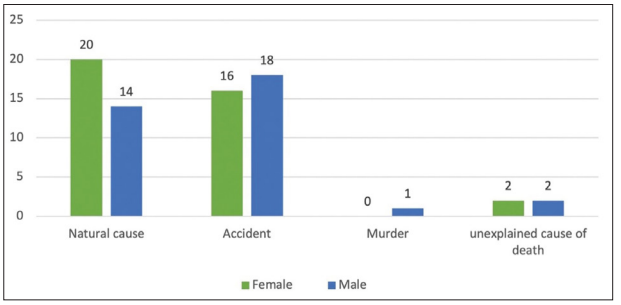

Figure 4. Cause of death and distribution by gender

Figure 5. Cause of death and distribution by age groups

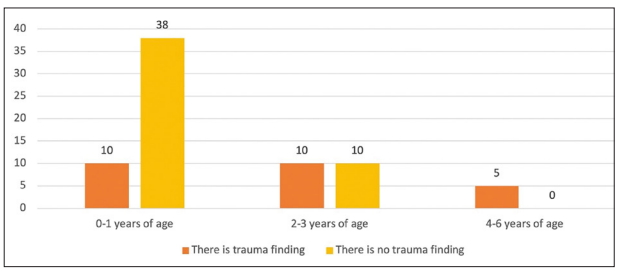

Figure 6. Presence of trauma finding in pediatric deaths

4. Discussion

According to the State of the World's Children 2016 report of UNICEF, it is seen that 16 thousand children under 5 years of age still die every year, and that these deaths are one of the most important indicators of the welfare status of the children and their future generations. According to the same report, there are 6 million 821 thousand children under 5 years of age in Turkey with a population of 78 million 666 thousand, and 19 of every 1,000 children dying annually in Turkey were determined to be children under 5 years of age (14). According to the UNICEF, the death rate among children under 5 years of age in 2015 was determined as 14%, and according to the Turkish Statistical Institute, the death rate among children under 5 years of age between 2011-2016 was 12.1%, while this rate was found to be 10.8% in the Central Anatolia (15).

Autopsy is one of the gold standard tools to determine the cause of childhood death and postmortem examinations have an important place in pediatric deaths, especially in the 0-6 age group. In our study, it was found that of the 73 autopsied pediatric cases, 65.8% (n:48) were 0-1 years old, 27.4% (n:20) were 2-3 years old and 6.8% (n:5) were 4-6 years old. It was found that the majority of deaths among children aged 0-1 years was due to sudden infant death syndrome with 35.4% (n:17), the most common cause of death in children aged 2-3 years was drowning in water with 35% (n:7), followed by deaths resulted from accidents due to fall with 30% (n:6), and deaths among children aged 4-6 years was due to traffic accident with 100% (n:5). In our study, deaths by natural causes were classified as disease-related, prematurity- and SIDS-related. Although SIDS-related deaths (n:17) are common among deaths among children aged 0-1 years, it is seen that this is followed by disease-related deaths (n:12) and prematurity- or maternal disease-related stillbirths (n:7). As is consistent with our region, in a study of 642 cases conducted by Demirci et al. regarding childhood deaths, it was reported that 35% of the deaths occurred between 0-4 years of age, and that there was no sudden infant death syndrome (SIDS)-related death in this age group (16); in another study included 178 cases conducted by Tokdemir et al., it was reported that 38.2% of the deaths were between 0-5 years of age, and that infectious diseases and their complications and cardiac anomalies were at the forefront in sudden deaths due to pathological causes among children aged 1-4 years. (6) Compared to the international literature, the most common causes of death are seen to be SIDS due to mechanical asphyxia following falls from height. (8-17) We think that the reason for the significantly higher incidence of deaths due to SIDS caused by preventable mechanical asphyxia in the 0-1 age group in our study compared to the national and/or international studies (6,8,16,17,18) is due to the fact that the risk factors are unknown to the locals. In a study of 207 cases without trauma finding and unknown cause of death by postmortem examinations conducted by Pakis et al. regarding SIDS-related deaths among children aged 1 week-1 year between 2000 and 2006, later detection of SIDS in 52 cases shows how it is extremely difficult to find the cause of death among children aged 1-2 years. (19). The most important reason for the higher incidence of deaths at home in the comparison of location-related deaths in our study is common SIDS deaths resulted from preventable mechanical asphyxia due to lying in the wrong position (positional

asphyxia). We are of the opinion that determination of risk factors, such as face-down lying position, use of soft beds, sharing the same bed with the mother, and raising awareness of the locals about this issue have an important role in reducing and preventing the cases in this age group. Again, disease-related deaths were most commonly encountered in the 0-1 age range in our study, and it is seen that how this age range is susceptible to deaths by natural causes due to insufficient development of respiratory system. In a study of 140 cases conducted by Okoye et al. regarding the epidemiological pattern of childhood deaths, the fact that 30% of the cases (42/140) were disease-related or sudden infant death syndrome-related is consistent with our study and demonstrates that child deaths in this period are generally deaths by natural causes due to insufficient development of respiratory organs and muscles (20). The classification of deaths by natural causes between 0-1 years of age, which is the subject of our study, is presented in Figure 7. Another important point to note is that SIDS- and prematurity-related deaths among deaths by natural causes between 0-1 years of age secondary to SIDS, disease and prematurity due to environmental stress occur more commonly in males (21), whereas deaths by natural causes more commonly occurred in females in our study. The reason for this is that deaths due to disease are more common among females. Again, in line with the literature (6), it was seen that infectious deaths caused by pneumonia and gastroenteritis were the most common among the disease-related deaths, followed by cardiac anomalies. **Figure 8** presents the classification of disease-related deaths.

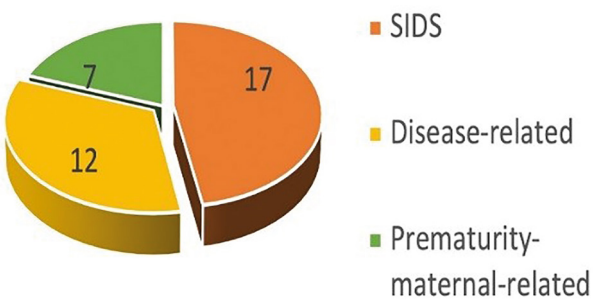

Figure 7. Natural cause of death

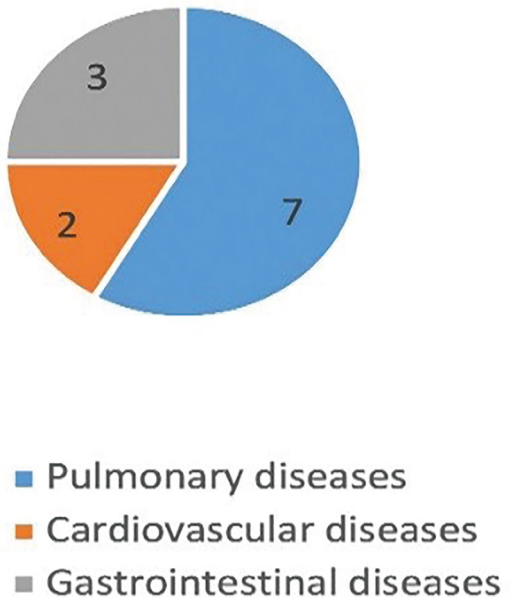

Figure 8. Disease-related deaths

Accidental deaths continue to be a serious public health problem that may lead to disability and/or death for growing children worldwide. In numerous international statistical studies published in the literature, it is seen that childhood accidents continue to be one of the most important causes of death (22-25). In our study of 73 cases, it is seen that deaths were mostly due to forced and/or accidental causes, deaths secondary to SIDS due to mechanical asphyxia resulted from accident were remarkable in deaths among children aged 0-1 years (n:17), drowning- (n:7) and fall-related (n:6) deaths resulted from accident were common in deaths among children aged 2-3 years, and all deaths among children aged 4-6 years (n:5) were due to traffic accidents. Deaths due to drowning in water are the second most common cause of deaths in infants and children following traffic accidents in the USA and Australia (26,27). In numerous autopsy series, it was observed that males were at a greater risk than girls during childhood in terms of childhood deaths in addition to pre-school children aged 0-4 years (10,11). In the national literature, in a study of 301 cases conducted by Aydin et al. regarding medicolegal childhood deaths in Samsun, it was reported that drowning in water (n:33) was remarkable as the most common cause of death following traffic accidents (n:112) and falls (n:34) (28); again, in a study by Tokdemir et al., it was reported that deaths among children aged 0-5 years were due to drowning in water (6). The high incidence of deaths due to drowning in water and falls among pre-school children aged 2-3 years in our study was observed to be consistent with the national and international literature. We are of the opinion that the primary cause of these deaths is the presence of natural water sources, such as river, stream, dam water, or irrigation canals close to settlements in our region, and that children swim unawares in these waters without knowing the depth and characteristics of water, and that children tend to be more accident-prone since they cannot gain motor skills in this period. Figure 9 presents the most common causes of death among children aged 2-3 years.

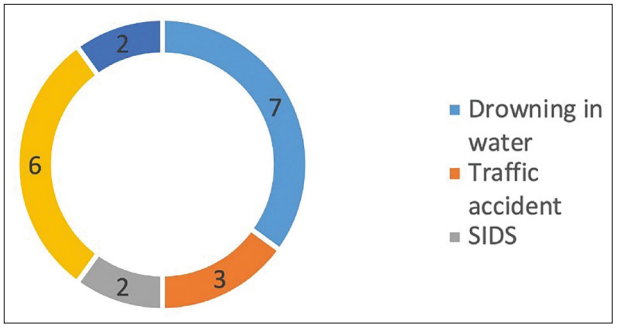

Figure 9. Deaths among children aged 2-3 years

Although the most common cause of death is accidental injury among children, the rate of deaths due to traffic accidents especially increases when children are in play age and commonly play in areas open to motorized traffic and start cycling. In our study, it was observed that especially all of children in the 4-6 age group died due to traffic accident. The fact that the most common cause of deaths due to accidents in childhood is motor vehicle accidents in many studies shows that children are more prone to accidents in this period since their cognitive functions have not fully developed and they have not gain avoidance skills, and that accidents result in death in this period when they are vulnerable. Considering the most common injury site in traffic accidents, it was found to be head and limb. Figure 10 shows the distribution of injury sites.

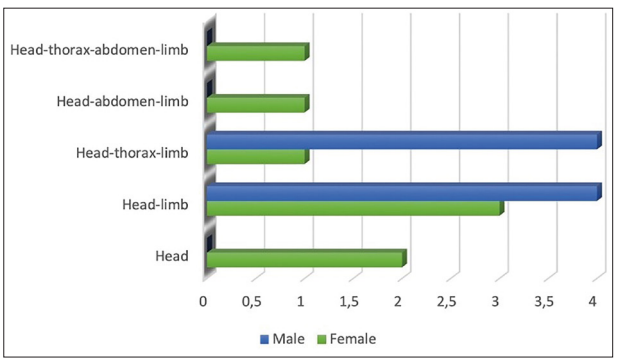

Figure 10. Injury sites due to traffic accidents

In conclusion, sudden and unexpected asphyxial deaths can be severely traumatic for families. In numerous studies, infants' sleep environments have been found to be the most important factor regarding sudden and unexpected deaths. Parents or childminders should keep clothes, toys that may be potential suffocation items for infants or objects that may lead to asphyxia away from the cradles or sleep environments of infants, as well as should prevent children from lying in positions that may lead to positional suffocations such as face-down lying (prone) position. The American Academy of Pediatrics and NBSC (National Back To Sleep Campaign) suggest that avoidance of prone/face-down sleeping position in children will provide an about 40% reduction in SIDS-related deaths (33). Again, sharing the same bed should be avoided as families' or other children's sharing the same bed with infants may present a potential danger that could lead to accidental suffocations. Another important point is the deaths and/or injuries that occur in environments where there is insufficient environmental measures such as traffic accidents, falls, drowning in water, especially for children who are in pre-school age and who want freedom of play. In order to reduce the rate of childhood deaths, first of all, studies requiring multidisciplinary approach should be conducted on a national scale rather than local scale to determine why children die and how their deaths can be prevented. Statistical studies from the autopsy series that forensic medicine specialists perform frequently regarding the causes why children die each year should be taken into consideration, and precautions should be taken by the relevant institutions in line with these results. Community health, family health and public health physicians, non-governmental organizations and the relevant units of the government should come together with regard to child health and discuss the measures to reduce the rate of child deaths according to the statistics determined and should get into the act. International data should be compared and the measures taken to reduce deaths in countries where child deaths are common should be evaluated and the conclusions obtained should be shared with the community. We are of the opinion that creating awareness campaigns in this regard, informing and enlightening the community about this issue, and implementing legally preventive measures and deterrent penalties will reduce the rate of childhood deaths.

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Research Article

Characteristics of the Sociodemographic, Clinical and Crime-Related Actions in Patients with Psychotic Symptoms Evaluated with the Claim of Committing a Crime-Related Action in a University Hospital between 2012 and 2018

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Abstract: **Objective:** The present study aims to investigate characteristics of the sociodemographic, clinical and crime-related actions in patients with psychotic symptoms and also to explore the effects of these characteristics on their criminal behavior and criminal responsibility.

Materials and Methods: In this study, 597 Forensic Medicine Board Reports issued for criminal responsibility assessment between 2012 and 2018 were investigated retrospectively. The reports and patient files of the 182 individuals diagnosed with psychotic symptoms were examined in detail.

Results: The findings obtained in this study showed that 85.7% of the cases were male and the mean age at the time of the crime was 40.87±11.78. Among 182 individuals, 78.6% of them did not have a profession and were unemployed. The mean duration of education was 7.98±3.19 years, 72% of them were single, divorced or separated, the mean disease duration of cases was 10.49±7.98 years, 22.5% of them had a comorbid psychiatric disorder and 14.6% of the comorbid diseases were substance use disorder. The persecutory delusion was the most common delusion with a rate of 45%. 44.5% had a crime-related action history, 77.5% of them had committed violent crime-related actions and most of the crime victims were individuals that patients were familiar with them. 67% of them did not have criminal responsibility, while 12.1% of them diminished criminal responsibility and 11.5% had criminal responsibility.

Conclusion: In the evaluation of criminal responsibility, sociodemographic, clinical and crime-related action characteristics should be considered in a holistic approach. Investigating the risk factors concerning crime-related activities will help us to understand the reasons for the patients to take such actions and will guide the studies about mental health and forensic psychiatry in cases with psychotic symptoms evaluated for criminal responsibility.

Keywords: Psychotic Symptoms, Crime, Violence, Criminal Responsibility

Öz: **Amaç:** Suç olarak nitelendirilen eylemlerde bulunan psikotik belirtili bireylerin sosyodemografik, klinik ve suç olarak nitelendirilen eylemlerle ilgili özelliklerini belirleyerek bu özelliklerinin suç davranışına ve ceza sorumluluklarına etkilerini incelemek amaçlanmıştır.

Gereç ve Yöntem: Süleyman Demirel Üniversitesi Tıp Fakültesi Adli Tıp Anabilim Dalına 2012 – 2018 yılları arasında ceza sorumluluğu değerlendirmesi için gönderilen olgulara düzenlenen 597 Adli Tıp Kurul Raporu retrospektif taranarak psikotik belirtileri bulunan ve bir tanı konulmuş olan 182 yetişkin hastanın raporu ve hasta dosyası Adli Tıp ve Psikiyatri uzmanlarınca ayrıntılı bir şekilde incelenmiştir.

Bulgular: Suç sırasındaki yaş ortalaması 40,87±11,78 olarak saptanan olguların %85,7'si erkekti. Olguların eğitim süreleri ortalamasının 7,98±3,19 yıl olduğu, %78,6'sının meslek sahibi olmadığı ve çalışmadığı, %72'sinin bekar, eşinden ayrılmış veya boşanmış olduğu saptanmıştır. Olguların hastalık süresinin ortalama 10,49±7,98 yıl olduğu, %22,5'inde komorbid bir psikiyatrik hastalık bulunduğu, komorbid hastalıklardan %14,6'sının madde kullanım bozukluğu olduğu belirlenmiştir. Olgularda %45 gibi bir oranla en çok kötülük görme sanrısı saptanmıştır. %44,5'inin daha önce de suç olarak nitelendirilen eylem öyküsünün bulunduğu, %77,5'inin suç olarak nitelendirilen şiddet içerikli eylemlerde bulunduğu, suç mağdurlarının belirgin bir şekilde olguların tanıdıkları bireylerden oluştuğu bulunmuştur. Raporlarda olgulara, %67'sinin "ceza sorumluluğunun bulunmadığı", %12,1'inin "ceza sorumluluğunun azalmış olduğu", %11,5'inin "ceza sorumluluğunun bulunduğu" şeklinde sonuçlar verildiği görülmüştür.

Sonuç: Ceza sorumluluğu değerlendirmelerinde sosyodemografik, klinik ve suç olarak nitelendirilen eylemlerle ilgili özelliklerin bütüncül bir yaklaşımla dikkate alınması gerekmektedir. Suç olarak nitelendirilen eylemler açısından risk faktörlerini belirlemek hastaların söz konusu eylemlerde bulunma nedenlerini anlamaya ve ceza sorumluluğu değerlendirmesi yapılan psikotik belirtili olgularda ruh sağlığı ve adli psikiyatri yönünden yapılacak çalışmalara yön verecektir.

Anahtar Kelimeler: Psikotik Belirtiler, Suç, Şiddet, Ceza Sorumluluğu

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1. Introduction

When examining the criminal responsibility subject, we should keep in mind that "insanity" is not a psychiatric, but a legal term (1, 2). A legal term can generally be compatible with the medical diagnosis, but it cannot be the total equivalent of medical diagnosis (2). Among the conditions diminishing or removing criminal responsibility by affecting free will or conscious behavior, the most common is "not guilty by reason of insanity" defence. Although insanity is a legal concept, the defence history of insanity was highly influenced by the medical and organic models of abnormal behaviors. Thus, it should be proven that the person was under the influence of a mental disorder when the criminal behavior was committed, for the "not guilty by reason of insanity" defence to be effective (1). Although "not guilty by reason of insanity" defence has a long history, the case of Daniel M'Naughtan, an insane person who attempted to assassinate British Prime Minister Sir Robert Peel in 1843, influenced the recent past (3). A short time after the case review, The House of Lords defined a series of official criteria for insanity known as M'Naughten Rules and stated as follows: "[….] *that to establish a defence on the ground of insanity, it must be clearly proven that, at the time of the committing of the act, the party accused was laboring under such a defect of reason, from disease of the mind, as not to know the nature and quality of the act he was doing; or if he did know it, that he did not know he was doing what was wrong*" (4). M'Naughten Rules and its variations state that the defendant must know (i) the quality of the act he committed and (ii) that the act was wrong to be legally responsible for a criminal act were started to be used in the legal systems of countries like United States, England, Canada, Australia, Portuguese and New Zealand (5-7). In these countries, forensic psychiatrists determine whether the individuals who have a mental disorder and are establishing a defence on the ground of insanity are under the influence of insanity when committing the crime-related acts and a two-way evaluation is performed to see whether the individual has criminal responsibility or not (6, 7). Different from this two-way evaluation, criminal responsibility is based on a graded scale in some countries, such as Holland, Belgium, Germany, Greece and China. For example, while the criminal responsibility of an accused party is based on five grades, including full responsibility, mildly diminished responsibility, diminished responsibility, severely diminished responsibility and completely diminished responsibility in Holland, it is based on three grades, including full responsibility, diminished responsibility and completely diminished responsibility in Greece and China (6, 8, 9). In Sweden, "not guilty by reason of insanity" concept is missing, while the "guilty but insane" concept is present. This means that anyone committing a crime is regarded to be guilty and the presence of insanity is evaluated only after the offender is found guilty and this may cause a compulsory treatment decision (2, 6, 10). All named countries other than Sweden have accepted that mental disorders may diminish criminal responsibility within the scope of insanity. While it is universally acknowledged that major mental disorder symptoms, including psychotic symptoms, limit criminal responsibility, personality disorders and psychopathy, seem to be more controversial. For individuals who have mental disorders and commit crime-related actions, these countries prefer to provide rehabilitation in hospitals as an alternative or supplementation to confinement (6).

There are two main constituents in criminal responsibility determination, according to the Turkish Criminal Code (TCC). The first constituent is whether the individual can perceive the legal meaning and results of their actions and the second is whether the individual has the ability to lead his/her behaviors or not. Concerning insanity, while the offender lacks criminal responsibility in the presence of insanity significantly diminishing any of these constituents according to TCC Article No 32/1, the criminal responsibility diminishes in case of insanity, which insignificantly diminishes the behavior leading ability which is the second constituent according to Article No 32/2.

All legal insanity standards cover the presence of a mental disorder causing a significant loss in the ability of an individual to understand the legal characteristics of his behavior and to be aware of its results (11). Individuals committing crime-related actions under the influence of psychotic symptoms meet the legal criteria for insanity based on the details of each case and the valid legal standards (12).

Although some studies show that there is a relative violence risk among the individuals with the mental disorder compared to the general population, many studies also show that the absolute violence risk among mental disorder patients as a group is still very low and only a small ratio of the violence in the society can be attributed to the individuals with a mental disorder (13). Although all psychiatric disorders do not have the same potential about violence behavior, it is considered that violence becomes common also in individuals with a psychiatric disorder in parallel to the increasing crime-related actions in the whole society (14).

Although psychosis terminology is no longer covered in the current classification system used for diagnostic disease codings, psychosis is regarded as a psychiatric

disease that may cause the diminishing or lack of criminal responsibility depending on its severity in older forensic psychiatry books (15). Psychosis is defined as a group of symptoms which include symptoms like disorganized speaking and common disruptions in behavior and the perception of reality in general and it is a group of symptoms which means delusions and/or hallucinations and causes disruptions in the mental capacity, emotional reaction and communication and relationship with others in its narrowest sense. Schizophrenia, schizophreniform disorder, delusional disorder, brief psychotic disorder, substance or medication-induced psychotic disorder and general medical condition-related psychotic disorders are among psychotic disorders (16). Although it was reported that mental disorders increase homicidal violence risk twice in males and six times in females and schizophrenia increases violent behavior six to ten times in males and eight to ten times in females, it is not clarified why some patients with mental disorders commit violent actions while others do not (17). The findings in some studies suggest that the patients with a mental disorder are not more dangerous than the general population, but among these patients, there is a group who presented behaviors, such as committing crime-related actions, alcohol-substance use or non-compliance to treatment in the past, too (18-20). Thus, sensible acting is important to prevent individuals with a mental disorder from the labelization of being associated with violent actions.

Although there is a relationship between the lack or diminishing of criminal responsibility and psychotic symptoms, this relationship is determined through sociodemographic, developmental and clinical factors (2).

In addition to harming other individuals or the society, crime-related actions of the individuals with psychotic symptoms have several effects, such as restricting their own freedom and increasing social labelisation against them. Determining risk factors for committing crime related actions in patients included in psychosis diagnosis group and taking necessary precautions may keep these individuals from such actions (21).

The present study aims to investigate the effects of sociodemographic, clinical and crime-related action characteristics of individuals in the psychosis diagnosis group who commit crime-related actions on committing crime-related actions and their criminal responsibilities.

2. Materials and Methods

Retrospectively scanning 597 Forensic Medicine Board Reports issued for the cases transferred to the Department of Forensic Medicine, Faculty of Medicine at the Isparta Süleyman Demirel University from Isparta and nearby cities for criminal responsibility assessment between 2012 and 2018, reports and files of adult patients who had psychotic symptoms and were diagnosed were examined in detail by a Forensic Medicine Expert and a Psychiatrist and the patients with missing information in their files were excluded from this study and 182 adult patients in all were included in this study. Sampling group included patients whose consultation was demanded from Department of Mental Health and Diseases following the examination of investigation and/or legal proceeding files and medical documents (if available) and the completion of medical examination in the Department of Forensic Medicine and who were diagnosed according to Diagnostic and Statistical Manual of Mental Disorders Revised Fourth Edition (DSM-IV-TR) by Psychiatrists. It was observed that a criminal responsibility decision was based on whether the individual was under the effects of the disease at the time of the incident considering a bill of indictment, accused, victim and witness statements, medical documents taken before and after the date of the crime, anamnesis of the patient and relatives if necessary, diagnosis, how the crime took place and statements of the patient and relatives about the crime available in the Forensic Medicine Board Reports. Examining sociodemographic characteristics, clinical symptoms, characteristics of crime-related actions and report results of the cases, their connections with criminal behavior and effects on their criminal responsibility were investigated in this study. “SPSS for Windows 18.0” package program was used for data analysis. Descriptive characteristics and constant variables were given as mean ± standard deviation and discrete variables were given as number and percentage.

Ethical Declaration

Ethical approval was obtained from Süleyman Demirel University Clinical Research Ethical Committee with date 10.05.2019 and number 69328, and Helsinki Declaration rules were followed to conduct this study.

3. Results

3.1. Sociodemographic Characteristics

Data on sociodemographic characteristics are provided in Table 1. In this study, it was detected that a diagnosis was made due to psychotic symptoms in 30.4% of 597 individuals (n=182) who were investigated and/or prosecuted for committing crime between 2012 and 2018 and were sent to the Department of Forensic Medicine for criminal responsibility evaluation with insanity suspicion/allegation.

Table 1. Sociodemographic Characteristics of the Cases

		Mean ± SD	n (=182)	%
Age	Age at the time of medical examination	44.65±11.7		
	Age when the crime was committed	40.87±11.78		
Gender	Male		156	85.7
	Female		26	14.3
Marital Status	Married - living together		51	28
	Married - separated		37	20.3
	Single		59	32.4
	Divorced		35	19.2
Education	None		16	8.8
	Elementary school graduate		112	61.5
	High school graduate		45	24.7
	University graduate		9	4.9
	Education duration	7.98±3.19		
Employment Status	Yes		39	21.4
	No		143	78.6
Lives with	Spouse		9	4.9
	Spouse and child (children)		42	23.1
	Child (children)		13	7.1
	Mother and/or father		64	35.2
	Alone		54	29.7

In this study, 85.7% of the cases was male, and 14.3% of the cases was female and the age distribution was between 22 and 75 at the time of medical examination with a mean age of 44.65±11.7 years. The mean age at the time of the crime was 40.87±11.78, and criminal responsibility evaluation examinations were performed 3.90±2.62 years after the crime-related actions on average.

When the educational conditions of the patients were examined, it was observed that 8.8% of them did not have any education at all and 61.5% of them were elementary school, 24.7% of them were high school and 4.9% of them were university graduates and mean education duration was 7.98±3.19 years.

When the professional statuses of the cases were examined, it was detected that a high ratio of 78.6% of the cases did not have a profession and was unemployed.

Concerning marital status, 48.3% of them were married, 32.4% of them were single and 19.2% of them were divorced. 20.3% of married individuals were living apart from their spouses. In this study, 4.9% of the cases were living only with their spouses, 23.1% with spouse and child(ren), 7.1% only with child(ren), 35.2% with mother and/or father and 29.7% were living alone.

3.2. Clinical Characteristics

Clinical characteristics of the cases are given in Table 2 and mean disease starting age was 33.92±11.07 and disease duration was 10.49±7.98 years based on disease characteristics. Diagnosis distribution of the cases was schizophrenia in 35.2%, not otherwise specified (NOS) psychotic disorder in 54.4%, schizoaffective disorder in 8.2%, brief psychotic disorder in 1.1% and delusional disorder in 1.1%. 53.8% of the cases were under regular medical treatment and follow-up and 70.9% had a history of minimum one hospitalization in the psychiatry services and mean hospitalization count of the patients who had inpatient treatment changed between 1 and 20 and the mean hospitalization count was 2.51±2.36. 19.2% of the cases were using depot antipsychotic and 22.5% had a comorbid psychiatric disease.

Based on delusion and hallucination content of the cases at the time of crime-related actions, the highest ratio was for persecutory delusion with 45%, 29.7% of them only had a persecutory delusion, 10.4% of them had both persecutory delusion and auditory hallucination and 4.9% of them had both persecutory delusion and visual hallucination. While 4.9% of the cases had only auditory, 1.6%

of the cases had only visual and 2.2% of them had both auditory and visual hallucinations, 2.7% of them had jealous, 3.8% of them had grandiose and 1.6% of them had bizarre delusions and symptoms could not be detected or other delusions were detected in 37.4% when committing crime-related actions.

The distribution of comorbid diseases was detected as depression in 26.8%, personality disorder in 19.5%, anxiety disorders in 14.6%, substance use disorders in 14.6%, mental retardation in 14.6% and obsessive-compulsive disorder in 9.8% of the cases (Table 3).

3.3. Characteristics of Crime-Related Actions

Data for crime-related actions of the cases are provided in Table 4. A total of 77.5% of the cases were sent with violent crime committing claims, including 45.6% injury, 22% insult and threat, 3.8% damage to property, 4.9% with sexual assaults and 1.1% with homicide while 10.4% were sent with the claim of theft, 2.7% with calumny and 9.3% with the claim of other crimes, such as traffic offenses, forgery, fraud, drug possession and trade, 44.5% had a history of crime-related actions, and 11% had alcohol or substance use at the time of the action. When the relationship between the cases and the victims of the claimed crime-related actions were evaluated, 25.5% of them was family members, 4.4% of them was relatives, 1.5% of them was colleagues, 39.4% of them were acquaintances, such as neighbors or fellow villagers and 29.2% of them were random people.

Based on the report results of the committee of experts, it was detected that 67% of the cases diagnosed with psychotic symptoms did not have criminal responsibility within the scope of TCC Article No 32/1 and 12.1% had diminished criminal responsibility and 11.5% had criminal responsibility within the scope of TCC Article No 32/2 and it was also detected that an opinion was issued in 9.3% claiming that the accused individuals must be kept under surveillance within the scope of Turkish Criminal Procedure Code (CPC) Article No 74 to determine whether they had criminal responsibility.

Table 2. Clinical Characteristics of the Cases

		Mean ± SD	n (=182)	%
Disease duration		10.49±7.98		
Disease starting age		33.92±11.07		
Diagnosis	Schizophrenia		64	35.2
	NOS psychotic disorder		99	54.4
	Schizoaffective disorder		15	8.2
	Brief psychotic disorder		2	1.1
	Delusional disorder		2	1.1
Regular follow-up and treatment	Present		98	53.8
	None		84	46.2
Psychiatry service hospitalization	Present		129	70.9
	None		53	29.1
Depot antipsychotic use	Present		35	19.2
	None		147	80.8
Comorbid psychiatric disease			41	22.5
Symptom at the time of CRA	Persecutory delusion		54	29.7
	Persecutory delusion + auditory hallucination		19	10.4
	Persecutory delusion +visual hallucination		9	4.9
	Jealous delusion		5	2.7
	Grandiose delusion		7	3.8
	Bizarre delusion		3	1.6
	Auditory hallucination		9	4.9
	Visual hallucination		3	1.6
	Auditory + visual hallucination		4	2.2
	Unidentified or Other		66	37.9

CRA= Crime-Related Action, NOS= Not Otherwise Specified

Table 3. Distribution of Comorbid Psychiatric Diseases

	n (=41)	%
Depressive disorder	11	26.8
Personality disorders	8	19.5
Mental retardation	6	14.6
Anxiety disorders	6	14.6
Substance use disorders	6	14.6
Obsessive-compulsive disorder	4	9.8

Table 4. Characteristics of Crime-Related Actions of the Cases

		n (=182)	%
Report results	Full criminal responsibility	21	11.5
	No criminal responsibility	122	67
	Diminished criminal responsibility	22	12.1
	Observance	17	9.3
CRA characteristic	Injuring	83	45.6
	Insult, threatening	40	22
	Theft	19	10.5
	Sexual assault	9	4.9
	Damage to property	7	3.8
	Killing	2	1.1
	Calumny	5	2.7
	Other	17	9.3
Alcohol/ substance use during CRA		20	11
CRA story		81	44.5
Violent CRA		141	77.5
Characteristics of CRA victims	Family	35	25.5
	Relative	6	4.4
	Colleague	2	1.5
	Acquaintance	54	39.4
	Random person	40	29.2

CRA=Crime Related Action

Based on the distribution of violent crime-related actions, a total of 28.4% included verbal violence like insult and threat, a total of 65.2% arose from physical violence, including 2.1% firearm injury, 19.1% injury with sharp, incisive or penetrating tools, 37.6% injury with bare hand or foot, 1.4% homicide and 5% damage to property and 6.4% included sexual violence (Table 5).

Table 5. Distribution of Acts Defined as Violent Crimes

		n (=141)	%
Verbal violence		40	28.4
Physical violence		92	65.2
	Firearm injury	3	2.1
	Injuring with sharp, incisive or perforating tool	27	19.1
	Injury with bare hand	53	37.6
	Killing	2	1.4
	Damage to property	7	5
Sexual violence		9	6.4

4. Discussion

4.1. Sociodemographic Characteristics

Based on the gender distribution of the cases, males had a ratio of 85.7%, which was a higher ratio than females. Almost all studies presented that males committed more crime-related actions than females among individuals with psychotic symptoms (7, 10, 22-24). Considering that the male gender, in general, is more related to violent and illegal behaviors in the whole population, given that males also have an overwhelming ratio among the cases with psychotic symptoms committing crime-related actions can be considered as an expected result. Based on the Turkish Statistical Institute data, 95.6% of the total number of convicts and prisoners in 2017 were male (25).

With a mean age of 44.65 years, the age distribution of the cases was between 22 and 75 at the time of medical examination. The mean age at the time of the crime was 40.87 and the criminal responsibility evaluation examinations were performed 3.90 years after the crime-related actions on average. The mean ages detected in the studies changed between 38.10 and 43.96 (7, 10, 21, 23, 24, 26). In our study, the average age at disease onset was detected as 33.92±11.07 and similar to other studies, it was evaluated that the high ratios of committing crime-related actions around the age of 40 could be related to factors, such as the weak social support provided for individuals with a mental disorder in long disease duration and lack of regular and efficient treatment.

When the educational backgrounds of the cases were examined, it was observed that 8.8% of them did not have any education at all and 61.5% of them were elementary school, 24.7% of them were high school, and 4.9% of them were university graduates and mean education duration

was 7.98±3.19 years. Based on the studies in our country, mean education duration was detected as 6.06±3.50 years by Oncu et al. (24), as 7.99±3.81 years by Oncu et al. (21) and as 6.18±3.42 years by Inan et al. (26). In a study conducted in Italy, on cases whose forensic psychiatric evaluations were completed and more than half of which were patients with a schizophrenia spectrum disorder, it was detected that 68.9% did not have any education at all or were secondary school graduates in line with the ratios detected in our study (23).

When the professional statuses of the cases were examined, a high ratio of (78.6%) cases did not have a profession, was unemployed and had a low socioeconomic level. In studies comparing patients with psychotic symptoms who committed or did not commit crime-related actions, unemployment ratios of the individuals who committed crime-related actions were observed to be significantly higher compared to cases who did not commit such actions (21, 27). Again, the studies on schizophrenia patients who committed crime-related actions presented that high unemployment ratio (28) and low socioeconomic level (7, 21, 29, 30) were among the common characteristics of these cases. Low education levels, unemployment and lack of a profession should primarily be considered as an expected result of their disease for the individuals in the psychosis diagnosis group. It was considered that the provision of employment opportunities in suitable areas for individuals with psychotic symptoms who have the opportunity to work based on the characteristic of their diseases could be helpful for their rehabilitation phases.

Based on marital status, 28% of the cases were married and were living with their spouses while the ratio was 32.4% for single individuals and 20.3% for married cases living apart from their spouses and 19.2% of the cases were divorced. Similar to our study, many studies in the literature show that unmarried patients commit more crime-related actions (7, 8, 21, 23, 24, 26, 28).

In this study, 4.9% of the cases were living with the spouse, 23.1% with spouse and child(ren), 7.1% with child(ren), 35.2% with mother and/or father and 29.7% were living alone. In a study on cases with psychotic symptoms who committed crime-related actions in Australia, the ratio of homeless individuals was reported as 18.03% (27) and in a study carried out on 1476 patients mostly including schizophrenia, schizotypal and delusional disorder patients whose forensic psychiatric evaluations were completed, the ratio of homeless individuals was 41% and the ratio of the patients living alone was 72% (10). In a study conducted in our country, the ratio of homeless individuals among the cases with psychotic symptoms who committed crime-related actions was detected as 2.9%, while the ratio was 15.7% for the patients living alone (21). As also detected in our study, it was considered that the significantly lower ratio of the cases with psychotic symptoms who are homeless or are living alone in our country compared to Europe is based on social and sociocultural differences and the mothers, fathers and children provide care to patients with psychotic symptoms who need care in our country.

4.2. Clinical Characteristics

In our study, it was detected that a diagnosis was made due to psychotic symptoms after the medical examinations performed by Forensic Medicine Experts and Psychiatrists in 30.4% of 597 individuals (n=182) who were investigated and/or prosecuted for committing a crime and were sent to the Department of Forensic Medicine for criminal responsibility evaluation with insanity suspicion/allegation between 2012 and 2018. In a study conducted in a forensic psychiatry unit in Portugal on 274 patients without criminal responsibility due to mental disorders, 50.5% of the patients were diagnosed with schizophrenia (7). In a study carried out on 61 patients without criminal responsibility due to mental disorders in Italy, it was reported that 54.1% of the patients were diagnosed with schizophrenia, delusional disorder, schizoaffective disorder, substance use related psychotic disorder, schizophrenia spectrum disorder and other psychotic disorders (23) and in a study conducted in Sweden on 1476 patients for whom judicial authorities decided upon compulsory psychiatric treatment and who were evaluated in forensic psychiatry unit, 59% were diagnosed with schizophrenia, schizotypal and delusional disorder (10). Since the sampling groups in the mentioned studies included patients with a mental disorder without criminal responsibility, it was evaluated that the higher rates of diagnosis with psychotic symptoms among all cases compared to our study constituted an expectable result.

In this study, 35.2% of the cases were diagnosed with schizophrenia, 54.4% with NOS psychotic disorder, 8.2% with schizoaffective disorder, 1.1% with a brief psychotic disorder and 1.1% with delusional disorder. Mean disease duration was found as 10.49±7.98. In a study, including schizophrenia patients presenting homicidal behavior, it was reported that mean disease duration was 12.65 ± 8.94 years and long disease duration was related to homicidal behavior tendency (28). In a study comparing patients with psychotic symptoms who committed or did not commit crime-related actions, the mean disease duration of the individuals who committed crime-related actions was found 13.14±8.55 years, but a statistical difference was

not found among the two groups (21). In a study comparing patients with psychotic symptoms who presented homicidal behavior and the patients with psychotic symptoms who did not commit crime-related actions between 1988 and 2001, chronicity of the disease was among the significant factors in presenting homicidal behavior (31). In another study, it was reported that 40.3% of the patients who were diagnosed with schizophrenia and related disorders, did not have criminal responsibility and committed crime-related violent actions committed crime-related actions after a disease duration of 10 years and 20.8% committed them after a disease duration of 5-10 years (8). The disease duration of individuals who committed crime-related actions and were diagnosed with psychotic symptoms in our study was found in line with the literature and when long disease duration combined with factors, such as the lack of social support, suitable treatment and follow-up, they were considered to be effective in their committing of crime-related actions, mainly violent actions.

In our study, 46.2% of the cases did not have regular psychiatric treatment and follow-up. This finding of our study is consistent with the EUFEST study (32), stating 42% of the treatment noncompliance. Depot antipsychotic use was detected as 19.2% in our cases. It is inevitable that the active arrangement of the regular follow-ups and treatments, including depot antipsychotic treatments, considering the crime-related risks in the individuals in the psychosis diagnosis group, would be preventive for crime-related actions.

In this study, it was detected that 22.5% of the cases had a comorbid psychiatric disorder and 19.5% of these were personality disorders and 14.6% were substance use disorders. Based on the studies abroad, it was detected that comorbid diseases were at higher rates compared to the studies in our country and high substance use disorder rates were especially € interesting. Substance use disorder rates of patients in psychosis diagnosis group committing crime-related actions were reported as 44.3% by White et al. (27) and as 32% by Heinrich and Sam (29). Comorbid disease ratios in our country were detected as 25% by Oncu et al. (24) and as 13.1% by Inan et al. (26). Alcohol-substance use ratios when committing the crime were determined as 14.2% by Oncu et al. and as 10% by Ural et al. (33) and Belli et al. determined the ratios as 5.2% for alcohol and as 2.2% for drugs (34). Lower comorbid disease ratios in our study and other studies in our country compared to Europe may be due to lower alcohol-substance use in our country compared to western countries. Detection of the facts that 11% of the cases in our study (n=20) were under the effects of alcohol or substance while committing crime-related actions and that 60% of these patients committed violent acts was found in line with studies showing that alcohol-substance use was a risk factor for crime-related violence acts (8, 23, 28).

Many studies showed that delusions are related to violent actions (8, 33, 35). In the studies, it was stated that emotions, such as skepticism, hostility, nervousness and anger occurring due to persecutory delusions, caused the patients to present violent behavior (35-37). High violence crime and persecutory delusion rates in patients determined to be in the psychosis diagnosis group in our study support that the delusions and hallucinations are effective in violent crime-related actions.

4.3. Characteristics of the Crime-Related Actions

Given that 77.5% of the individuals with psychotic disorder commit crime-related violent actions in our study is in line with literature information stating that violent behavior risk is high for the individuals in the psychosis diagnosis group (17, 23). Concerning the quality of violence, it was observed that 28.4% of the cases in our study committed verbal, 65.2% committed physical and 6.4% committed sexual violence and among cases applying physical violence, 37.6% did not use any tools and 5% damaged property. In terms of the essence of violence, committing physical violence without substantial verbal violence and crime weapon were found in line with the data acquired from other studies (33, 38) and this condition made us consider that the individuals in the psychosis diagnosis group were facing impulse control issues as an effect of their diseases and were committing crime-related actions without planning.

Because 44.5% of the cases also committed crime-related actions before was found in line with the literature information stating that history of crime-related actions was an important data to determine the recurrence risk of such actions (8, 24, 39, 40).

It was detected that the victims of the crime-related actions significantly included family members, relatives and acquaintances of the cases. Our results have a significant similarity with other studies on this subject (8, 24, 28, 33). It was considered that this condition could arise from individuals in the psychosis diagnosis group needing the care of their families because of their diseases, their social relations mostly being restricted with their families and relatives and their delusions being towards these individuals as a natural result.

Based on the results of the reports issued for cases by a committee of experts, 67% of the cases did not have a

criminal responsibility within the scope of TCC Article No 32/1 and 12.1% diminished responsibility within the scope of TCC Article No 32/2. In line with our study, a study conducted in China showed that 74% of the 1108 schizophrenia-diagnosed cases who committed the crime did not have a crime responsibility and 21% of them diminished criminal responsibility (9) and in many similar studies, most of the patients with no or diminished crime responsibility were in psychosis diagnosis group (7, 10, 39, 41). Considering that psychosis in general covers disorganized behavior and deteriorations in reality perception, mental capacity, emotional reaction, reality perception ability and the communication and relationship with others (16), lacking or diminished criminal responsibility in individuals with psychotic symptoms can be an expected result of the disease. However, the main issue in determining criminal responsibility is to examine the mental condition, free will and intentional acting ability of the offender when the crime was committed (1). The examination to be performed is based on forensic psychiatric inspection and medical examination. The important thing here is not whether the individual had any psychiatric presentation before or after the incident but the presence or lack of criminal responsibility (consciousness and freedom of action) when the crime was committed (42). Within this concept, based on the nature of the crime, it was observed that an opinion stating that 11.5% of the cases evaluated not to be under the influence of disease while committing the crime and that 9.3% of the cases should be kept under supervision within the scope of CPC No 74 to be able to make this distinction was issued. For the individuals in the psychosis diagnosis group without any causality relation between the disease symptoms and the crime and for whom a view stating that they had full criminal responsibility was issued, giving liberty-restricting penalties should be discussed - since they may exacerbate the symptoms and increase the destruction- and a solution should be found. In addition to hindering the treatments, it is obvious that giving liberty-restricting penalties to individuals with psychotic symptoms would not serve the corrective and deterrent aims of punishment. Although it was stated in Items 32 and 57 of Turkish Criminal Code that rehabilitation will be applied in hospitals with high security and safety precautions to individuals with diminished or no criminal responsibility due to insanity, no regulation covering such rehabilitation was applied for individuals who have both insanity and full criminal responsibility For individuals in the psychosis diagnosis group but evaluated to have full criminal responsibility since there was no causality connection between the committed crime and disease, it was considered that completing the penalty duration of their crimes under treatment and follow-up in hospitals with high security instead of prison would be a way of solution. Also, the doctors evaluating criminal responsibility should present their medical views on the health precaution conditions under which the execution should be performed due to the disease/diseases of the individual and on the fact that the individual should not be kept in prison in their reports even if this is not covered in the laws and not asked by concerned authorities.

We can name the inaccessibility of data on the treatments received by the cases, their accordance with the treatment and the effects of provided treatments on criminal behavior and the lack of clinical diagnosis scales among the limitations of our study since this is a retrospective study.

Determination of criminal responsibility is quite a complicated subject that requires a careful examination. It is interesting that while education, socioeconomic levels, employment ratios and regular follow-up and treatment ratios were low for the individuals with psychotic symptoms who committed crime-related actions in our study, disease duration was long, especially persecutory delusion among all delusions were observed at a high ratio, and previous crime-related actions had a high ratio. It is also interesting that crime-related violence actions are also committed against family members and acquaintances rather than random people. Although the effects of psychotic symptoms on criminal responsibility and their relationship with criminal behavior are known by the experts of the subject, the characteristics of sociodemographic, clinical and crime-related actions should be considered in criminal responsibility evaluations with a holistic approach. Our descriptive study would be helpful for psychiatrists and forensic medicine experts concerning crime risk to analyze the behavioral variables defined as a crime in individuals with psychotic symptoms, mainly violence crimes.

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Research Article

Assessment of Suicide Attempt in The Forensic Medicine Outpatient Clinic in Muğla

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Abstract: **Objective:** Suicides and suicide attempts are an important public health problem. In the study, by evaluation of the forensic reports of the suicide attempts patients in the Forensic Medicine outpatient clinic; it was aimed to present sociodemographic/regional characteristics, methods and develop recommendations for protective measures.

Materials and Methods: The reports between 01.06.2014 and 31.12.2018 were evaluated retrospectively and statistically.

Results: 405 (5.3%) of cases attempted suicide, 263 (64.9%) were women, 142 (35.1%) were men, mean age was 27.7 years. 11.8% of them were under 18years-old, 66.9% (n:271) of them was in the 15-29-age group, 27.8% (n:111) was in the 30-49-age group. There is a significant difference was found between age-group and sex (p <0.001). No significant difference was found between months and seasons. The most commonly used method was drugging (86.2%, n:349). In terms of severity of the injury, it was found that 3.2% of the cases had a life-threatening injury, 88.4% of them were mild with simple medical intervention and 8.4% were mild/moderate.

Discussion and Conclusion: The most common method was taking drugs. One of the striking results that, the rate of attempting suicide of women under 19 years of age is higher than men, and men in the 30-39 age group are higher. In this result for women; gender roles, identity problems and freedom restrictions are playing a role, and for men; gender roles, identity problems, economic problems are playing a role. The findings are important to shed light on protective measures. It would be useful to refer the patients who applied to social support units.

Keywords: Suicide Attempt, Suicide Method, Forensic Medicine, Forensic Report.

Öz: **Amaç:** İntiharlar ve intihar girişimleri önemli halk sağlığı sorunlarından biridir. Çalışmada Muğla Sıtkı Koçman Üniversitesi Eğitim/Araştırma Hastanesi Adli Tıp Polikliniğinde intihar girişimi nedeniyle adli rapor düzenlenen olguların değerlendirilmesiyle; bölgesel ve sosyodemografik özellikler ve kullanılan yöntemler ortaya konularak, koruyucu önlemler açısından öneriler geliştirmek amaçlanmıştır.

Gereç ve Yöntem: 01.06.2014-31.12.2018 tarihleri arasında Adli Tıp Polikliniğinde intihar girişimi nedenli başvuruların raporları retrospektif değerlendirilerek verilerin istatistik analizleri yapılmıştır.

Bulgular: Olguların 405'inin (%5.3) intihar girişiminde bulunduğu görülmüştür. 263'ü (%64.9) kadın, 142'si (%35.1) erkektir, yaş ortalaması 27.7 yıl (SD:11.1), aralık 12-76 yıldır. Olguların %11.8'i (n:48) 18 yaş altında, %66.9'u (n:271) 15-29 yaş aralığında ve kadınlar çoğunlukta, %27.8'i (n:111) 30-49 yaş aralığındadır. Yaş gruplarına göre cinsiyette anlamlı bir fark bulunmaktadır (p<0.001). Ay ve mevsimlere göre anlamlı bir farklılık saptanmamıştır. Yöntemler içinde en sık ilaç alma (%86.2, n:349) kullanılmıştır. Bunu kesici alet kullanma (%8.9, n:36) ve ası (%2.2, n:9) yöntemleri izlemiştir. Yaralanma ağırlığı; olguların %3.2'sinde yaşamsal tehlike, %88.4'ünün basit tıbbi müdahale ile giderilebilecek nitelikte hafif, %8.4'ünde ise hafif olmadığı şeklindedir.

Tartışma ve Sonuç: İntihar girişiminde bulunan olguların çoğunluğu yöntem olarak ilaç kullanımını seçmiştir. 19 yaş ve altında kadınların intihar girişiminde bulunma oranı erkeklere göre fazla, 30-39 yaş grubunda ise erkeklerin oranı daha fazla bulunmuştur. Bunda; kadınlar için toplumsal cinsiyet rolleri, ergenlerin kimlik arayışı, özgürlük kısıtlamaları; erkelerde ise yine toplumsal cinsiyet rolleri, ekonomik nedenlerin rol oynadığı düşünülmüştür. Elde edilen bulgular koruyucu önlemlere ışık tutması açısından önemlidir. İntihar girişimi nedeniyle başvuran olguların sosyal destek birimlerine yönlendirilmesi faydalı olacaktır.

Anahtar Kelimeler: İntihar Girişimi, İntihar Yöntemi, Adli Tıp, Adli Rapor.

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1. Introduction

Suicides and suicide attempts are among the major public health problems. Suicide-related deaths and suicide attempts are increasing in the world and in our country (1).

World Health Organization (WHO) reported that suicides have constantly increased in recent years and are among the top ten causes of death, and that one person attempts suicide every 40 seconds (2). More than one million people attempt suicide every year, and suicide attempts to account for 1.8% of the burden of disease in the world (1-3). It is reported that attempted suicides are 10-20 times higher than completed suicides and thus it creates a much more important public health problem (1,4).

Suicide attempts are all willful attempts towards the self-annihilation individuals, which does not result in the death he / she has carried out in order to kill himself. It is reported that the rate of suicide increases with age and completed suicides are higher in males, whereas suicide attempts are more common in adults and women (5-8).

It is of great importance to identify the people at risk in terms of suicidal behavior in advance, and make the necessary examinations and interventions without delay. It has been reported that many suicide attempts are of repetitive nature and that raising the awareness of healthcare professionals are in this regard is highly critical (7). In one study, it was reported that 50-75% of suicide cases met with a doctor little earlier before the suicide attempt, while a few of them received psychiatric treatment, whereas proper assessment and treatment of the psychiatric conditions of the cases could be effective in terms of preventive measures (6).

According to the criminal law in our country, the action taken by the person who attempted suicide does not constitute crime, but those who persuade, encourage, strengthen someone else's suicide decision, and help in any way are punished (9).

Suicide attempts are examined in forensic medicine outpatient clinics within the scope of forensic cases, and the severity of the action of the person performed on himself is reported with the forensic report. For this reason, the vast majority of cases attempting suicide are directed to forensic medicine outpatient clinics.

In cases of suicide attempts that do not result in death, it is the physician's responsibility to determine the methods and causes of suicide attempts and to take prudential preventive measures and ensure the participation of individuals in psychiatric rehabilitation processes. Forensic examinations should also be considered as an opportunity to recognize the suicide attempts reported to the forensic outpatient clinics, to initiate the treatment processes by guiding the patients correctly and to reduce the risk of recurrence

In this study, the reports of suicide attempts that were referred to Muğla Sıtkı Koçman University Training and Research Hospital Forensic Medicine Outpatient Clinic with forensic report request were analyzed backwards, sociodemographic characteristics, suicide attempt methods and level of severity of the damage caused by the person were examined. By determining the socio-demographic characteristics and regional dynamics of suicide attempts in our region, it is aimed either to raise awareness for guiding people to psychiatry and related units and to shed light on regional preventive measures.

2. Materials and Methods

Sample; 405 cases who applied to the Forensic Medicine Outpatient Clinic of Muğla Sıtkı Koçman University Training and Research Hospital between 01 June 2014-31 December 2018, with the request for a forensic report on suicide attempt were included in the study.

Criteria for inclusion in the study; Forensic reports of all age group male and female cases who were admitted to the hospital with a history of suicide attempts within the reported date range and about whom forensic reports were issued, and the reports were evaluated retrospectively.

By creating a data collection form; the distribution of the cases according to gender, age, suicide attempt method, month and season, degree of health damage and report results were recorded in the form. Statistical analysis; for descriptive statistics data were evaluated using SPSS version 22 program, percentage, rate, mean and standard deviation were used, chi-square test was used in comparative analysis and $p < 0.05$ was considered as an indicator of significant difference.

Ethical Declaration

Ethical approval was obtained from Muğla Sıtkı Koçman University Human Research Ethical Committee with date 05.02.2019 and number 180200, and Helsinki Declaration rules were followed to conduct this study.

3. Results

Between the June 01, 2014 and December 31, 2018, a total amount of 7556 forensic reports were issued in the Forensic Medicine Outpatient Clinic, of which 405 (5.3%) are reports of attempted suicides.

263 (64.9%) of the cases, for which a forensic report was issued on attempted suicide, were female and 142 (35.1%) were male (Chart 1). The female / male ratio was found to be 1.8.

Table 1. Distribution of age groups by gender

Age Groups	Male		Female		Total	
	n	%	n	%	n	%
Under 15 and 15-29	77	54.3	194	73.8	271	66.9
30-49	55	38.7	56	21.3	111	27.4
50 and over	10	7.0	13	4.9	23	5.7
Total	142	100.0	263	100.0	405	100.0

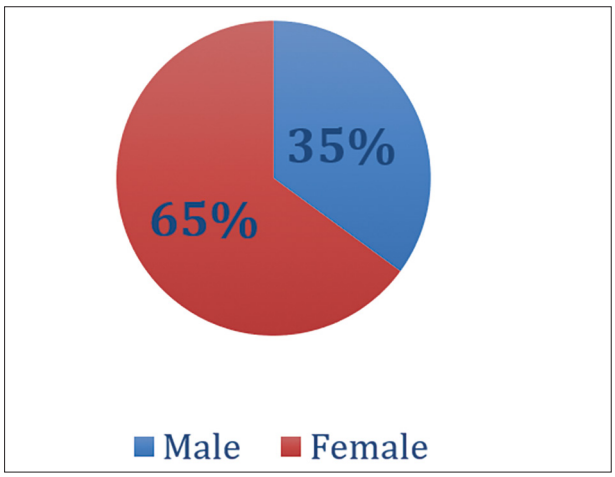

Figure 1. The gender distribution of suicide attempts.

The average age of the cases is 27.7 years (SD: 11.1), the age range is 12-76 years, 48 cases (11.8%) are under the age of 18. The distribution of age groups according to the gender of the cases where reports were issued on suicide attempts are given in Table 1. Age groups; In accordance with the age groups reported by WHO; they are grouped as under 15 years old, 15-29 years old youth group, 30-49 and 50 years old and above. According to WHO, since the number of cases aged 65 and over, the elderly group, was very low in our study, this group was included in the group of over the age of 50.

In the distribution of cases for which a report was issued on suicide attempts by age groups; a group of under 15 and 15-29 constitute the largest group (66.9%). Under the age of 19 (in the children group), the rate is 24.2% (n: 48), and in the age range of 20-29, the rate is 42.7%. There was a statistically significant difference between the genders in terms of age groups of the patients who attempted suicide which is ($p < 0.01$). 73.8% of female cases are in the adolescent and youth age group (age 15 and 15-29). In this age group, the rate of women attempting suicide is higher than men, while in other age groups, the rate of men is higher than women. Nine of the female cases were found to be pregnant during a suicide attempt.

It was observed that 361 (89.1%) of the cases referred to the outpatient clinic for forensic reports were sent from the provinces, the rest were directed from the counties, 90.4% of the cases were requested by law enforcement units and 8.4% (n: 34) of the prison administration.

In the distribution of the cases according to the months and seasons in which the suicide attempt was made, it was determined that 100 people (24.7%) in the winter months, 109 people in the spring (26.9%), 95 people in the summer (23.4%), 101 people in the autumn (25%) attempted suicide. No significant difference was detected according to the months and seasons.

The distribution of the methods used in the suicide attempt is given in Table 2. The most used method is drug intake with a rate of 86.2%. The most commonly used drugs were a antidepressant group and nonsteroidal anti-inflammatory/pain killer medication groups. Addictive substances such as amphetamine, methamphetamine, opiate, benzodiazepine, tetrahydrocannabinol (THC) were also detected in the examinations performed in 11 of the patients who attempted suicide by taking medication. 49 (12.0%) of the cases were brought to the hospital for a suicide attempt, it was found that they also had alcohol when brought to hospital. 23 of the patients who had alcohol were women and 26 of them were men.

Drug taking method was followed by making an incision in the body with a cutting tool with a rate of 8.6% and the hanging method with a rate of 2.2%.

Table 2. Distribution of methods used in a suicide attempt

Suicide attempt method	n	%
Drug taking Drug + addictive substance association (n: 11)	349	86.2
Creating an incision in the body	36	8.9
Hanging	9	2.2
Gunshot wound	2	0.5
Jump from high place	4	1.0
Multiple method	5	1.2
Total	405	100.0

The distribution of the severity of the damage caused by the cases after the suicide attempt within the framework of Articles 86 and 87 of the Turkish Criminal Code (TCK) is given in Table 3. The severity of injury of 88.4% of the cases was found to be 'mild enough to be resolved by a simple medical intervention'. The severe injury was detected in only 13 cases (3.2%), to the extent that it could be life-threatening.

Table 3. Distribution of severity of injuries

Severity of injury	n	%
Mild enough to be resolved by simple medical intervention	358	88.4
Not mild enough to be removed by simple medical intervention	34	8.4
Life-threatening	13	3.2
Total	405	100.0

4. Discussion

It has been reported that suicide attempts constitute 1.8% of the burden of disease in the world and create a much more important public health problem as it is seen much more than completed suicides (1-4). In this study, the forensic reports of forensic cases who attempted suicide applied to a forensic medicine clinic of an education and research hospital were evaluated.

It was found in our study that 65% of the cases who attempted suicide were women. In line with our work, in various studies conducted in different parts of Turkey in patients with suicide attempts the majority of women are emphasized (3,5,8,10-16). In studies conducted worldwide, it has been reported that the rate of women in suicide attempts is high (17-21). Studies emphasize that the number of women in suicide attempts (incomplete suicide) is high, and the number of men is high in suicide events resulted in death (completed) (13,22). In a study conducted for 14 years, covering the years between 2002-2015, in Turkey, the average of men who committed suicide has been reported that approximately 2 times greater than the average number of women. Of those who committed suicide in 2018, 75.6 percent were men while 24.4 percent were women (https://www.bik.gov.tr/turkiyenin-2018-olum-istatistikleri-aciklandi/).

In studies in Turkey (22-26) and in studies that evaluated the sociodemographic characteristics in the world (15.27 to 35), it is stated that the attempted suicide rate of women is higher than men. As in our study on suicide attempts, the high number of female cases around the world suggests that women use less lethal methods and the suicide attempt is actually a cry for help.

In our study, the mean age of the patients who attempted suicide was 27.7 years. There are 48 cases under the age of 18. In the study conducted by Arslan et al. (10) ; It was reported that 81.48% of the cases were female and the youngest case was 13 years old. In a study conducted in Urfa, 76.54% of the cases were reported to be in the 13-24 age group, 78 % were female while 22% thereof were male (3). In our study, the rate of suicide attempts in the adolescent and youth age group was found as 66.9%. 73.8% of female cases are in the adolescent and youth age group (under the age of 15 and between the age of 15-29). In this age group, the rate of women attempting suicide is much higher than that of men, while in other age groups, the rate of men is higher than that of women and a significant difference was determined. In this, gender roles for women, adolescent's search for identity pressures, and gender roles in men as well, economic reasons and pressures are thought to play a role. The conducted studies have stated that suicide rates increase in the young population, and it was emphasized that the main reasons for this are stress and indifference (13,19).

When we look at the distribution of the units requesting reports, it was seen that the highest number of report requests was made from the police centers with the ratio of 78.8% and a from gendarmerie centers with a ratio of 11.6%. While the Forensic Medicine Branch Directorate, which is available in our city, as it works with the UYAP system, it can only serve the cases sent by the courts and public prosecution offices. In the Forensic Medicine Outpatient Clinics, it can additionally be served to the requests coming from authorities such as Police Departments, Police and Gendarmerie Patrol Commands working on behalf of the prosecution

Although the seasonal fluctuation at neurochemical levels was associated with completed suicide and suicidal behavior (17,18), no significant difference was detected between suicide attempts and month and seasonal distribution in our study.

According to the suicide statistics of Turkey Statistical Institute's concerning 2011 data (26) the most commonly used methods of suicide were reported to be hanging (52.0%), firearms (26.1%), high jump (10.1%), use of chemicals (5.3%) The first method in suicide attempts was given as high dose drug intake.

In our study, the most common method used in 'suicide attempt' was the high dose of drug intake with a rate of 86.2% (Table 2). In many studies, it has been reported that the most frequently used method is chemical intake and these chemicals are drugs that are frequently prescribed (3,8,11,21,22). In our study, it was observed, in accordance with other studies that, drugs the most

frequently used in suicide attempts were antidepressant, anti-inflammatory and analgesic group drugs that were prescribed. Similarly, the use of drugs or toxic substances ranks first in the literature (36-38). It is reported that men use more traumatic methods such as hanging, using cutting tools, and firearms in completed or incomplete suicides (38-40). In our study, the use of cutting-piercing tools as a suicide method in male cases varies significantly compared to women. This supports the fact that men use more traumatic methods in attempting suicide.

Addictive substances such as amphetamine, methamphetamine, opiate, benzodiazepine and THC were detected in 11 of the cases who attempted suicide by taking medication, and alcohol was detected in 49 cases. In studies investigating risk factors leading to suicide in young people (31) and (41-43) in studies related to recurrent suicide attempts alcohol and substance abuse are said to be risk factors for suicide

The distribution of the severity of the damage caused by the cases after the suicide attempt within the framework of Articles 86 and 87 of the Turkish Penal Code (TCK) is given in Table 3. It was observed that 88.4% of the cases were 'mild enough to be relieved with a simple medical intervention'. In only 13 cases (3.2%) severe injury was detected, which could be life-threatening. It has been observed that a large part of the drug intakes used as a method is not at the level being life- threatening.

Risk factors in suicide cases resulting in death are as follows; being young, male gender, unemployment, living in the urban area, having family problems, having a mental illness (10,13,14,24,25).

As for the risk factors for suicide attempts are young age, female gender, living alone or separated, low education level and unemployment, as well as past suicide attempts or a history of severe mental disorder. It has also been reported to be associated with some socio-demographic variables (16,44). Among the risk factors reported in our study in accordance with the literature; it was found that the majority of the cases were in the youth age group and the excess of the female gender. As our study is retrospective, it is its shortage that other risk factors other than age and gender could not be evaluated. Within the borders of our city and in all Turkey comprehensive studies evaluating every aspect of suicides and suicide attempts should be conducted and preventive measures for risk factors should be developed.

5. Conclusion

In this study, the forensic reports of the patients who attempted suicide and applied with a request of forensic report to the Forensic Medicine Outpatient Clinic in Muğla province within a 4.5-year interval were evaluated. With this study, which evaluates the sociodemographic characteristics of suicide attempt cases, suicide attempt methods and results of forensic reports, an evaluation that has not been done in our province has not been made before and regional characteristics have been revealed.

Suicide attempts are more common in young adults and women. Suicide attempts are too complex to be considered a social scream or a simple incident. It is very important to identify the people at risk for suicidal behavior in advance, and make the necessary evaluations and interventions without delay. Regional predisposing factors and risk factors will be guiding in terms of solutions. We think that this study will create a database for both comprehensive and preventive studies.

Our country needs national suicide prevention programs, having measurable targets, the effectiveness of which can be evaluated, and covers the whole society and permanent. These programs should be carried out as part of public health implementations. Considering that suicidal behavior has many genetic, psychological, social and cultural risk factors; prevention programs should be multidisciplinary and governments, mental health workers, educators, media, and family should work together to prevent suicide.

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Research Article

Poison and High Dose Drug as The Cause of Death in Detective Novels: A Comparison of Agatha Christie's and Ahmet Ümit's Works

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Abstract: **Objective:** The aim of this study was to compare the use of poison or high-dose drugs as the cause of death in Western and Turkish literature.

Materials and Methods: The works of Agatha Christie and Ahmet Ümit were examined as examples of crime novels. The use of poison or high-dose drugs as the murder weapon and cause of death, the properties of these drugs and substances, and the findings of poisoning were given in the work were evaluated comparatively.

Results: In the Agatha Christie novels, various poisons and drugs are given by mixing them into the victim's food or drink. The causes of the victims' death are cyanide in "Ten Little Niggers (And Then They Were None)", "Sparkling Cyanide" and "Mirror Crack'd from Side to Side"; and morphine in "Sad Cypress" and "Death Comes As The End". In Agatha Christie's other novels, strychnine, taxine, thallium, phosphorus, arsenic, hemlock, aconitine, belladonna, physostigmine, nicotine and a drug containing barbituric acid have been used as the murder weapon.

In the novels of Ahmet Ümit, murder weapons such as knives and pistols appear instead of poisonous preparations that kill the victim. On the other hand, Ahmet Ümit's novel "İstanbul Hatırası" shows that the victims were neutralized with propofol, a short-acting anesthetic, before being killed, and mivacurium, a neuromuscular blocker, in "Kırlangıç Çığlığı". The main theme in the novel "Sultanı Öldürmek" is that Fatih Sultan Mehmet may have been poisoned with opium or a similar substance, while in this novel the murder weapon is a letter opener.

Conclusion: The use of poison and high-dose drugs as a murder weapon is noteworthy in the works of Agatha Christie, while in only a few novels of Ahmet Ümit there have been statements about the use of certain drugs for a short period of time. Although killing with poison is a mysterious subject in Ottoman history, it can be interpreted as a foreign element in terms of the Turkish conception of crime.

Keywords: Agatha Christie, Ahmet Ümit, Crime, Drug, Poison

Öz: **Amaç:** Bu araştırmada Batı ve Türk edebiyatından polisiye eserlerde ölüm nedeni olarak zehir ya da yüksek doz ilaç kullanımının karşılaştırmalı olarak incelenmesi amaçlandı.

Gereç ve Yöntem: Polisiye roman örnekleri olarak Agatha Christie ve Ahmet Ümit'in eserleri incelendi. Cinayet silahı ve ölüm nedeni olarak zehir ya da yüksek doz ilaç kullanımı olup olmadığı, varsa bu ilaç ve maddelerin özellikleri ile zehirlenme bulgularının eser içerisinde veriliş şekli karşılaştırmalı olarak değerlendirildi.

Bulgular: Agatha Christie romanlarında çeşitli zehir ve ilaçların, kurbanın yemeğine ya da içeceğine karıştırılarak verildiği görülmektedir. Kurbanların ölüm nedenleri "Şampanyadaki Zehir", "On Küçük Zenci", "Ve Ayna Kırıldı"da siyanür; "Koltuktaki Ölü", "Sonunda Ölüm Geldi" romanlarında morfindir. Agatha Christie'nin diğer romanlarında striknin, taksin, talyum, fosfor, arsenik, baldıran otu, yüksük otu, güzel avrat otu ile barbitürik asit içeren bir ilaç cinayet silahı olarak kullanılmıştır.

Ahmet Ümit romanlarında ise kurbanı öldüren zehir terkipleri yerine bıçak, tabanca gibi cinayet silahları karşımıza çıkmaktadır. Öte yandan Ahmet Ümit'in "İstanbul Hatırası" romanında kurbanların öldürülmeden önce kısa etkili bir anestezik olan propofol ile, "Kırlangıç Çığlığı"nda ise nöromüsküler blokerlerden mivakuryum ile etkisiz hale getirildikleri görülmektedir. "Sultanı Öldürmek" romanında ana tema Fatih Sultan Mehmet'in afyon veya benzeri bir madde ile zehirlenerek öldürülmüş olabileceği iken bu romanda da cinayet silahı bir mektup açacağıdır.

Sonuçlar: Zehir ve yüksek doz ilacın cinayet silahı olarak kullanımı Agatha Christie eserlerinde dikkat çekici olarak karşımıza çıkmakta iken Ahmet Ümit'in sayılı romanında kısa süreli olarak bazı ilaçların kullanıldığına dair ifadelere rastlanmıştır. Zehirle öldürmek, Osmanlı tarihinde gizemli bir konu olsa da, Türk toplumsal suç anlayışı açısından yabancı bir unsur olarak yorumlanabilir.

Anahtar Kelimeler: Agatha Christie, Ahmet Ümit, İlaç, Suç, Zehir

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Ethical Declaration
This study was written in accordance with the Helsinki Declaration, and the ethics committee approval was not obtained since written documents were examined in terms of comparative literature.

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1. Introduction

Detective novels are literary works about crime and reflect the conception of crime in the society. Crime can be studied in a wide range from concealing an important truth to human murder, but in detective novels, death and enigma often form the main subject. However, detective novels, which must ultimately have logic and reason, are different from stories that contain fantastic elements related to ghosts and the other world (1,2). Detective novel, also known as murder novel *(cinai)* and crime novel, has gained its true identity in the 20th century. In Western and Turkish literature, there are important representatives of this literary genre, which has evolved and changed over time.

Agatha Christie (1890- 1976), English detective novelist, is the world's greatest crime writer. Agatha Christie, who has written more than 80 crime novels, also wrote short stories in the final years of her life. She wrote one of her most famous novels, "Murder on the Orient Express" in the Pera Palace Hotel in Istanbul, which maintains Christie's room as a memorial to the author. After her marriage to an archaeologist in Syria, Istanbul served as a bridge between them (3,4). Agatha Christie is also known as the most-translated author and the best-selling fiction writer of all time. Hercule Poirot and Miss Marple are detective characters introduced by the author and internationally renowned.

Ahmet Ümit (1960-) is one of the most successful detective novelists of Turkish literature. He began to write his first stories in 1983, and his first detective novel "Sis ve Gece" *(Fog and Night)* (1996), also translated into Greek, has earned the title of the first Turkish detective novel translated into a foreign language. Ahmet Ümit, who uses the lenses of various scientific disciplines like philosophy, psychology, sociology, history and toxicology in his works, takes on social events and organized crime rather than individual crimes. The author, who considers mystery to be one of the most important literary genres, argues that crime and evil re-present life to us. During the last 30 years, he has published nearly 30 works, most of them are detective novels. The Chief Inspector Nevzat stands out as the main character repeated in his works (5).

A detective novel has three main elements: the murder (crime), the killer, and the police detective investigating the murder and trying to find the killer. Besides this question "who is the killer", how the crime is committed, time and space dimensions of the narrative, and the psychological analysis of the characters are also important building blocks of the detective novel. Criminal evidence can be presented to the reader in varying ways during the narrative, and the author's cunning and the reader's awareness compete at this point. The murder weapon can often be cutting/ piercing instruments, firearms and sometimes poisons.

Although it is thought that detective novel does not convey real-life situations, it is possible to be inspired by real events, since a logical fiction is essential. For example, Ahmet Ümit's novel "Kar Kokusu" *(Odor of Snow)*, published in 1998, shows traces of the author's experience in Moscow. "Kukla" *(Puppet),* another novel of Ahmet Ümit, was also written inspired by the Susurluk incident (5). Agatha Christie's inspiration came from drugs and poisons. She worked as a volunteer nurse during the First World War, and it provided her with medical knowledge as well as experience in the effects and side effects of drugs (6).

Agatha Christie in Western literature and Ahmet Ümit in Turkish literature are authors who have not only given the best examples of detective novels but also contributed to the development of this literary genre. The aim of this study was to examine the use of poison or high-dose drugs as the cause of death in the novels of Agatha Christie and Ahmet Ümit by comparing Western and Turkish literature.

2. Materials and Methods

The criminal elements and the novel structures in Agatha Christie's and Ahmet Ümit's works were examined. Agatha Christie's novels mentioning poison or high dose drug use as murder weapon, "Sparkling Cyanide"(7), "Mirror Crack'd from Side to Side" (8), "And Then They Were None/ Ten Little Niggers" (9), "A Pocket Full of Rye" (10), "Sad Cypress" (11), "Curtain" (12), "Death Comes as The End" (13), "Cards on The Table" (14), "Lord Edgware Dies" (15), "The Mysterious Affair at Styles" (16), "The 4.50 from Paddington/ What Mrs. McGillicuddy Saw!" (17), "The Pale Horse" (18), "Dumb Witness" (19), "The Big Four" (20), "Appointment with Death" (21), "Five Little Pigs" (22), "They Do It with Mirrors" (23), "Three Act Tragedy" (24), "A Caribbean Mystery" (25), "Crooked House" (26) were compared with Ahmet Ümit's novels, "İstanbul Hatırası" (*A Memento for Istanbul*) (27), "Sultanı Öldürmek" (*To Kill a Sultan*) (28) and "Kırlangıç Çığlığı" (*Swallow's Cry*) (29) in terms of properties of substances used, delivery routes, drug effects and poisoning findings. The way the authors handled these items and all the data were evaluated with the relevant literature.

3. Results

Poisons and drugs used in Agatha Christie's and Ahmet Ümit's novels, their administration routes and toxicological findings are presented in Table 1.

In the novels of Agatha Christie, various poisons and drugs were given by mixing into the victim's food and drink or injecting. In these fictional murders, the victim took the poison without any suspicion, died in accordance with the chemical properties of the substance used and also showed signs of poisoning. What poison was used as a murder weapon could be understood at the end of the novel's by simple toxicological assessments and observations.

Cyanide was the poison that Agatha Christie used most often in her novels when fictionalizing murder. The cause of the victim's death was cyanide in the novels "Sparkling Cyanide" (7), "Mirror Crack'd from Side to Side" (8) and "Ten Little Niggers" (9); and taxine alkaloids in "A Pocket Full of Rye" (10). These poisons, which could act quite quickly, suddenly killed the victims in such a way as to maximize dramatic effect. There was a single victim in "A Pocket Full of Rye" (10), while serial murders were observed in "Ten Little Niggers "(9), "Sparkling Cyanide" (7), and "Mirror Crack'd from Side to Side" (8). In the novels, poisons were given by mixing them into the victims' drinks.

In the novel "Sad Cypress" (11), the murder was committed with morphine mixed into tea. The killer, a nurse using her pharmacology knowledge, drank the same tea, but she injected herself with apomorphine which induced vomiting and emptying her stomach. Morphine as a murder weapon was also used in Agatha Christie's other novels "Curtain" (12) and "Death Comes as the End" (13), in which the poison was given by adding it into the victims' drinks.

In Agatha Christie's novels, another character who used his authority and knowledge of medicine to commit murder is Dr. Roberts in "Cards on the Table" (14). He killed his victim with an injection of *Evipan*, a depressant drug such as morphine and containing hexobarbital; however, he incapacitated the victim with a drug called a *Veronal* (barbiturate) tablet prior to that. Dr. Roberts murdered his other victims with anthrax bacilli contamination and vaccine injection including an unspecified pathogen. *Veronal* tablet was a widely used painkiller until the middle of the 20th century. In the novel "The Murder of Roger Ackroyd", it was used by the killer to commit suicide. *Veronal* also was the murderer's chosen weapon in "Lord Edgware Dies" (15).

"The Mysterious Affair at Styles" (16) was Agatha Christie's first published novel. The murder weapon in the novel was strychnine. Strychnine, which could be very effective orally and lead to death even in low doses, was placed in the victim's dinner. The victim's death occurred later in the night after dinner. Strychnine, an ideal poison due to its quick absorption, was replaced by tasteless and odorless arsenic in "4.50 from Paddington/ What Mrs McGillicuddy Saw!" (17). Because of its easy dissolution, especially in hot drinks such as tea, the poison was given by adding into the drinks. In this novel, unlike the fiction of murder with sudden death, deaths occurred as a result of chronic exposure to arsenic.

Another novel by Agatha Christie comprising chronic poisoning cases was "The Pale Horse" (18). In this novel, the victims were exposed to a rare poison thallium. In addition to nonspecific symptoms such as fatigue and stomach complaints, typical hair loss symptoms were also mentioned in the novel. In "Dumb Witness" (19), another unpredictable poison was chosen as a murder weapon: high doses of phosphorus. The poison that was administrated in the victim's liver pills was detected by its characteristic glow in the dark.

In addition to lethal drug applications, some poisonous plants appeared in Agatha Christie's detective fictions. In "A Pocket full of Rye" (10), the victim was killed with cyanide and taxoides in yew plants. In the novel" The Big Four "(20), one of the victims helped solve the murder by writing in ink "yellow jasmine" on his newspaper before his death. The poison mentioned in the novel was gelsemine, and its source was Yellow Jasmine. Yellow Jasmine also was a plant growing all over the house where the victim died. In the novel "Appointment with Death" (21), it was seen that digitalis (or digoxin), cardiac drug derived from the foxglove plant, was given in lethal doses and by injection.

Coniine, one of the poisons derived from plants, was mentioned in the novel "Five Little Pigs" (22). Coniine had been stolen from a laboratory, and it was found in a glass from which the victim had drunk beer. Like coniine from hemlock, aconitine extracted from monkshood or wolfsbane plant was used as a murder weapon in "4.50 From Paddington/ What Mrs McGillicuddy Saw!" (17) and "They Do It with Mirrors" (23). Nicotine, one of the alkaloid phytotoxins, also appeared as the poison that killed the victims in the novel "Three Act Tragedy" (24).

Another plant mentioned in Christie's novels was Atropa belladonna known as the source of the parasympathomimetic drug atropine. In the novel "A Caribbean Mystery" (25), this drug, which could be hallucinogenic in high doses, was added to the cosmetic ingredients of the victim and caused terrible nightmares. In this novel, as an example of local administration, the death of the

poisoned person did not occur. Interestingly, physostigmine that is the atropine antidote also was used as a murder weapon in the Christie's novel "Crooked House" (26).

Agatha Christie often used her knowledge of toxic substances in her novels written in the 1900s, and prepared her murder fiction in the light of this knowledge. When the novels written by Ahmet Ümit were examined from this point of view, it could be seen that he was interested in toxicology in his recent works. Ahmet Ümit's first detective novel "Fog and Night" was published in 1996. Murder weapons such as knives, iron sticks and pistols appeared in all of his novels. Agatha's poison preparations were replaced by cutting and piercing tools or firearms in the works of Ahmet Ümit.

Ahmet Ümit's novel "İstanbul Hatırası" (*A Memento for Istanbul*) (27) explored serial murders related to the history of Istanbul. The profile of the killer chosen by the author, who also narrated the details of the historical places in Istanbul, was made clear that the murderer had knowledge of medicine. Toxicological analysis of the blood of the victims revealed that an anesthetic substance called propofol, was used to incapacitate the victims, although not used as murder weapon. Propofol was also important in the novel as evidence that caught the killer.

A few years after "İstanbul Hatırası" *(A Memento for Istanbul*) published in 2010, Ahmet Ümit wrote a new novel named "Sultanı Öldürmek" *(To Kill a Sultan)* (28) published in 2012. In this novel, the author focused on a subject much discussed by historians, the death of Sultan Mehmed the Conqueror. The main characters in the novel were two history professors; one of them was killed with a letter opener. The author questioned that the possibility that Sultan Mehmed's death was a murder. He used details of slain professor's research with reference to the Freudian theory of "patricide", and then tried to reveal clues of a possible murder by referring to rumors that Bayezid, first son of Sultan Mehmed the Conqueror, was addicted to opium drugs, and that Sultan Mehmed considered his other son to be the Sultan after him. The history professor, the first victim in the novel, was killed while investigating this issue and making attempts for toxicology analysis. While the main characters of the novel argued that a simple toxicological analysis would be sufficient to clarify the possible murder of Sultan Mehmed, it was observed that the word "toxicology" was emphasized in different parts of the novel and even the short definition of "toxicology" was given.

Another novel by Ahmet Ümit, "Beyoğlu'nun En Güzel Abisi" *(When Pera Trees Whisper)*, published in 2013, told about street children using volatile substances, but the murder had no relation to substance use in the novel. The author returned to the theme of serial murders in the novel "Kırlangıç Çığlığı" (*Swallow's Cry*) (29) published in 2018. Similar to "İstanbul Hatırası" *(A Memento for Istanbul*), he created fiction that the killer had knowledge of drugs in murders involving messages. Ahmet Ümit, who also created a doctor character in "Kırlangıç Çığlığı" *(Swallow's Cry)* (29), described the use of drugs as a misleading element by letting the main character, Chief Inspector Nevzat, say: "The killer must have knowledge of medicine". However, the doctor was not the killer.

In "Kırlangıç Çığlığı" *(Swallow's Cry)* (29), the drug that used by the killer to incapacitate his victims was a neuromuscular blocker named mivacurium. In the novel, the characteristics of this drug were given in detail with the words of the character Zeynep, who was introduced by the author as a criminologist and had knowledge of toxicology. It was predicted that an overdose of the drug paralyzed the victims and killed them in higher doses; after the injection, they were aware of what was going on, but unable to act.

4. Discussion

Agatha Christie's novels show that the author has knowledge of toxicology. In a significant number of his works, she used poison or high-dose drugs as an effective means of murder. It is not surprising that Agatha Christie knew so much about drugs, as she is known to have worked in a hospital during the First World War and to have acquired her knowledge of chemistry here as well (6). In almost every novel she chose a different substance as a murder weapon and used it in her novel fiction in accordance with its physicochemical properties. In the author's novels, it can be seen that poisons thrown into the tea, that is, the hot drink. This is not coincidental; rather it is related to the dissolution properties of substances in hot liquids (30).

Apart from the solubility of the drugs, Agatha Christie also used their other important properties such as being colorless and odorless, or toxic to cause sudden death in low doses (7-10, 17). Strychnine and cyanide as murder weapon could cause sudden death after a single dose. In some of her novels, Agatha Christie used substances such as arsenic and thallium to describe the poisoning of victims as a result of chronic exposures. The findings of poisoning were detailed in the novels, and the preliminary determination of the poison that caused the death was done in this way. An example of this is thallium causing hair loss (18, 31). In addition to the effects of poisons on the body, their physical properties are also presented as evidence in Agatha Christie's novel fiction. In one of

her novels, the victim was poisoned with phosphorus, which was determined by its characteristic glow in the dark. (19).

In Agatha Christie's novels involving poisons or high-dose drugs, it is seen that poisons are often given orally. In addition to substances that may be poison, the author also used toxins and high doses of routine drugs as the cause of death in the novel fiction. The vaccine toxin and Evipan (hexobarbital) given by injection can be cited as an example in terms of both the causative agents and the ways of administration (14). Veronal tablet, which was widely used as a painkiller until the 1950s, is also a drug containing barbiturates and is seen as the cause of poisoning in high doses in Agatha Christie novels. Barbiturates are drugs that can have dose-dependent anesthetic and lethal effects; therefore, their use as a painkiller did not last long (32).

Apart from toxic substances in nature, toxins and high doses of some routinely used drugs, Agatha Christie also appears to have important information about plants that may be poisonous. The phytotoxins mentioned in the author's novels are coniine (hemlock), taxine (yew leaves), atropine (belladonna), gelsemine (yellow jasmine), aconite (wolfsbane) and nicotine. Atropine is a drug typically given as eye drops which is also used to treat certain eye conditions today (33). This drug was locally administered by adding to the victim's cosmetic materials in one of the novels (25). While drugs given by oral or parenteral route have systemic effects, drugs applied locally do not show intense systemic effects, except when skin integrity is impaired, or when applied to the mucosa. In the novel, it could be seen that the victim did not die, despite showing signs of intoxication.

Ahmet Ümit, who took his place among Turkish crime writers with his first detective novel "Sis ve Gece" *(Fog and Night)*, has used historical and social events as well as crime and mystery in his works. The author states that there are no individual crimes that can be the subject of detective novels in Turkey, and that he chooses the subjects from organized crime (5). From this point of view, Ahmet Ümit's novels are not only literary works, but also include important sociological and historical analyses. He has written many detective novels and stories from the late 1990s to the present. "Agatha'nın Anahtarı" *(Agatha's Key),* which includes short crime studies from Turkey, was published in 1999. Agatha's traces are also seen in the first story of his newest book "Aşkımız Eski Bir Roman" *(Our Love is an Old Novel),* published in 2019.

The novels of Agatha Christie, the most widely read books in the 1900s, and Ahmet Ümit's novels presenting crime and social structure at the end of the century, have common features in terms of being translated into many languages. No note on poison or high-dose drug use was found in Ahmet Ümit's works until his book "İstanbul Hatırası" *(A Memento for Istanbul*), published in 2010. In "İstanbul Hatırası" *(A Memento for Istanbul*) (27), the killer character's use of propofol to incapacitate the victims is remarkable in this respect. Like Agatha Christie's barbiturates, propofol is a dose-related anesthetic, and its use is common today in surgery. Propofol, which is also a veterinary drug, is presented in the novel as an evidence to help solve the murder (34).

In relation to propofol mentioned in "İstanbul Hatırası" *(A Memento for Istanbul*) (27), there are details about the pharmacokinetics of this drug as well as the dose-dependent effect. Evidence based on propofol levels suggests that the victims did not resist before they were killed, but because the bodies could not be found in less than 48 hours, it could be not possible to detect the drug in blood. The onset time of propofol, a drug with rapid dispersion (half-life: 2-4 minutes) and rapid elimination (half-life: 30-60 minutes), is also approximately 30 seconds after single parenteral administration. It is a highly lipophilic drug that provides rapid induction of anesthesia (35). Propofol, which is applied into the vein and prepared as a lipid emulsion, is also called "Amnesia milk" because of its milk-like appearance. Propofol, which can cause severe cardiac dysfunction and respiratory failure in high doses, is also known as the drug that caused the death of African-American singer Michael Jackson, known as the "King of pop" in 2009, and the famous singer's death is still under discussion (36, 37).

"Kırlangıç Çığlığı" *(Swallow's Cry)* (29), one of Ahmet Ümit's latest novels, is similar to "İstanbul Hatırası" *(A Memento for Istanbul*) (27) in terms of murder fiction. In this novel, it is seen that the victims were incapacitated by high dose drugs before they were killed. The drug chosen in this novel is mivacurium, a neuromuscular blocker. It is used as an adjunct drug in anesthesia and provides relaxation of muscles in short-term surgical procedures. Its effect begins in approximately 2-3 minutes depending on the intravenous dose, and it is rapidly hydrolyzed by the plasma enzyme cholinesterase. Clinical efficacy lasts approximately 15-20 minutes in adults and the drug's effect disappears within half an hour (38). Mivacurium became more known in 2001 when Vickie Dawn Jackson, a former nurse, killed 10 patients with this paralyzing drug (39). This drug, which can cause death due to apnea and bradycardia at higher doses, can also be toxic and fatal in individuals with pseudocholinesterase deficiency.

Propofol and mivacurium, mentioned in Ahmet Ümit's novels, are seen only as drugs that facilitate murder, although overdoses of the drugs can be lethal. The author's novel "Sultanı Öldürmek" *(To Kill a Sultan)* (28) also contains toxicological assessments and determinations; however, the murder is seen to be committed with a cutting- piercing tool. In this novel, the first victim investigated the death of Sultan Mehmed the Conqueror, and mysteriously died leaving some papers about another mysterious death, the death of the Sultan. The author, who opened the doors of history to the reader while following the murderer, makes references to Franz Babinger's book "Mehmed the Conqueror and His Time" (40). Babinger's book, published in 1953, on the fifth centenary of Istanbul's conquest, mentions that the Conqueror may have been killed by poisoning. In the novel, it is stated that the artist and eminent museum curator Elif Naci suggested opening the Sultan's tomb in 1964 and conducting toxicological analysis, and that the intellectuals of the period did not see any harm in this; however, the matter faded away. The notes of history and the dialogues between the characters created as historians show that there is no consensus on this issue, and also those who think that the possibility of the Sultan being killed should not be discussed at all are not in the minority. If Sultan Mehmed the Conqueror was killed with a metal-like poison, and his body was mummified, it is thought possible to detect traces of poison today.

To date, no evidence has been found that Mehmet the Conqueror was poisoned and no analysis has been done. In the novel "Sultanı Öldürmek" *(To Kill a Sultan)* (28), the author tells about a poem by Aşıkpaşazade, a contemporary chronicler of history, which suggests that the Sultan died as a result of poisoning: *"To whom did the physicians give that fatal vial/ From which the sultan drank, Lacerating his liver (lungs)/ Destroying him, consuming him in toxic fire/ As he fell, he asked why they had slain him/ Leaving him to perish in blood and agony…"* These lines, which Babinger considered as the depiction of poisoning, were not questioned by most of the Turkish historians, and they stated that none of the curatives or medicines was effective and that he died due to illness. Without any evidence, only based on the physical properties of the Sultan, it has been also suggested that Sultan Mehmed the Conqueror had diabetes and his death was caused by diabetic ketoacidosis, because gout disease which was a known illness of the Sultan would not result in such a clinical picture (41,42).

In his novel "Sultanı Öldürmek" *(To Kill a Sultan)* (28), Ahmet Ümit reviews the death of Sultan Mehmed and the Freudian theory of "patricide" through the first victim's research. The relationship between the Sultan's sons, Cem Sultan and Bayezid II, who took the throne in place after dying the Sultan, are mentioned in the novel. It is also mentioned in letters documenting that Bayezid was addicted to opium-like drugs in his youth and therefore apologized to his father. In the novel, Ahmet Ümit includes Babinger's suspicion of poisoning related to the death of the Sultan and likely being his son Bayezid II who killed the Sultan.

In 1966, Tekindağ (43) published his article "Fatih'in Ölümü Meselesi" *(The Question of the Conqueror's Death),* and under the titles "poisoning hypothesis" and "denial of poisoning hypothesis" he emphasized that Babinger's claims were not acceptable, and that the death of Sultan Mehmed the Conqueror was due to gout attack, and it was detailed in the texts of Aşıkpaşazade. The words of Aşıkpaşazade cited by Tekindağ are as follows: "*The cause of his death was the pain in his foot, the physicians were incapable of treating, and they gave şarabı fariğ (a kind of syrup), and he died."* Although there is no information about the content of the drug given to the Sultan, it is known that gout can cause severe pain.

Gout is a disease not only suffered by Sultan Mehmed the Conqueror, but also by the sultans who came after him. It is known that surincan pill containing colchicine or surincan paste was used in the sultans' gout treatment (44). Colchicine is one of the oldest drugs obtained from plants and is currently used in acute gout treatment. It is used in acute attacks until nausea, vomiting or diarrhea begins. Many different types of medicines have pain-relieving properties may be also used in gout attacks. During the Ottoman period, opium was used as a paste and pill because of its painkiller properties. Those who sold opium (*afyon)* and opium preparations, which were also used as pleasantries, were called "*esnaf-ı afyonciyan*". The production opium and its use in the Ottoman Empire were described in the itineraries of European travelers who lived in 16th- 18th centuries. The Turkish opium cultivated in the Aegean region containing high quantity morphine, was regarded in Europe as the best quality of opium (45). Morphine-like opiates are known to have pain-relieving properties, but one of the characteristics is to reduce bowel movements and stop diarrhea.

It is known that Moses Bin Hamon, a Jewish-born physician who had been a palace physician since Bayezid II, treated Sultan Suleiman the Magnificent's gout attacks with opium-containing drugs, and other physicians opposed this treatment method (44). Opium may have been preferred by the Conqueror's physicians in case of a non-stop gout attack because it relieves pain and reduces diarrhea caused by colchicine. Ahmet Ümit illustrates

Table 1. Poisons and drugs mentioned in the novels of Agatha Christie and Ahmet Ümit

POISON/ DRUG	NOVEL NAME	ROUTE	EFFECTS OF POISON/ DRUG
AGATHA CHRISTIE NOVELS			
Cyanide	Sparkling Cyanide	Oral	Headache, dizziness, dispnea and vomiting, seizures, bradycardia, hypotension, loss of consciousness, and cardiac arrest
	Ten Little Niggers	Oral	
	A Pocket Full of Rye	Oral	
	Mirror Crack'd from Side to Side	Oral	
Morphine	Sad Cypress	Oral	Nausea, vomiting, stomach and intestinal spasm, constipation, respiratory depression, pupillary constriction, coma
	Curtain	Oral	
	Death Comes as the End	Oral	
Barbiturates	Lord Edgware Dies	Oral	Headache, paresthesia, speaking and walking difficulties, bradycardia, relaxation of muscles, breathing difficulty and respiratory arrest
	Cards on the Table	Parenteral/Injection	
Strychnine	The Mysterious Affair at Styles	Oral	Restlessness, tremors, tachypnea, muscle spasm, tachycardia, pupillary dilation, cyanosis
Arsenic	4.50 from Paddington	Oral	Acute: nausea, vomiting, burning in mouth and throat, severe abdominal pains, circulatory and heart failure Chronic: weakness, diarrhea, impaired consciousness, nervous system disorder, anemia, and typical lines in nails
Thallium	The Pale Horse	Oral	Acute: nausea, vomiting, diarrhea, neuralgia, paralysis, behavioral disorders Chronic: fatigue, headache, depression, loss of appetite, foot pains, hair loss
Phosphorus	Dumb Witness	Oral	Confusion and respiratory distress, arrhythmia, liver and kidney toxicity (by converting to phosphine gas in the stomach)
Taxsines/ Yew leaves	A Pocket Full of Rye	Oral	Nausea, vomiting, abdominal pain, arrhythmia, bradycardia, hypotension, headache, decreased respiratory rate
Gelsemine/ Yellow Jasmine	The Big Four	Parenteral/Injection	Vomiting, diarrhea, involuntary contractions, vision loss, blindness, paralysis
Digitalis/ Foxglove	Appointment with Death	Parenteral/Injection	Nausea, vomiting, diarrhea, yellow-green halos around objects, headache, lethargy, confusion, coma, bradyarrhythmias
Coniine/ Hemlock	Five Little Pigs	Oral	Headache, ataxia, excessive salivation, and tachycardia; bradycardia, motor paralysis, respiratory arrest (in late stage)
Aconitine/ Wolfsbane, Monkshood	4.50 from Paddington	Oral	Diarrhea, cold sweats, tingling in the body, excessive salivation, dry mouth
	They Do It with Mirrors	Oral	
Nicotine	Three Act Tragedy	Oral	Vomiting, nausea, lethargy, tachycardia, seizures, coma, respiratory arrest and cardiac arrest
Atropine/ Atropa belladonna	A Caribbean Mystery	Local	Hallucinations, short-term memory loss, agitation, respiratory failure, dry skin, fever, tachycardia, cardiovascular arrest (dose dependent)
Physostigmine	Crooked House	Oral	Nausea, vomiting, diarrhea, loss of appetite, dizziness, headache, sweating, seizures, respiratory failure, cardiac arrest
AHMET ÜMİT NOVELS			
Propofol	İstanbul Hatırası (A Memento for Istanbul)	Parenteral/Injection	Short-term sedative hypnotic effect; acute bradycardia, asystole, rhabdomyolysis, respiratory arrest in high doses
Mivacurium	Kırlangıç Çığlığı (Swallow's Cry)	Parenteral/Injection	Short-term neuromuscular blocker and skeletal muscle relaxant; paralysis, loss of consciousness and respiratory arrest in high doses
Opium/ Morphine	Sultanı Öldürmek (To Kill a Sultan)	Oral	Nausea, vomiting, stomach and intestinal spasm, constipation, respiratory depression, pupillary constriction, coma

this point in "Sultanı Öldürmek" *(To Kill a Sultan)* (28) when he states "*For days, the sultan had been battling severe pains in his stomach and the pain was now getting worse. His Persian physician, Hamideddin el-Lari, was the first to treathim, but try as he might, none of the curatives or medicines he administered seemed to have any effect. The sovereign, his face and body contorted in agony, called for Maestro Iacopo, also known Yakup Paşa was dismayed, and told his friend and sultan that el-Lari had given him the wrong medicines. The curatives he had been administered had clogged up his intestines and now there was little that could be done. And unfortunately, Iacopo was right. On the 3rd of May, a Thursday, Fatih Sultan Mehmed, writhing in agony, succumbed to his maladies and breathed his last."* As noted in the novel, medication considered useful was given to the Sultan, but the drug blocked his intestines and poisoned him. This suggests that the opium preparation used as a painkiller may have caused such an effect. If it is thought that opium (or morphine) overdose may have caused the death of the Sultan, it is expected that the lung (not the liver) is the most affected organ (i.e. respiratory depression) along with intestine obstruction. Opiates are known to cause pulmonary hemorrhage (bleeding in the lung) in high doses (46). Aşıkpaşazade's words "*… From which the sultan drank/ Lacerating his liver (lungs)/ destroying him, consuming him in toxic fire/ Leaving him to perish in blood and agony…*" actually indicate that the substance given to the Sultan damaged his lungs (not the liver) and caused a visible bleeding. *"Ciğer"* used by Aşıkpaşazade is a general term for the lungs (*akciğer*) and the liver (*karaciğer*). In English version of the book, this word has been translated as "liver", but it should be "lungs".

Whether Sultan Mehmed the Conqueror was killed by his son Bayezid II or he died due to wrong medicine and his illness is a controversial issue. However, it is known that Ottoman familicide is the subject of many investigations. Ahmet Ümit, in his novel "Sultanı Öldürmek" *(To Kill a Sultan)* (28), tried to find the answer to the question and the possible killer: "Who would benefit from the victim's death?" After the death of Sultan Mehmed the Conqueror, his eldest son Bayezid II became Sultan despite the opposition of the Conqueror's other son, Cem Sultan. Bayezid, whose death also was suspicious, was forced to relinquish his throne under the pressure of his son Selim II. Like his father, Bayezid II is known to be suffering from gout and to be on regular medication, and historical documents on Bayezid's death indicate that he may have been poisoned as well (47).

5. Conclusion

The use of poison and high-dose drugs as a murder weapon is remarkable in Western literature, especially in the works of Agatha Christie.

Agatha Christie has knowledge of the effects of drugs and toxins. There are many examples of pharmacological aspects such as dose-related effects, administration-based effects, antagonistic effects, drug absorption and adverse effects in the author's novels. Similarly, half-life of drugs and dose-related effects have been used in Ahmet Ümit's works.

In Ahmet Ümit's novels, drugs seem to be used to incapacitate the victims, and while high doses may also cause death. In the author's novel about the death of Mehmet the Conqueror, which remains mysterious today, the poisoning has been mentioned, but there is no clear statement regarding the name or content of the poison. As a result, although discussed in Ottoman history, murder by poison can be interpreted as a foreign element in terms of the Turkish conception of crime.

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Research Article

Violence Prediction on Somatization and Emotional Self-Awareness with Machine Learning Methods

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Abstract: **Objective:** This study aims to predict the violent victimization of individuals using the classification of algorithms of supervised learning, one of the methods of machine learning through somatization and emotional self-awareness concepts.

Materials and Methods: This study consisted of 552 participants, 149 (27%) male and 403 (73%) women. Personal Information Form, Somatization Scale and An Emotional Self Awareness Scale-10 (A-DÖFÖ-10) were used as data collection tools in this study. K-Nearest Neighbor, Support Vector Machines, Naive Bayes and Logistics Regression, one of the classification algorithms frequently used in machine learning, were applied.

Results: The performance comparison of the relevant classers was made according to the model performance criteria. Given accuracy and f1-score values, the best classification performance was derived from Logistics Regression with 0.74 accuracy and 0.82 f1-score value.

Conclusions: Accordingly, it is possible to say that the methods of machine learning through somatization and emotional self-awareness concepts can be used to estimate the victimization of violence of individuals at a certain rate of accuracy.

Keywords: Violence, Somatization, Emotional Self-Awareness, Machine Learning

Öz: **Amaç:** Bu çalışma, somatizasyon ve duygusal öz farkındalık kavramları üzerinden makine öğrenmesi yöntemlerinden biri olan gözetimli öğrenmenin sınıflandırma algoritmaları ile bireylerin şiddet mağduriyetlerinin tahmin edilmesi amacını taşımaktadır.

Gereç ve Yöntem: Bu çalışmada, 149 (%27) erkek ve 403 (%73) kadın olmak üzere toplam 552 katılımcıdan oluşmaktadır. Araştırmada veri toplama araçları olarak Kişisel Bilgi Formu, Somatizasyon Ölçeği ve A Duygusal Öz Farkındalık Ölçeği-10 (A-DÖFÖ-10) kullanılmıştır. Makine öğrenmesinde sıkça kullanılan sınıflandırma algoritmalarından K-En Yakın Komşu, Destek Vektör Makineleri, Naive Bayes ve Lojistik Regresyon kullanılmış olup; ilgili sınıflayıcıların performans karşılaştırması model başarım ölçütlerine göre yapılmıştır.

Bulgular: Doğruluk ve f1-skoru değerleri göz önüne alındığında en iyi sınıflama performansı 0.74 doğruluk ve 0.82 f1-skoru değeri ile Lojistik Regresyondan elde edilmiştir.

Sonuç: Bu doğrultuda, somatizasyon ve duygusal öz farkındalık kavramları üzerinden makine öğrenmesi yöntemleri ile bireylerin şiddet mağduriyetlerinin belirli bir doğruluk oranında tahmin edilebildiğini söylemek mümkündür.

Anahtar Kelimeler: Şiddet, Somatizasyon, Duygusal Öz Farkındalık, Makine Öğrenmesi

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1. Introduction

The importance of violence, which is as old as human history, continues concerning individuals and societies today. While the Turkish Linguistic Society defines violence as "the degree of power, intensity, stiffness", "speed", "power arising from a movement" and "brute force", etymologically it is related to the word "şidda(t)" in Arabic and has the meaning of toughness, rigidness and hardship (1,2).

World Health Organization (WHO) defines violence as the intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community that either results in or has a high likelihood of resulting in injury, death, psychological harm, maldevelopment, or deprivation (3,4). It is seen in the literature that there are different types of violence. The WHO has divided violence into three categories as follows: self-directed violence, interpersonal violence and collective violence. Self-directed violence; while it involves self-harm and suicidal behavior, interpersonal violence is seen as family and spouse/partner, group violence, and collective violence is seen as social, economic and political (5,6).

The emergence of acts of violence is classified as physical violence, sexual violence, psychological/emotional violence and neglect/deprivation (4). Physical violence is defined as any kind of attack that harms the integrity of someone else and makes them suffer; It includes several methods, such as slapping, punching, kicking, pushing, biting, bending his arm, squeezing his throat, injuring with a cutting or piercing tool, torturing, burning with fire or boiling water (7). All aggressive behaviors with sexual content are evaluated under the heading "sexual violence" (8), which includes behaviors, such as forcing sexual intercourse with physical strength, threats and intimidation, performing degrading sexual acts, and taking away the right to take measures to protect against sexually transmitted diseases (9). Psychological/emotional violence has been defined as repeated or multiple forms of acts, such as verbal humiliation, following, controlling, limiting one's communication with others and threats (10). Negligence can be defined as the deprivation of the basic needs of the person, such as food, clothing and warming (11). In addition to this classification, it is also necessary to mention economic violence. Economic violence may involve behaviors, such as knowingly stealing money or resources, harming the economic well-being of a partner, controlling the financial situation, pleading for money, not buying basic needs and sabotaging business performance (12).

There are many negative effects of interpersonal violence, both physically and mentally. Physically it has consequences ranging from insignificant injuries to brain damage or even death. There may be possible cases of a decrease in self-confidence, depression, anxiety disorder, post-traumatic stress disorder, sleep disorders, eating disorders, alcohol and substance abuse, self-injury and suicidal behaviors, attention problems and learning difficulties (13, 3). Somatization also appears as a mental result of interpersonal violence.

Somatization can be defined as the expression of mental distress and psychosocial stress with physical symptoms rather than being emotional and cognitive (14). Many theories have been proposed to explain the emergence of somatization. According to one of these, negative childhood experiences contribute to the development of somatization behavior (15). The presence of physical illness or illness behavior in family members and the experiences of the individual about attracting interest and love from the environment through physical complaints and the presence of secondary gains are also factors that support somatization. Especially due to the traumatic experiences of childhood, emotions that cannot be verbalized due to the individuals' limited ability to express their emotional lives are expressed through physical symptoms (14). At this point, it is necessary to consider the concept of emotional self-awareness. Emotional self-awareness requires focusing attention on emotions, thinking on emotional experiences, and making general evaluations about emotions. Individuals who lack the ability to recognize and make sense of their emotions experience difficulties in managing and coping with negative emotions because they cannot evaluate their emotions correctly (16).

In recent years, it has been observed that machine learning methods, one of the phases of artificial intelligence, have been used in research in many fields, including Psychology, Psychiatry and Forensic Sciences. When looking at studies using machine learning methods, Oh, Yun, Hwang & Chae (2017) predicted suicide in over 573 participants. Their findings showed that the general accuracy rate of the model used was found to be 93.7% in one month, 90.8% in one year and 87.4% in lifelong suicide attempts (17). In the studies of Chekroud et al. (2016), the prediction rate was found to be 59.6% in one of the models used for the treatment of depression and 59.7% in the other model (18). In Yöntem and Adem' (2019) study, when the polynomial distribution findings in the Support Vector Machines (SVM) model are examined, it can be seen that automatic thoughts can predict the level of alexithymia to a great extent. This finding shows that it is useful for the treatment of alexithymia within the scope of cognitive-behavioral therapies (19).

Machine learning is defined as programming computers to increase their performance using sample data or

past experience (20). Methods based on machine learning consider the interaction between data units and are also used in classification, diagnosis and protective measures by making statistical inferences (21,22). Supervised learning, which is one of the methods based on machine learning, is used to predict a feature. The property you want to predict can be a category or a numerical value. For this, a relationship between different properties and the target value is investigated through the utilization of previously observed and known data set (23).

This study aims to estimate the violence victimization of individuals with the classification algorithms of supervised learning, which is one of the methods of machine learning through the concepts of somatization and emotional self-awareness. In this context, it is believed that this could work as a guide for the applications to primary healthcare institutions that enables ease in receiving responses regarding the physical complaints and emotional self-awareness of the individuals, and that accelerates the processes to recognize the violent victimization, to identify and inform the judicial authorities and to start the treatment process. This study also aims to provide a resource for future work.

2. Materials and Methods

Ethical Declaration

The participants of this study were contacted after the approval of the Haliç University Ethics Committee dated 31.01.2020 and numbered 8, and Helsinki Declaration rules were followed to conduct this study. The participants were informed about this research before the scales were applied and it was stated that the participation was on a voluntary basis.

The total number of participants was 12,823,598 people. According to the 2018 Turkish Statistical Institute (TÜİK) data (24), they are young adults between the ages of 18-30. When sampling through a simple random sampling method from the universe, 95% confidence interval and 5% error margin was decided to be sufficient for analysis with at least 385 participants. The final research was conducted with 552 people.

Personal Information Form, Somatization Scale and An Emotional Self-Awareness Scale-10 (A-DÖFÖ-10) were used as data collection tools in this study.

Personal Information Form: Personal Information Form was prepared by the researchers to determine the demographic characteristics of the participants. This form includes questions about some variables, such as gender, age, marital status and education level.

Somatization Scale: The Somatization Scale was taken from the items related to the somatization disorder of the Minnesota Versatile Personality Inventory (MMPI). The scale consisted of 33 items in total and was evaluated by Dülgerler (2000). Internal consistency reliability coefficient of the somatization scale (Kuder Richardson-20) 0.83, test-retest reliability coefficient 0.996, test half technique (Split-Half), 1st half alpha value 0.8810, 2nd half alpha value 0.8439, SCL-90-R scale correlation with the scale (Pearson Moments Product correlation coefficient) was found to be 0.80 (Each item in the 25th scale has two choices: “right” or “wrong.” 1-4-5-6-7- 10-11-19-20-21-22-23-26-27- 32-33 is given 1 point when the answer is “right”, 0 point when the answer is “wrong”, 2-3-8-9-12-13 -14-15-16-17-28-24-25-28-29-30-31 is given 1 point when the answer “wrong”, and 0 when the answer is “correct.” Total score is obtained by the sum of the correct and wrong answers. The scores obtained from the scale vary between 0-33. The increase in the total score indicates that the symptoms of somatization are high. According to these data, the somatization scale was determined to be a valid and reliable scale (25).

An Emotional Self-Awareness Scale-10 (A-DÖFÖ-10): According to the reliability and item analysis results for the scale consisting of 10 items, the internal consistency reliability coefficient was calculated as 0.85 in both the female and the male group. The scale is a 5-point Likert type and the range of scores varies between 10 - 50 and the high score indicates the high level of skill for reading and noticing emotions. (16).

In this study, a supervised learning method, one of the machine learning methods, was used. Using the input values, the classification algorithms of the supervised learning method and the victims of violence were estimated. In addition, using the confusion matrix, deductions were made by calculating the accuracy, precision and recall rates. The programming language used for machine learning is Python, and the medium used to write the codes is designated as Spyder in Anaconda.

Classification Algorithms used in this study are as follows:

i. K-Nearest Neighbor (KNN)

The K-Nearest Neighbor rule is one of the non-parametric classifiers. In the K-Nearest Neighbor algorithm, the class of a new sample is determined by calculating the distance from the samples in the current sample, based on a specified k value. The algorithm is expressed as follows:

First of all, the new sample whose class is to be determined is calculated by determining the distance from the other samples. Then the calculated distances are listed.

The smallest figure is selected. Finally, voting is done to determine the class of the new sample.

Let's choose $X = x_1, x_2, x_3, \dots, x_n$ as a sample space, for an arbitrary sample of $x_i \in X$, $a_r(x_i)$, x_i, shows x_i's value of the attribute .

$$d(x_i, x_j) = \sqrt{\sum_{i=1}^{n} \left(a_r(x_i) - a_r(x_j)\right)^2} \qquad (1)$$

the function is used as the distance function (Euclidean distance) for the algorithm in this study. In addition, majority voting was used as the voting in this study, where the most recurring class was the researched class (K = 19 was chosen) (26).

ii. Naive Bayes

Naive Bayes algorithm is a statistical method based on calculating the probability of the effect of each attribute on the result. This algorithm is expressed as follows:

$X = \begin{bmatrix} \overrightarrow{x_1} \\ \overrightarrow{x_2} \\ \vdots \\ \overrightarrow{x_m} \end{bmatrix}$ m times sample set, $\begin{bmatrix} x_{11}\ x_{12} \cdots x_{1n} \\ x_{21}\ x_{22} \cdots x_{2n} \\ \vdots\ \ \vdots\ \ \vdots\ \ \vdots \\ x_{m1} x_{m2} \cdots x_{mn} \end{bmatrix} \in R^{mxn}$

observation matrix consisting of n times attribute and m times data set $c_1, c_2, \cdots, c_k$ sample space class value and if $\vec{x} \in X$ sample taken from sample set and unclassified data set is presented below;

$$P(c_j|\,\vec{x}) = \frac{P(\vec{x}|\,c_j).P(c_j)}{P(\vec{x})}, j = 0,1,2,\dots,k \qquad (2)$$

$$P(\vec{x}|\,c_j) = \prod_{i=1}^{n} P(x_{a_i}|c_j), i = 0,1,2,\dots,n, j = 0,1,2,\dots,k \qquad (3)$$

Unclassified sample class is calculated by the equation:

$$\underset{c_j}{\operatorname{argmax}}\{P(x_{a_i}|c_j).P(c_j)\} \qquad (4)$$

Gaussian method was used in this study.

In the equation μ_{c_j} was assigned the mean, and σ_{c_j} as standard deviation,

$$P(x_i|y_i) = \frac{1}{\sigma_{c_j}.\sqrt{2\pi}}.e^{\frac{-1}{2}\left(\frac{x_i - \mu_{c_j}}{\sigma_{c_j}}\right)^2} \qquad (5)$$

iii. Logistic Regression

Regression Analysis is used to measure relationships between two or more variables, providing descriptive and inferential statistics. The main purpose of the Logistic Regression Analysis is to establish an acceptable model that can define the relationship between dependent and independent variables to achieve the best match with the least variable.

In this study, binary logistic regression, which is the two-category state of the dependent variable, was used. The Logistic Regression Model is expressed as follows:

x_{ik} are the elements of the design matrix, y_i are the elements showing the successes observed in each population, N is the total number of populations, M is the total number of observations, n_i^s are number of observations for i. population and β being parameter vector log-likelihood function is expressed as

$$l(\beta) = \sum_{i=1}^{N} y_i.(\sum_{k=0}^{K} x_{ik}.\beta_k) - n_i.ln\left(1 + e^{\sum_{k=0}^{K} x_{ik}.\beta_k}\right) \qquad (6)$$

β_k's are resolved by taking the first order derivative being equal to zero for each β of this function.

$$\frac{\partial l(\beta)}{\partial \beta_k} = \sum_{i=1}^{N} y_i x_{ik} - n_i \pi_i x_{ik} = 0 \qquad (7)$$

iv. Support Vector Machines (SVM)

Support Vector Machines use the margin as a criterion. Model parameters are written as the weighted sum of the effects of a subset of learning examples, and these effects are defined by an application-specific similarity kernel.

The Logistic Regression Model is expressed as follows:

Let the sample $X = \{x^t, r^t\}$, if $x^t \in C_1$, if $r^t = +1$ and $x^t \in C_2$ ise $r^t = -1$, $w\ ve\ w_0$ .Then parametres

$$r^t(w^T x^t + w_0) \geq +1 \qquad (8)$$

meet the conditions. In the case of linear separation, these two classes of data can be separated by a hyperplane. The aim is to choose the hyperplane that will make the classification error the smallest. For this, a valid w and w0 values should be determined.

$$\min \frac{1}{2}\|w\|^2 \qquad (9)$$

The solution under the constraint of the problem (8) gives the best values of . (20).

In this study, the linear kernel function is used in this algorithm.

Model Success

In this study, the Confusion Matrix was used to measure the success of classification algorithms. The definitions and formulas of the confusion matrix are as follows:

The confusion matrix is roughly; it is a matrix with predicted values on one axis and actual values on the other axis.

The confusion matrix consists of the expressions True Positive, True Negative, False Positive and False Negative.

In fact, if the class classifies the positive model as positive, this condition is named as true positive and false if it is classified as a false negative.

In fact, if the model classifies the negative as a negative model, this is called true negative, if it is classified as positive, it is called false positive.

Table.1 Complexity matrix

	Forecast C_1	**Forecast C_1**
Real C_1	True Positive(TP)	False Negative(FN)
Real C_1	False Positive(FP)	True Negative(TN)

Accuracy: The ratio of the number of correctly classified samples to the total number of samples.

$$Accuracy = \frac{TP + TN}{TP + TN + FP + FN} \qquad (10)$$

Precision: The accuracy rate in the observations that the model classifies in the positive group.

$$Accuracy = \frac{TP}{TP + FP} \qquad (11)$$

Sensitivity (Recall): The accuracy rate of the model in observations that are in the positive group.

$$Recall = \frac{TP}{TP + FN} \qquad (12)$$

f1-score: The f1-score value found by calculating the harmonic average of precision and sensitivity is also used as a model performance indicator (23).

f1-score = 2. (Accuracy. Sensitivity) / (Accuracy + Sensitivity) (13)

$$f1 - score = 2.\frac{Accuracy.Sensitivity}{Accuracy + Sensitivity} \qquad (13)$$

3. Results

The research group in this study consisted of 552 participants, of which 149 (27%) were men and 403 were (73%) women. The ages of the participants ranged from 18 to 30 ($\bar{x}$ = 20.69, SD = 2.68). The average age of male participants was 21.87 ± 2.90, and the average age of female participants was 20.25 ± 2.46.

The findings obtained in this study showed that 309 (77%) of the female participants and 82 (55%) of the male participants were exposed to some type of violence.

I. Data Set

This study consisted of 552 data. Each of these data has 52 features consisting of answers to the questions of the Personal Information Form, Somatization and Emotional Self-Awareness Scales. The cleaned data set inputs, in which the Machine Learning Algorithms would be used are in the size of (552,52), outputs, on the other hand, were in the size of (552,1) (Dataframe), which consisted of the victims of violence.

II. Evaluation

The data set used in this study consisted of 552 data. 33% (183 data) of this data set was reserved for testing, 67% (369 data) for training. Then, the input data in the training and test cluster was standardized. KNN, Naive Bayes, SVM and Logistic Regression models were created with standardized training data. Confusion matrices for each model were obtained from the test data to P-value, showing the number of people who had been subjected to violence and N value showing the number of people who had not been subjected to violence.

Table 2. Confusion matrices from models

P N			**Forecast**	
			P	**N**
KNN	Real	P	113	16
		N	44	10
SVM	Real	P	106	23
		N	30	24
NAİVE BAYES	Real	P	83	46
		N	21	33
Logistic Regr.	Real	P	109	20
		N	27	27

Accuracy, precision, sensitivity and f1-score values were obtained for each model with data in confusion

matrices. Considering the accuracy and f1-score values, the best classification performance was obtained from Logistic Regression with 0.74 accuracy and 0.82 f1-score value.

Table 3. Model success values

Method	Accuracy	Precision	Sensitivity	f1-score
KNN	0.67	0.72	0.88	0.79
SVM	0.71	0.78	0.82	0.80
Naive Bayes	0.63	0.80	0.64	0.63
Logistic Regr.	0.74	0.80	0.84	0.82

4. Discussion and Conclusion

This research was conducted to estimate the victims of violence with the classification algorithms of supervised learning, which is one of the methods of machine learning through the concepts of somatization and emotional self-awareness. K-Nearest Neighbor, support vector machines, Naive Bayes and logistic regression were used, which are frequently used in machine learning. Performance comparison of the related classifiers was made according to model performance criteria. When these performance criteria are examined, the highest values are obtained from logistic regression.

An average accuracy rate between 70% and 74% is measured in a meta-analysis study (Singh, Grann & Fazel, 2011) (27). Blair, Blattman and Hartman (2015) concluded in their research that their models using 2008 risk factors predicted 88% of the violence in 2012 (28). Menger, Scheepers and Spruit (2018) described the 78% accuracy rate that they had reached in assessing the risk of violence as promising (29). In case of this study, a 74% accuracy rate is observed as the estimated rate of violence.

In line with the findings of this research, it is possible to say that, in accordance with the literature, somatization, which is a psychological result of violence, and the lack of skills to recognize and make sense of emotions, the classification algorithms of supervised learning, which is one of the methods of machine learning through emotional self-awareness concept, can be estimated at a certain accuracy rate. To our knowledge, although there is no study on the prediction of violence through the concepts of emotional self-awareness and somatization in the literature, there is a parallel accuracy rate with studies having similar purposes. In this context, during the applications of physical complaints to health institutions, with the knowledge that it is possible to obtain answers about the emotional self-awareness of people, the method could be used to help identify whether they are the victim of violence. At the point of being noticed, it may be possible to have more detailed interviews about the violence experience, to make a diagnosis and to start the treatment process as soon as possible. If there is a need to report to judicial authorities, the legal process can be accelerated. Furthermore, it will also be possible to identify and prevent those who are at risk of victimization. In this respect, this research focuses on the importance of prevention strategies.

Considering the frequency of violence events both in the world and in our country, as well as because there are barriers that prevent individuals to verbalize and/or report when they are victims of violence, it is significant to realize and make necessary interventions. Violence can only be prevented through active consciousness, determination of needs and application of necessary procedures.

In this study, violence is evaluated only on emotional self-awareness and somatization dimensions. In the future, it is suggested that conducting research on other observable results of violence on the subject proves beneficial. Furthermore, increasing the number of data and samples can help increase the accuracy rate estimation.

The present study aims to reveal the victims of violence, to contribute to both future studies and prevention activities and to be guiding. However, 73% of the individuals participating in this study were female, and 27% were male, making it challenging to compare between genders. In future research on the subject addressed here, it would be appropriate to have a close number of male and female participants. It is also assumed that it would be appropriate to include different age groups. Additionally, it is suggested that while this research focuses only on whether the victim is exposed to any type of violence, future work on different types of violence will also be useful.

Finally, we should note that the contribution of machine learning together with technological developments to our life will contribute to many areas, including Psychology, Psychiatry and Forensic Sciences.

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Adli Tıp Bülteni

Research Article

Age-Related Metric Changes in Ear Size and Position

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Abstract: **Objective:** In the field of identification, the effects of age on the face have always been an interesting subject, especially concerning age estimation. Although there are many studies on this subject with front face images, the profile (side face) images, especially the ear studies, are insufficient, which remained under-researched., in this study, we aimed to examine the changes in human face profile and ear with age and contribute to future age estimation studies in the literature.

Materials and Methods: Data regarding human face profile and ear that provide statistically significant results were included in this study. Within the statistically significant data, the values that showed a continuous increase/decrease with age focused on seeing how the effects of age on the face are. Linear regression analysis was performed using 19 anthropometric points (landmarks) together with profile face and ear area measurements.

Results: A total of 369 volunteers' profile images and ear images (166 female, 203 male) were gathered in this study. Profile face and ear measurements were taken and analyzed in ImageJ. It was observed that the continuous increase in profile and ear measurements was in the ear in women. Similar to women, an increase in ear size was observed in men, as well as an enlargement in the auricle.

Conclusion: According to the data, the findings suggest that in a forensic case, when the age is estimated from the human facial images, the profile image and the ear image can be helpful in cases where the front image cannot be obtained. If more data and parameters are used in future studies, more successful results can be obtained.

Keywords: Age Estimation; Forensic Sciences; Anthropometry; Biometry; Ear; Identification.

Öz: **Amaç:** Kimliklendirme alanında özellikle yaş tahmini açısından yaşın yüze etkisi her zaman ilgi çekici bir konu olarak görülmektedir. Konuyla ilgili ön yüz görüntüleriyle yapılmış çok sayıda çalışma bulunmasına rağmen profil ve özellikle kulak ile ilgili çalışmalar yetersiz kalmaktadır. Dolayısıyla bu çalışmada, insan yüz profilinde ve kulakta yaşla birlikte meydana gelen değişikliklerin metrik olarak incelenmesi ve ileride yapılacak yaş tahmin çalışmalarına katkı sağlanması amaçlanmıştır.

Gereç ve Yöntem: Elde edilen değerlerden istatistiksel olarak anlamlı sonuç verenler çalışmaya dahil edildi ve bunların içinde, yaşın yüze etkisinin ne yönde olduğunu görebilmek için yaşla birlikte sürekli artma/azalma gösteren değerlere odaklanıldı. Yan yüz ve kulak alan hesaplamalarıyla birlikte, 19 antropometrik nokta kullanılarak doğrusal mesafe ölçümleri alındı.

Bulgular: Çalışmada 166 kadın, 203 erkek olmak üzere 369 gönüllünün yan yüz ve kulak görüntüleri üzerinden ImageJ programıyla ölçüler alındı. Kadınlarda yan yüz ve kulak üzerinden alınan ölçüler içinde sürekli artışın kulakta olduğu gözlendi. Erkeklerde de kadınlara benzer şekilde kulak boyutunda artış gözlenmekle birlikte kulak kepçesinde de genişlenme olduğu belirlendi.

Sonuç: Çalışmada elde edilen verilere göre, adli bir vakada kişilerin yüz görüntüsü üzerinden yaş tahmini yapılırken, ön yüz görüntüsünün elde edilemediği durumlarda profil görüntüsü ve kulak için yardımcı olabilecek nitelikte oldukları söylenebilir. Gelecek çalışmalarda veri sayısının ve parametrelerin artırılması halinde daha başarılı sonuçlar elde edilebilir.

Anahtar kelimeler: Yaş Tayini; Adli Bilimler; Antropometri, Biyometri; Kulak; Kimliklendirme.

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Conflict of Interest

The authors declare that they have no conflict of interests regarding content of this article.

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Ethical Declaration

Permission was obtained from the Istanbul University Cerrahpasa, Medical Faculty Clinical Research Ethics Committee for this study, and Helsinki Declaration rules were followed to conduct this study.

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1. Introduction

Human shows different forms of aging on different ages. However, there are general changes and similarities during aging. Skin aging is the most understandable change in aging. During the first growth and development of the face, the biggest change consists of the craniofacial region (1).

When a person's age is found suspicious by legal authorities, they can ask age estimation. Nowadays, any age estimation method can accurately detect the chronological age (2). Since the difference between calendar age and medical age increases as the person gets older, the error rate can be up to 10 years (3).

Whether or not identification can be made from a visible part of a person's body is an issue that has been explored for years (4). Ear is a significant feature because it has been used in forensic science for years due to its shape, cartilaginous structure, and specificity of the auricle tissue (5,6). Since ear does not change much with facial expression and head movements, it has some advantages over identification concerning the face (7).

The most common method used in studies is ear images. The human ear grows comparatively throughout life. Although ear shape applications are not widely used, it is interesting for crime research. On the other hand, there is no standardized and generally accepted description used for the ear, unlike the face. We can remember people from their faces, but it is quite difficult to remember from their ears (8).

The effect of age on the face is an interesting subject for years. Different methods have been used for this subject. Although many studies are conducted with the front face images, the profile and especially the ear research are insufficient. Thus, in this study, we examined the changes that occur with age on the human face, especially on the ear.

2. Materials and Methods

2.1. Sample Group

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Permission was obtained from the Istanbul University Cerrahpasa, Medical Faculty Clinical Research Ethics Committee for this study, and Helsinki Declaration rules were followed to conduct this study.

The data obtained in this study were from166 female, 203 male, 369 participants who were randomly selected from the Marmara Region. Height and weight information and Body Mass Index (BMI) of the 369 volunteers were measured, and the participants in the obesity group, they were excluded from this study. After that, this study was completed using the data of a total of 345 participants, including 151 female participants and 194 male participants. Volunteers ages were divided into five groups, as follows: 18-28, 29-38, 39-48, 49-58, 59-68+. The number of people in these age groups is given in Table 1 with their gender information.

2.2. Methods

Volunteers' front and profile photos were taken in the amateur studio by one of the researchers in this study. The tools used in the studio were as follows: Elinchrom D-Lite-4 for lighting in the studio; Fancier 532 tripod to fix the camera; a white curtain to create white background; Nikon D5100 (18-55 mm lens) to take the photographs of the volunteers; hydraulic rotating stool, so that they could sit down during the photo shoot; digital scale with height meter for weight and height measurements. The purpose of this study was explained to the volunteers, and to record the information, the questionnaire form was filled, and informed consent forms were signed. Volunteers' height and weight measurements were taken first; then, the face photos were taken at a distance of 1 m, with 800 ASA and 50 mm flat lighting. Measurements on the images were taken by the ImageJ 1.50i (9).

Anthropometric Landmarks and Field Information Used in this Study

Otobasion superius (Obs): It is the connecting point of the helix in the temporal region and determines the upper border at which the ear meets the face (10).

Otobasion inferius (Obi): It is the point of attachment of the ear lobe to the cheek. Determines the lower border at which the ear meets the face (10).

Nasion (N): The point where the nasal bone meets the median sagittal line and forehead bone (11).

Gnathion (Gn): The lowest point in the median sagittal line in the lower jaw (11).

Pronasal (Prn): The most protruding point of the nose tip on the median sagittal line to the front (11).

Glabella (Gl): The point between the two eyebrows that protrudes forward in the median sagittal line (11).

Supramental (Sm): The deepest point of the concavity extending from the bottom of the lower lip to the chin (12).

Tragus (T): The part protruding in front of and above the auditory canal (13).

Superaurale (Sa): The highest point of the auricle (11).

Subaurale (Sba): The lowest point of the auricle (11).

Postaurale (Pa): The most outer point of the curvature of the auricle backwards (11).

Preaurale (Pra): The front of the ear. Positioned at the level of helix attachment to the head (14).

Intertragic notch (İntno**):** Deep notch between the Tragus and antitragus (intertragic notch) (15).

Ear rectangular area (ERA): Using the 'rectangular' selection tool in the ImageJ, using Obs and Obi landmarks, whichever is more external; Sa above; on the outside Pa; Sba points at the bottom are accepted as the boundary, the ear is placed in the frame and the area is calculated.

Ear polygon area (EPA): Obs, Sa, Pa, Sba, Obi and T landmarks on the ear were used for polygonal calculation. The area of the polygon obtained with the lines drawn between the placed points was calculated.

Linear distance measurements taken using the given anthropometric landmarks were handled in four different groups:

Distance between profile landmarks and Tragus: T-Gl, T-N, T-Prn, T-Sm, T-Gn (Figure 1).

Distance between the landmarks on the ear and Tragus: T-Obs, T-Sa, T-Sba, T-Obi (Figure 2).

Distances between the landmarks on the ear: Obs-Obi, Sa-Sba, Sa-Pa, Pa-Sba, Obi-Sba, Obi-Pa, Intno-Obi, Intno-Sba, Pra-Pa (Figure 3).

Ear area measurements: Ear Rectangle Area (Figure 4) and Ear Polygon Area (Figure 5).

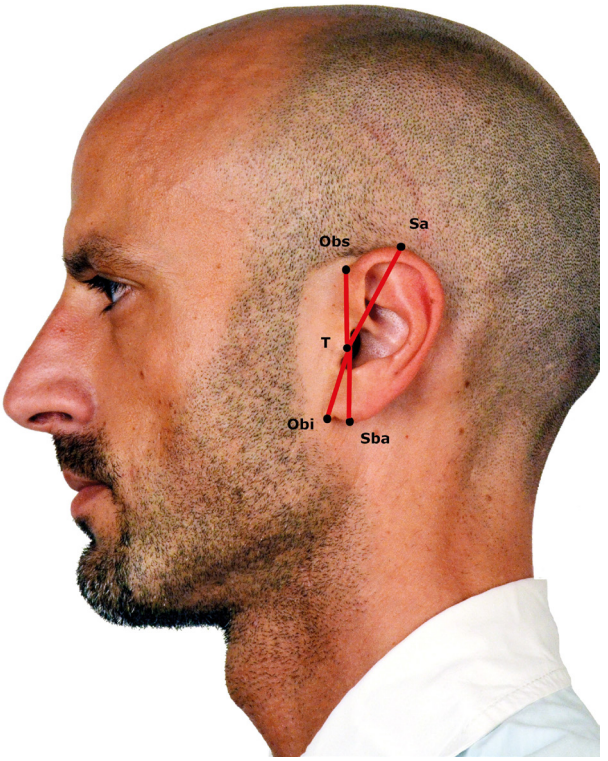

Figure 2. T-Obs, T-Sa, T-Sba, T-Obi (Distance between the ear and Tragus) [Published with the permission of the participant]

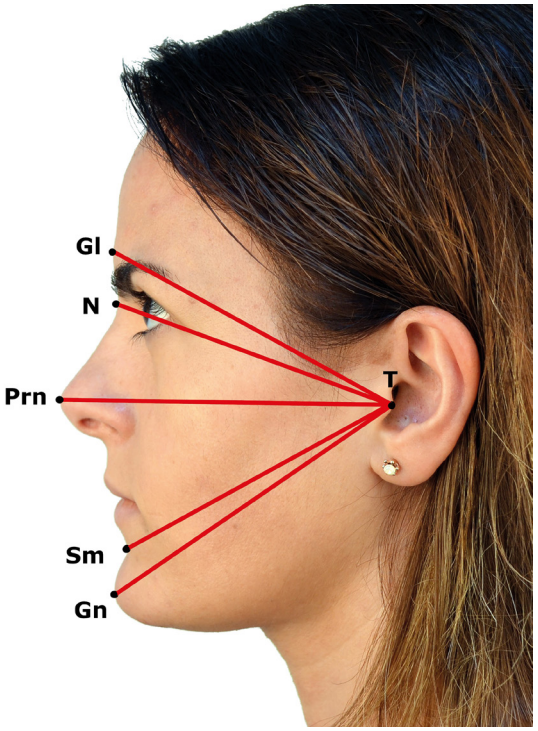

Figure 1. T-Gl, T-N, T-Prn, T-Sm, T-Gn (Distance between profile points and Tragus) [Published with the permission of the participant]

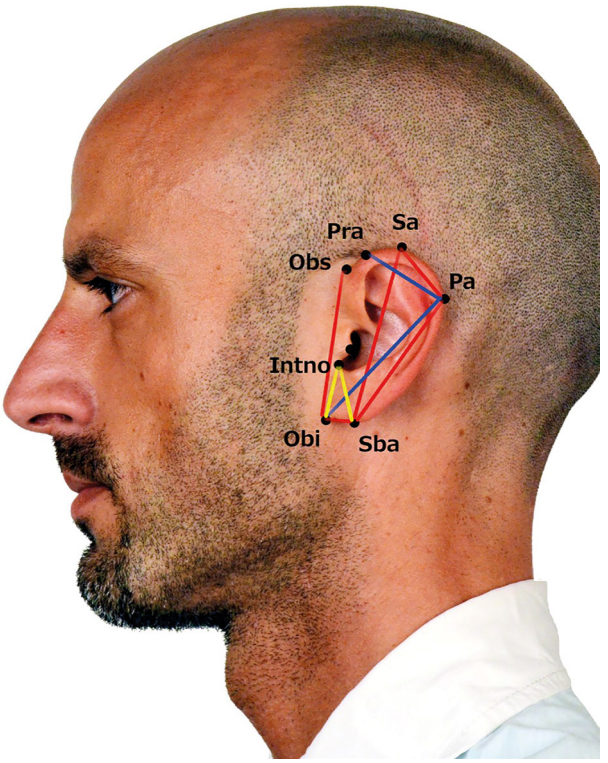

Figure 3. Obs-Obi, Sa-Sba, Sa-Pa, Pa-Sba, Obi-Sba, Obi-Pa, İntno-Obi, İntno-Sba, Pra-Pa (In-ear measurements) [Published with the permission of the participant]

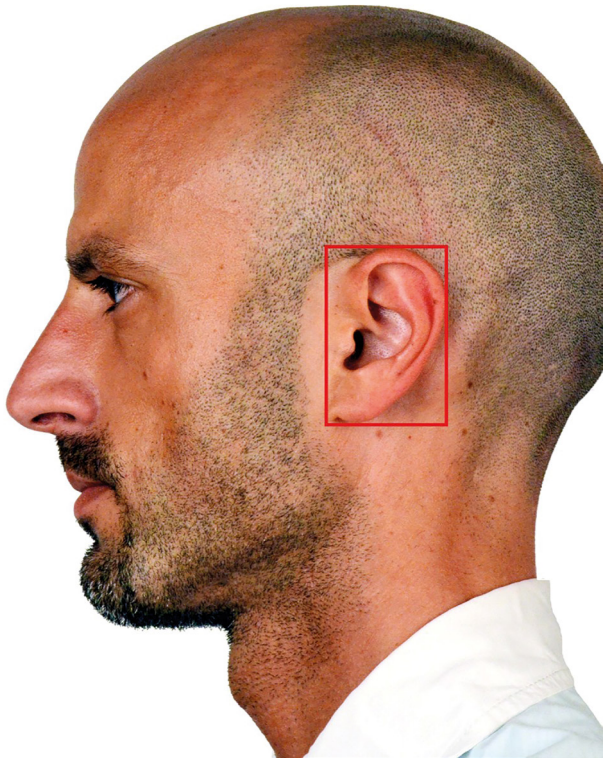

Figure 4. Ear Rectangle Area [Published with the permission of the participant]

Figure 5. Ear Polygon Area [Published with the permission of the participant

2.3. Statistical Analysis

ANOVA analysis was performed to compare measurement averages together with descriptive analyzes giving the number of volunteer participants in age groups. Post hoc tests for the groups that differed by ANOVA analysis were completed using the Tukey test. SPSS 20.00 (Statistical Package for the Social Sciences) was used for statistical analysis.

3. Results

In this study, after excluding data from a group of volunteers due to obesity, the information of 151 female, 194 male, a total of 345 volunteers was included, and the age groups and gender distribution are shown in Table 1.

Table 1. Distribution of participants by age groups and genders

Age groups	Female		Male	
	N	%	N	%
18-28	35	23,2	36	18,6
29-38	32	21,2	43	22,2
39-48	28	18,5	45	23,2
49-58	27	17,9	33	17,0
59-68+	29	19,2	37	19,1
Total	151	100,0	194	100,0

The average height of female volunteers was 161,77 cm, the average weight was 64,30 kg; the average height of male volunteers was 174,70 cm and the average weight was 81,90 kg (Table 2).

Table 2. Height and weight information of the volunteers with gender

	Height		Weight	
	Mean	S.D.	Mean	S.D.
Female	161,77	6,292	64,30	11,414
Male	174,70	7,425	81,90	12,471

The averages of female volunteers' measurements by age groups are given in Table 3. No statistical significance was observed in Profile-Tragus measurements in female ($P<0,05$) participants. However, all measurements in the Ear-Tragus, in-ear points and ear areas groups differed by age groups (Table 3).

In the measurements taken from male volunteers, there was a significant difference ($P <0,05$) in all measurement groups (Profile-Tragus, Ear-Tragus, In-ear measurements, Ear area) by age groups (Table 4).

Results related to measurements between Profile-Tragus Landmarks

There was no significant difference found in female all measurements, but a significant difference was found in all measurements in male participants (Table 4). In post hoc analysis, for male, 59-68+ age group were not different from the age group of 49-59 (P=0,583) in the measurements between Tragus-Supramental, and higher than all the other groups (age groups from young to adult, P= 0,004; 0,019; 0,007, respectively). Again, in the 59-68+ age group, it was observed that it was higher than for the distance between Tragus and Gnathion from 39-48 age group (P=0,038), for the distance between Tragus and Pronasal, from both 18-28 (P=0,018) and 39-48 age group (P=0,030), for the distance between Tragus and Glabella only from 18-28 age group (P=0,048) (P<0,05). Although in ANOVA analysis, there was a difference in the measurements between Tragus and Nasion, there was no difference between groups in post hoc analysis (Tables 3, 4).

Results related measurements between Ear-Tragus Landmarks

18-28 age group values were significantly (P<0,05) lower than 59-68+ age group in female (P=0,012) and 49-58 age group in male (P=0,029) participants for the distance between Tragus and Superaurale. There was no difference between other age groups in both genders.

It was found that the measurement between Tragus and Subaurale in 59-68+ age group in female participants was significantly higher than all age groups (P=0,000 in all other age groups) (P<0,05) except the 49-58 age group (P=0,078). Again, the 49-58 age group was higher than the groups under 38 in both genders (P=0,000; 0,003 in female; P=0,000; 0,002 in male) (P<0,05).

59-68+ age group in female participants was higher than 18-28 (P=0,000) and 39-48 (P=0,002) age groups; 59-68+ age group in males was higher than all the age groups in the measurements between Tragus-Otobasion superior landmarks. Also, in male, the 49-58 age group measurements were higher in the 18-28 (P=0,000) and 39-48 age groups (P=0,043) (P<0,05).

59-68+ age group in female was higher in the measurements between Tragus-Otobasion inferior landmarks from all the other groups (P=0,000; 0,001; 0,031; 0,032, respectively) (P<0,01-0,05). Groups over the age of 39 did not differ among themselves; however, they were found higher than the age groups 18-28 (P=0,000) and 29-38 (P=0,014) in male (P<0,01 – 0,05) participants.

Results Related Measurements between the In-ear Landmarks

Distances between the Otobasion inferior-Otobasion superior and Otobasion inferior-Intertragic notch in the 59-68+ age group (P=0,000; 0,001; 0,003; 0,002, respectively for Obs-Obi and P=0,000; 0,000; 0,001; 0,012, respectively for Intno-Obi) was higher than all age groups

Table 3. Average values and standard deviations of ear measurements by age in female

Measurements groups	Measurements	18-28		29-38		39-48		49-58		59-68+		P
		Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	
PROFILE-TRAGUS	T-Gl	151,34	10,47	150,13	10,91	151,73	11,10	153,31	11,27	154,26	11,89	0,633
	T-N	138,53	11,28	136,76	10,18	139,33	12,33	142,20	12,39	141,76	11,86	0,345
	T-Prn	162,60	12,97	158,24	12,04	160,80	13,58	163,11	13,78	162,70	11,93	0,548
	T-Sm	148,85	12,44	142,13	12,06	144,02	12,95	147,54	11,64	147,88	11,91	0,145
	T-Gn	157,10	12,59	151,88	13,14	153,60	12,84	156,75	11,05	158,08	12,94	0,259
EAR-TRAGUS	T-Obs	35,86	3,81	37,36	3,07	36,15	3,37	37,39	4,17	40,25	5,39	0,000
	T-Sa	50,91	4,93	51,59	3,44	51,29	4,05	54,54	4,62	54,76	5,61	0,001
	T-Sba	32,38	3,65	33,94	3,91	35,51	4,78	37,98	3,76	40,85	4,60	0,000
	T-Obi	27,16	4,57	28,39	4,57	29,54	5,48	29,51	4,94	33,44	5,55	0,000
IN-EAR	Obs-Obi	60,48	6,29	62,42	6,01	62,77	6,70	62,50	9,30	70,16	8,87	0,000
	Sa-Sba	80,72	6,93	83,03	6,05	84,09	7,65	89,89	6,88	94,09	8,44	0,000
	Pa-Sba	37,97	7,17	37,57	7,57	35,67	3,96	38,97	6,32	43,55	6,77	0,001
	Obi-Sba	10,02	3,32	10,53	3,71	10,52	3,93	13,21	4,37	13,16	5,24	0,003
	Obi-Pa	62,22	7,29	64,34	8,30	65,80	8,33	68,27	9,93	70,43	8,02	0,002
	Intno-Obi	19,55	3,68	20,82	4,61	21,64	4,65	22,49	4,27	26,56	6,06	0,000
	Intno-Sba	26,08	2,97	28,28	3,60	28,51	4,39	31,10	3,32	34,14	4,81	0,000
	Pra-Pa	47,30	3,94	48,61	5,42	46,56	5,14	48,99	4,76	52,66	6,58	0,000
EAR AREA	ERA mm2	4113,63	613,97	4378,51	590,75	4437,04	773,55	4995,76	779,88	5265,96	899,25	0,000
	EPA mm2	2377,39	319,87	2469,08	283,26	2526,57	420,22	2761,97	374,82	2954,23	562,20	0,000

in female participants and there was no significant difference between the other age groups (P<0,05). The distance between Preaurale and Postaurale was only in the 59-68+ age group from other groups in female (P=0,001; 0,028; 0,000, respectively); it was higher than the groups under the age of 39 in male (P=0,000; 0,027, respectively) participants.

In both genders, distances between Intertragic notch-Subaurale was different in the 59-68+ age group (P=0,000; 0,000; 0,000; 0,029, respectively in female; P=0,000; 0,000; 0,003 respectively in male); the distance between Superaurale and Subaurale was different in all groups under the age of 49 (P=0,000 in both genders). Also, it was higher than the 49-58 age group in female in all groups except the 59-68+ age group (P=0,000; 0,004; 0,036, respectively); in male, in the groups under the age of 39 (P=0,000; 0,013) (P<0,05).

In the female participants, the measurements between Postaurale and Otobasion inferior, in 49-58 age group was higher than 18-28 age group (P=0,045); 59-68+ age group was higher than the groups under the age of 39 (P=0,002; 0,044, respectively) (P<0,005 – 0,05).

In the male participants, the distance between Otobasion superior-Otobasion inferior was lower in the 18-28 age group than all age groups (P=0,045, respectively, and P=0,000 in the other three groups); in the 29-38 age group, it was lower than the two groups over the age of 49 (P=0,003; 0,004, respectively) (P<0,005 – 0,05). While the distances between Superaurale- Subaurale (P=0,000 in two groups over the age of 49 in the age group 18-28; P=0,013; 0,000 in the age group of 29-38, respectively), Intertragic notch-Otobasion inferior (18-28 age group in all groups above the age of 39 P=0,000; 29-38 age group above the age of 39 P=0,013; 0,001; 0,003, respectively) and Intertragic notch-Subaurale were smaller in the 18-28 age group than the older groups (P=0,000) and in the 29-38 age group was smaller than over the age of 49 (P=0,000) (P<0,005 – 0,05), no difference was found between the groups above the age of 49 (P<0,05). For this last measurement, the 59-68+ age group was higher than the 39-48 age group (P=0,003) (P<0,05).

In female, the distance between Otobasion superior and Otobasion inferior was higher in the 59-68+ age group compared to other groups (P=0,000; 0,001; 0,003; 0,002, respectively). In 59-68+ age group, the distance between Superaurale and Subaurale was higher than the all groups except 49-58 age group (P=0,000); in the 49-58 age group, it was higher in all younger groups (P=0,000; 0,004; 0,036, respectively). In the 59-68+ age group, the distance between Intertragic notch-Otobasion was inferior compared to all other groups (P=0,000; 0,000; 0,001; 0,012, respectively); the distance between the Intertragic notch-Subaurale in the 49-58 age group from the under the age of 39 (P=0,000; 0,045, respectively); in the 59-68+ age group, it was higher than all groups (P=0,000; 0,000; 0,000; 0,029, respectively) (P<0,05).

The distance between Otobasion inferior-Subaurale in female was higher in both groups over the age of 49

Table 4. Average values and standard deviations of ear measurements by age in male participants

Measurements groups	Measurements	18-28		29-38		39-48		49-58		59-68+		P
		Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	
PROFILE-TRAGUS	T-Gl	153,26	13,39	154,29	11,90	154,32	11,68	159,68	11,27	160,93	10,65	0,012
	T-N	140,75	12,70	142,03	11,56	142,61	11,16	146,46	11,25	147,82	10,10	0,042
	T-Prn	163,10	13,58	165,06	13,23	164,16	11,37	169,85	12,84	172,51	12,98	0,006
	T-Sm	148,47	12,07	150,18	12,10	149,41	10,18	154,30	12,15	158,50	13,22	0,001
	T-Gn	161,10	11,12	161,90	12,92	161,17	10,45	165,92	11,75	168,69	12,60	0,017
EAR-TRAGUS	T-Obs	39,47	3,94	41,86	3,03	41,78	3,77	44,11	3,38	43,72	3,86	0,000
	T-Sa	54,47	5,18	56,04	3,90	54,96	4,94	57,95	4,76	57,52	5,58	0,008
	T-Sba	34,16	3,55	35,32	4,21	37,96	4,35	39,45	4,54	42,97	6,21	0,000
	T-Obi	27,65	4,89	28,99	4,50	32,48	5,06	32,45	4,94	32,50	4,99	0,000
IN-EAR	Obs-Obi	63,43	6,50	67,61	6,23	71,00	7,04	73,25	6,58	72,98	6,67	0,000
	Sa-Sba	85,89	6,83	88,90	6,41	90,10	8,12	94,65	7,42	98,60	9,28	0,000
	Pa-Sba	67,58	10,63	68,64	8,92	69,73	9,48	73,13	11,12	76,41	8,56	0,001
	Obi-Sba	10,86	3,09	10,94	3,19	10,69	3,78	12,98	3,97	14,72	5,31	0,000
	Obi-Pa	67,83	9,68	69,40	8,42	71,03	8,53	74,24	10,42	74,53	7,35	0,004
	Intno-Obi	20,14	4,42	21,56	4,69	24,67	4,85	25,73	5,01	25,30	3,34	0,000
	Intno-Sba	27,48	3,43	29,05	3,66	31,46	3,79	33,27	4,53	34,90	5,66	0,000
	Pra-Pa	46,47	6,36	48,83	6,40	49,28	5,79	50,79	6,62	53,10	6,45	0,000
EAR AREA	ERA mm2	4544,29	697,10	4786,64	740,18	4935,57	943,22	5509,41	833,82	5690,62	967,50	0,000
	EPA mm2	2600,99	424,93	2734,12	425,34	2793,18	463,83	3115,75	538,64	3209,55	545,24	0,000

compared to the 18-28 age group (P=0,025; 0,024, respectively); the distance between Postaurale-Subaurale was higher in both groups over the age of 49 compared to the 18-28 age group (P=0,005; 0,001, respectively) (P<0,005 – 0,05). In the distance between Postaurale and Otobasion inferior, two groups over 49 were higher than the 18-28 age group (P=0,045; 0,002, respectively); it was also higher in above the age of 59 than the age group of 29-38 (P=0,044) (P<0,05). In the distance between Preaurale and Postaurale, for the 18-28, 29-38 and 39-48 age groups were smaller than the 59-68+ age group (P=0,002; 0,028; 0,000, respectively) (P<0,05-0,005).

The distance between Otobasion inferior-Subaurale was higher than all groups (P=0,000) above the age of 59, except the 49-58 age group in male. The distance between Postaurale- Subaurale was higher above 59 years of age than all groups (P=0,001; 0,004; 0,020, respectively) except the 49-58 age group. The distance between Postaurale and Otobasion inferior was lower in the 18-28 age group than over the age of 49 (P=0,025; 0,013). In the same way, the distance between Preaurale and Postaurale as lower in the 18-28 age group than over the age of 49 (P=0,040; 0,000) and also over the age of 59 was bigger than 29-38 age group (P=0,027) (P<0,05).

Results of the Ear Area Measurements

There were no differences in the ear polygon and ear rectangular area measurements for both female and male participants in two groups over the age of 49, and the values in these two groups were larger than the other age groups (P<0,05 – 0,001). The the female ear rectangular area in the 59-68 age group was larger than other groups, except the 49-58 age group (P=0,000); in the 49-58 age group, it was also larger than other groups, except over the age of 59 (P=0,000; 0,014; 0,047). The ear polygon area was also larger in the 59-68 age group than the other groups, except the 49-58 age group (P=0,000; 0,000; 0,001, respectively); in the 49-58 age group, it was larger than the other groups, except over the age of 39 (P=0,002; 0,047, respectively). The male ear rectangular area was larger in the 59-68 age group, except for the 49-58 age group (P=0,000; 0,000; 0,001, respectively); in the 49-58 age group, it was also larger than the other groups, except over the age of 59 (P=0,000; 0,003; 0,028, respectively). The ear polygon area was larger in the 59-68 age group than the other groups, except the 49-58 age group (P=0,000; 0,000; 0,001, respectively), in the 49-58 age group was also larger than the other groups, except over the age of 59 (P=0,000; 0,007; 0,030, respectively) (P<0,05).

4. Discussion

In regional studies on human face images, the ear is an important parameter because it is unique, it can be used with different methods (e.g., earprints and ear images) and it can be used concerning identification on the faces that are tried to be hidden in the security cameras and on the face viewed from the side.

For the first time in the 18th century, Lavator started to examine the ear by illustrating the ears of the people in his reports. In 1894, Bertillon used the earprint for identification and tried to reveal the characteristic features of the ear with anthropometric measurements. In 1906, Dr. Imhofer revealed all the characteristic features of the ear and permission of the earprint to be used in identification. The ear was used for the identification of a criminal for the first time in 1965. Iannarelli compared ten thousand earprints in 1989 and determined that they were different from each other. In later years, especially in forensic cases, the ear continued to be used as a parameter (16).

Today, such studies are tried to be developed by producing novel methods with technology. The importance of ear in forensic science has been increasing in recent years. Thus, in this study, especially by taking many measurements on the ear, its relationship with age was examined and tried to contribute to the literature.

Nabiyev (17) defended that the success rate in identification will increase when information about ear used with other features, such as nose, lips and forehead. Sforza et al. (18) stated that age-related growth/enlargement was observed more frequently in the ear during the aging process.

In this study, similarly, the statistical significance rates (P<0,05) of ear measurements resulted better than face profile measurements. While the *Tragus* was fixed point, the lateral measurements (Profile-Tragus) taken from the profile did not show any statistical significance with age in female participants, but the difference was observed in all age groups in male (P<0,05) participants. An increase was observed with age in profile dimensions, especially due to soft tissue sagging. It can be seen that the ear moves downward with age by the increase in the Glabella-Tragus and Nasion-Tragus distances of the profile (lateral measurements) in male.

Sforza et al. (18) stated that the ear length in 15-17 age group girls was slightly higher than the adult group values and found that the ear length in both genders developed more than the ear width. Gualdi-Russo (19) stated that the ear size and ear area develop faster than ear width. In the study conducted in the Caucasians, the ear length was found to be 65 mm on average in males between the

ages of 21-65 (20), Özkoçak (21) stated that ear length is higher than Caucasians and increases with age.

In this study, in female, there is a significant difference observed in the ear length, ear lobe length and ear width in their 60s age compared to other age groups. While ear lobe length did not differ among female in young age groups, it increased in 60s ages compared to other groups. The ear length and ear lobe length increased up to the age of 50s, after which this increase almost stopped in male. Moreover, ear width has increased from the age of 60s compared to other age groups. While there is a continuous increase in the measurements that Tragus-Subaurale, Intertragic notch-Otobasion inferius and Intertragic notch-Subaurale taken from the ear lobe, as the reason for not being seen only in the Otobasion inferius-Subaurale, the Otobasion inferius is thought to be moving downward with age like Subaurale.

The auricle is one of the few organs that continue to develop during its lifetime (22). Aroral noted that the size of the auricle increases with age, even after full development and the values are higher in older individuals. This increase may be due to the elastic fibers in the ear cartilage (23). It has been stated in other studies that the increase in ear size is also related to the decrease of the elasticity of the skin and gravity (24). Also, in a study of age-related morphological changes in adult human auricle elastic cartilage, it was observed that the auricle significantly increased with age in both genders. It has been suggested that this situation is associated with changes in elastic fibers after childhood (25). Another study stated that almost all linear dimensions of the auricle increased with age in both genders. It has been stated that this increase can be associated with decreasing tensile strength or decreasing elasticity of gravity with age (26).

Gender and age are the main factors affecting earlobe length in the adult population. Ethnicity, skin structure, gravity and BMI are not complicated (27). Shireen (2015) stated that an aging deformity that may develop with aging could cause the ear lobe to extend, and this is attributed to the loss of elastic fibers and gravity (28,29,30,31). Azaria stated that ear lobe length increased with age in both genders. In multiple regression models, age was seen as the most important factor affecting ear lobe length and affecting female twice as much as the male. It has been stated that the ear lobe length increased by 30-35% from the youngest group (the group of age 20-40) to the oldest group (age of 60). These changes have been linked to a decrease in the tensile strength of the connective tissue over time, similar to other studies mentioned (32). Extension of the ear lobe slows down significantly in the female after the age of 40. It has been stated that earrings increase the weight on the ears as a reason for the increase in female, which affects the lobe length. It has also stated that the width of the auricle continues to older ages in male and that gender differences may be affected by genetic factors (27,28). Eboh stated that ear lobe length was statistically significantly higher in girls than in boys, which was linked to population-specific factors (32).

Verma (2016) observed that ear measurements increased significantly with age in both genders and suggested that this change was related to changes in elastic fibers, which are seen faster in male than in female (29). Differences between studies on ear morphology can be affected by various factors, such as geographic location, ethnicity and genetics (32).

The projection at the levels of Superaurale and Tragus showed a decreasing trend with increasing age. It is stated that this decrease may be due to possible sleep position and skin elasticity (26).

When the in-ear measurements are examined, no comparison can be made due to the lack of similar measurements in the literature. However, it has been observed that the upper ear length has increased since the 60s for female and the 50s for male, and the lower ear length has increased since the 50s for both genders. This is thought to be due to the soft tissue sagging that occurs because the ear lobe does not contain bone and cartilage tissue, and the lower part of the ear is more prominently affected by aging. It was observed that, especially in the Tragus-Otobasion inferior, distance developed in the male until the 40s, unlike the female, and did not show any significant difference afterwards. It is thought that the ear lobe may be deformed female more than male due to the use of accessories; however, this analysis has not been strengthened.

Azaria (2003) stated that body mass index significantly affects ear lobe length in female, and in male, the weight, height and body mass index are not statistically significant ($P<0,05$) to ear lobe length (27). Due to the studies about the effects of obesity on ear measurement values, obese volunteers were not included in this study by looking at their BMI values.

5. Conclusion

Studies on identification in forensic science are gaining importance day by day as security issues are experienced due to the increasing number of people. This study is also important in the field of identification, to reach an age, especially in terms of emphasizing the ear. In security cameras, such studies constitute a statistical basis for age estimation, especially since the information on the

side and ear is important when the person is viewed from the side.

The ear is an important biometric field of identification, as it is personal. When its own measurements and its relationship with the face are determined, it will enable the production of more practical studies in terms of identification in forensic cases in the future. Metric and morphological knowledge and evaluation of each biometrics on the face are not only for forensic cases; they are also important for biometric technologies that include facial identification.

In a forensic case, when we evaluate the averages of the side and/or ear images at hand, within the age ranges, we can make an estimate of the age group of the person in the image. In future studies, more parameters should be used with a wider age group to obtain better results.

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Review

Understanding Homicide-Suicide

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Abstract: The term ¨Homicide-Suicide¨ is described with interpersonal violence where a perpetrator commits suicide after murders at least one victim. Homicide-suicide is mostly considered an act that is posterior to the decision of suicide of the dominant family member. In various cases, this situation is considered as a concern of the dominant member about leaving no-one behind. It has been considered that in those cases where an individual has suicided or has been killed, perpetrators persuade the victims even if they are not willing to do it. By homicide-suicide's very nature, perpetrator and victim are deceased. Thus, several sorts of information do not include sufficient nuance about the causes and dynamics of the event. This study aims to examine fundamentals, prevalence and differences of homicide-suicide and provide a perspective about the specific traits of sub-types of the cases in light of the literature. The method of the psychological autopsy, which is conducted to investigate the psychological/psychiatric antecedents and risk factors of the cases, includes all kinds of data collection and examination. Due to these reasons, it is very important to profiling the individuals and to enlighten the causes of homicide-suicide with examinations and evaluations. Thus, to prepare a protocol for psychological autopsy and to support professions can be useful given that it would be beneficial for risk prevention studies, both individually and socially.

Keywords: Homicide-Suicide, Interpersonal Violence, Psychological Autopsy, Psychological Antecedents

Öz Homisit-suisit (cinayet-intihar) bir failin en az bir kurbanı öldürdüğü ve ardından intihar ettiği kişilerarası şiddet durumunu belirtmek için kullanılan ifadelerdir. Çoğunlukla ailede baskın olan üyenin intihar eylemine karar verdikten sonra diğer üyeleri de buna sürüklemesi olarak düşünülmektedir. Birçok olguda bu durumun intihara karar veren baskın üyenin sorumluluğunu üstlendiği diğer aile fertlerini "geride bırakmak" istemediğinden kaynaklı olabileceği düşünülen eylemlerdir. Birden fazla bireyin intihar ettiği ya da öldürüldüğü olguların birçoğunda faillerin diğer bireyleri gönülsüz olsa bile ikna ettiği ya da rızaları olmadan kazara veya bilinçli bir şekilde öldürdüğü düşünülmektedir. Homisit-suisitin doğası gereği, fail ve kurban bu olaylarda ölmekte, bu nedenle, kullanılan veri kaynakları tipik olarak ilgili nedenleri ve olayın dinamikleri hakkında ayrıntılı bilgi içermemektedir. Bu çalışmada homisit-suisitin temellerini, görülme sıklığının doğasını, farklılıklarını incelemek ve eylemin alt tiplerinin spesifik özelliklerine literatür temelli genel bir bakış sunmak amaçlanmaktadır.

Homisit-suisit olgularının psikolojik/psikiyatrik öncüllerini ve risk faktörlerini belirlemede kullanılan psikolojik otopsi yöntemi, ölen bireyler ile ilgili her türlü verinin toplanmasını ve incelenmesini içermektedir. Bu nedenlerle, incelemeler ve değerlendirmeler sonucunda elde edilen bilgiler ile homisit-suisitlerin olası nedenleri ve bireylerin profillerinin ortaya konulması bu tür eylemlerin önlenmesi açısından çok önemlidir.

Sonuç olarak, ülkemiz için bir psikolojik otopsi protokolünün hazırlanması ve ilgili meslek elemanlarının bu protokol dahilinde desteklenmesi ve uygulamaya sunulması bireysel ve toplumsal önleme yollarının geliştirilmesine katkı sağlayacağı düşünülmektedir.

Anahtar kelimeler: Homisit-suisit (Cinayet-intihar), Kişilerarası Şiddet, Psikolojik Otopsi, Psikolojik Öncüller

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1. Introduction

In recent years, every year, 800.000 individuals have been losing their lives by committing suicide worldwide. Approximately one-third of this number is formed by the young population. According to the World Health Organization (WHO), while suicide is the second leading cause of death among men aged 15-29, it is reported that suicide is the third leading cause of death among females aged 15-29. Suicide has recently been becoming a growing problem, especially in high-income countries. However, studies have shown that 79% of the suicide cases occurred in the middle-income and low-income countries (1).

When the family members, friends, and the environment of the individuals who attempted suicide or lost their lives by committing suicide are considered, it is regarded that billions of individuals are affected by the suicide case (2,3). However, given that the suicide phenomenon is a delicate issue, both in the individual and social context, the legal aspects of suicide has become a question of debate in recent years. Social, cultural, psychological, and more risk factors may affect suicide behavior. Especially negative effects in individuals, such as depression, helplessness, and despair, which are psychological/psychiatric risk factors, are thought to be able to form a mental basis for suicide (4). Suicide is defined as that the individuals cannot find a way out as a consequence of conflicts between their individualistic routines and unmet needs and depression feeling that may cause stress, and the wish to flight from reality (5). However, suicide cases may be seen in various types differing from the situation that only one individual is concerned. Psychiatrist Forbes Winslow, who played a role in the clarification of a lot of suicides and murders, such as "Jack the Ripper", stated in his article published in 1840 about the mutual suicide cases. Suicide can be recognized in various types as the suicide pact, and homicide-suicide, which is a type of interpersonal violence. In this regard, this study aims to examine the fundamentals of homicide-suicide, to analyze the nature and the differences of the prevalence of homicide-suicide, and to provide a general perspective of the specific traits of the sub-types within the literature basis.

2. Suicide Pacts and the Homicide-Suicides

A suicide pact is defined as the group members who have different social and cultural backgrounds, form a pact with similar motivations, and commit suicide at the same time (6). It is encountered that individuals who were the members of a social or religious group committed mass suicide upon their beliefs, mostly under the leadership of a charismatic authority (7). According to the statistics, mass suicides covers approximately 0,6-4% of all suicide cases (8,9).

Differing from suicide pact, in homicide-suicide cases, the perpetrator commits suicide after the murder. It has been considered that in those cases where an individual has suicide, perpetrators persuade the victims even if they are not willing to do it (10,11). According to the studies ran in the United States of America, it has been reported that every year, the frequency of homicide-suicide cases ranges between 0,134 and 0,55 per 100.000 (12,13), and 1000-1500 deaths arise from homicide-suicide (14).

3. Types of Homicide-Suicide

Even though homicide-suicides in the literature remind the suicide pact (7) concerning the act that is posterior to the decision of suicide of a family member, mostly, the dominant member, in various cases, this situation is considered as a concern of the dominant member about leaving no-one behind. When it is interpreted in this aspect, mass suicides realized, as mentioned, can be classified as homicide-suicide. Homicide-suicides separate into various groups depending on how the action takes place (4). When the homicide-suicide cases are considered, it is more common that one of the adult family members commit suicide posterior to the murder of the other one, while it is rare that a family member in the guardian position commits suicide after killing the other ones (mostly parent-child). In fact, according to the study by Knoll and Freidman (2015), it has been detected that approximately 78% of the homicide-suicides occurred among adults, while 17% of them were intended from an adult family member to a child family member (15). Marzuk et al. (1992) were the first researchers who conducted a study to develop a classification system, which categorized homicide-suicide related to the relationship between the perpetrator and the victim. This categorization contains the spousal homicide-suicide, the homicide-suicide involving children, the familicide (the homicide-suicide incident involving both parents and children), and the homicide-suicide among people who do not have a bond with marriage (14). On the other hand, in the literature, there is a term for a child's murder by their parent, which is called "filicide". Even though it evokes a homicide-suicide type, because the parent (perpetrator) does not attempt to suicide after the murder, a different categorization is needed. This phenomenon that is seen in a few cases, especially in the literature are classified as "altruistic filicide", "acutely psychotic filicide", "unwanted child filicide" and "spousal revenge filicide" (16). As an example of

similar cases in the literature, a series of cases appeared in Turkey in November 2019 and gathered huge reactions nationally among the public. Characteristics of such cases have qualified as "altruistic filicide" by the authors after in-depth analysis and studies have been conducted for the clarification of the mentioned cases, and the findings showed that it is needed to be classified diversely other than all filicide or homicide-suicide types. When the reasons for this kind of action are analyzed, it is understood that mostly after the parent or the family member, who is obliged to look after the other family members, has economic difficulties and/or has to reduce their physical activity as they are diagnosed chronic or terminal illness. Thus, they assume that the individuals left behind cannot survive and live independently (17-23).

Although it is not be perceived as an altruistic behavior at first that a parent or a treater (a person who is obliged to look after the others) murder their child or dependents, when the individual's psychological/psychiatric structure is examined, it will become clear that they are depressive and ready to commit suicide, that they love too much, and even that the destroying the child they think as an inseparable part when the individual's psychological/psychiatric structure is examined (15,24). As it can be discussed in another case that involves four siblings from November 2019 once again, a treater or a parent's abnormal love towards the children or the dependents, and the damaged parent-child relationship may cause the parent or the treater regard the other as a reflection of themselves (25). However, the treater may reflect their depressive thoughts to others. In this respect, the dependents may turn into the individuals that they should end their own lives from the perspective of the treater who attempts to homicide (26,27).

It has now become ordinary in the Japanese culture that the family member, who is obliged to look after the others, attempts to homicide before attempting suicide due to the idea that they cannot support the other family members, especially economically. Some kind of suicide pact can also be detected in these suicide types called "*oyaka-shinju*" (parent-child suicide), "*ikka-shinju*" (spousal suicide), and "*kazoku-shinju*" (familicide) (28). However, in some cases, it can be seen that the family member who is obliged to look after the others commit suicide after the murder of the family member/members, assuming that their family's honour will be tarnished after their death (29). As it is examined within the historical context, once more, this case has been detected to manifest itself as consecutive family suicides. In fact, it has even been found out that the increasing number of familicides, committed as breathing deadly chemicals like carbon monoxide, and the illustrations of these incidents in the papers had negative effects on the public (30).

4. Psychological Autopsy

A psychological autopsy is a holistic initiative that has been using since 1958 in America for the investigation of suspicious deaths, that deals with all reports, crime scene, socio-demographic characteristics, information gathered from the perpetrator's/victim's relatives about all psychiatric symptoms that the perpetrator/victim had and all the precipitants leading the case acquired about it. When suicide pacts among the family members and homicide-suicide cases performed by the treaters towards other family members are examined with the "psychological autopsy" method in the context of psychological trajectors and leading factors, many antecedents emerge (31).

Psychological autopsy is considered a superior method than the examination of the absolute documents approach to determining the psychological/psychiatric antecedents and risk factors (32). Cases can be enlightened using various psychological/psychiatric methods for defining the perpetrator's relationship with the victims, and the motivations for the homicide-suicide action such as jealousy, altruism, revenge (20). For example, the factors found out with the help of the psychological autopsy method in homicide-suicide cases among the family members can be defined as domestic violence history, on and off relationships, the existence of firearms and symptoms of major depressive disorder (15). The psychological autopsy method involves gathering and examining all kinds of information related to deceased individuals. This method aims to reveal the possible reasons of the homicide/suicide and profile of the individuals with the help of the information, gathered from judicial records, medical records containing psychiatric and other medical information, socioeconomic and cultural research, the interviews with the individual's family and the social environment that they had a relationship or connection, and the examination of all forensic investigation files (33).

4.1 Judicial Records

It is made an inference on the motivation of the actions of the perpetrator in the homicide-suicide case, acquiring data, such as records related to the crime scene, police interrogations, and quality of the evidence. The criminal past is another important data that should be acquired to investigate the risk factors and analyze the structure of the case. Knoll et al. (2015) investigated 18 homicide-suicide cases; their findings showed that 50% of the perpetrator number had had a criminal past (15). In this respect, it can be said that the criminal past is a

determiner concerning the realization of this behavior. However, the existence of the material evidence or the criminal past alone is thought not to be adequate to reveal suicide or homicide-suicide cases.

4.2. Psychiatric History

Conduct disorder with disruptive behaviors in childhood, major depression and schizophrenia spectrum disorder, and other psychotic disorders' diagnosis may be a determiner in the homicide-suicide cases. Knoll and Hatters-Freidman's (2015) research showed that 78% of the homicide-suicide perpetrators had offensive behaviors in the past, while 22% of them still has had treatment history connected to a psychiatric disorder (15). It has been confirmed that 94% of the perpetrators fulfill any kind of a psychiatric diagnosis according to the same study. According to another study, this rate was 93% (4). In this regard, it is considered that negative changes in the perpetrator's mental health may be effective for the realization of these actions.

4.3 The Interviews with the Family and the Relatives

A psychological autopsy should be practiced with a comprehensive approach. In fact, it is important to reveal all the data existing other than the individual in the homicide-suicide or suicide cases. In this regard, the family history should be obtained, and the family members and the relatives of the individual should be interviewed. The presence of a suicide attempt history and major depression in the family may form a risk factor for the perpetrators. Along with the genetic impacts, conflicts with the family members and the loss of their relatives are assumed to be significantly important. It has been detected that especially middle-aged men are in the risk group for suicide in the event of losing one of their family members (34). However, how the individual acts towards the stressors around themselves and the sources of these stressors are accepted as a determiner. The individuals who cannot know how to act to the problems in their lives and have a weak problem-solving ability have been detected to tend to commit suicide when they face life events, such as a loss of a relative one or end of a relationship (35). Thus, it is suggested to conduct comprehensive research interviewing with the family members and relatives about the stress factors before the incident.

5. Conclusion and Suggestions

Perpetrator and victim may die in the homicide-suicide incidents. Thus, data resources used does not include detailed information about typically relevant causes and dynamics of the incident. Previous studies on homicide-suicide are based on only a few countries, and mostly, on case studies.

Interviewing with the relatives of the deceased, the examination of the hospital records belonging to the individual, the investigation of the criminal records supporting the evidence, analyzing physical and mental health, personality, social problems, and socialization of the homicide-suicide victim/victims (36) are substantial concerning clarifying of the incident with the help of the psychological autopsy method.

Studying on the survivors of homicide-suicide incidents may provide information about the basic causes of this action (37,38). Also, the information obtained about perpetrators and victims will ensure to use of the psychological autopsy method for further research (39).

It is substantial to implement legal regulations to investigate preventive measures in the sense of community health care (40). It should not be forgotten that most of the preventive measures used for homicide-suicide are similar to the measures that have already been used for only suicide and only homicide. Along with the examination of all components (only suicide or homicide) of homicide-suicide, as well as all of its aspects, risk factors that trigger homicide-suicide should be studied (5). Conducting further research in bigger sample groups will ensure the use of the psychological autopsy method.

Following a homicide-suicide incident, the press should not publish news without certain information, if it is possible. According to a study conducted with newspaper reports, it has been determined that false and unnecessary speculations about the homicide-suicide incident, and the mental disorders of the perpetrators (41). Also, studies have shown that these labels on individuals performing these kinds of incidents have mental disorders, and the news on the press was not accurate. However, it has also been determined that this may lead individuals with the same emotional problems to seek for a similar type of help. According to the studies, a negative attitude against the individuals who have mental disorders is common in public (42). In recent years, individuals' addiction to social media as a current news resource has increased, so how these types of news are presented may increase the stress level of public and can turn these actions into more sensational news (43).

In Turkey, the individuals contributing to the psychological autopsy practices for research of dynamics in homicide-suicide cases and serve as a protector-preventer for these incidents not to occur, healthcare professionals providing first-degree healthcare services (family physicians and nurses), and/or psychological counselors/

psychologists, social workers and child development personnel who work in Provincial Directorates of Family, Labor and Social Services need to be empowered with the in-service training based on mental health and disorders. Besides, it is necessary that a psychological autopsy protocol is made and put into practice, and the related members of the profession are given support within this protocol. It is significantly important that following the psychological autopsy protocols, psychosocial evaluations are made, and "psychosocial evaluation reports" qualified as protector-preventer are drawn up by the related members of the profession.

Consequently, the classification scheme, which is widely accepted, should be used to conduct the studies on homicide-suicide. When homicide-suicide sub-types are comprehended in more detail, it is considered that different risk factors for different sub-types may be originated. Research on similar and different aspects of the different subtypes of homicide-suicide can contribute to individual and social prevention methods in practice with a better understanding of risk factors.

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Adli Tıp Bülteni

Review

Forensic Medicine Education in Problem Based Learning: The Case of Pamukkale University

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Abstract: As a result of the health system and legal regulations in our country, primary care physicians have a great number of responsibilities related to forensic medicine services, but it is a known fact that our physicians describe forensic medicine as the most feared task because of the insufficiency of undergraduate forensic medical education.

A horizontal and vertical integration, spiral structured training program is implemented at Pamukkale University Faculty of Medicine. While they learn the basic concepts in the first years, in the fifth grade they take active education methods through the two-week task. In this forensic medicine education, it will enable the students to develop their interest in forensic medicine and to achieve the objectives of gaining knowledge, skills, and attitude in the core program. In this study, the undergraduate forensic medicine education model of Pamukkale University Faculty of Medicine is presented in detail.

Keywords: Forensic Medicine Education, Task-Based Learning, Problem-Based Learning

Öz Ülkemizdeki sağlık sistemi ve yasal düzenlemeler sonucunda birinci basamak hekimlerine, adli tıp hizmetleri ile ilişkili çok sayıda sorumluluk yüklenmiş olmakla birlikte mezuniyet öncesi adli tıp eğitiminin yetersizliği nedeniyle hekimlerimizin adli hekimlik görevini en çok korkulan görev olarak nitelendirdikleri bilinen bir gerçektir.

Pamukkale Üniversitesi Tıp Fakültesi'nde (PÜTF) yatay ve dikey entegrasyonu sağlanmış, spiral yapılanma gösteren bir eğitim programı uygulanmaktadır. PÜTF'deki adli tıp eğitim programında öğrenciler adli tıp konularıyla birinci sınıftan itibaren karşılaşmaktadırlar. İlk yıllarda temel kavramları öğrenirlerken, 5. sınıfta ise iki haftalık task boyunca aktif öğrenme yöntemlerinin kullanıldığı bir eğitim almaktadırlar. Adli tıp eğitiminde bu şekilde yıllara yayılmış, interaktif yöntemlerin uygulandığı, yapılandırılmış beceri eğitimi etkinliklerinin yer aldığı eğitim programlarının öğrencilerin adli tıp konularına ilgilerini artıracak, çekirdek programda yer alan bilgi, beceri ve tutum kazanma hedeflerine ulaşmalarını sağlayacaktır. Bu çalışmada PÜTF adli tıp eğitim modeli ayrıntılı olarak sunulmuştur.

Anahtar Kelimeler: Adli Tıp Eğitimi, Taska Dayalı Öğrenim, Probleme Dayalı Öğrenim

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1. Introduction

Primary care physicians have been assigned numerous responsibilities related to forensic medicine services as a result of the health system and legislative regulations. It is a known fact that our physicians describe forensic medicine as the most feared task because of the insufficiency of undergraduate forensic medical education. In various studies and meetings, the lack of forensic medicine education in medical schools has been stated as the beginning of the problems faced by physicians in conducting forensic medicine services (1, 2). In the meetings of the Deans Council by Medicine Faculty of Higher Education Council, it is observed that decisions have been made regarding the review of forensic medicine education programs before graduation.

On the other hand, in parallel with the developments in the world, medical education programs are changing in our country. Pamukkale University Faculty of Medicine (PAUMF) has been using the active training method in student education since 1999. This training has been conducted in the first three years under the name of active problem-based training and under the name of task-based training in the next two years. In the active education process, unlike traditional medical education, our students encounter forensic medicine subjects from the first year of medical school. Forensic Medicine Faculty members are also engaged in pre-graduation medical education from the early years. This article is aimed to present PAUMF as an example of pre-graduation forensic medicine education as a medical school using the active training method.

Ethical Declaration

Permission letter dated 07.02.2019 and number 9245 was obtained from Pamukkale University non-interventional clinical research ethics committee for our study.

2. Development of Forensic Medicine Education Program in PAUMF

As a department, our pre-graduation education program at the Faculty of Medicine was first established in 1997. The contents of the first program were prepared by taking into consideration the needs of other medical schools in our country and forensic medicine programs. In subsequent years it has also been reviewed twice according to the national core program (3). At the end of each education period, both the content and the educational strategies are constantly shaped according to the observations of the faculty members and the feedback of the students.

3. Period of Study

In the first three years of the PAUMF training program, active problem-based training is implemented, and task-based learning is implemented in grades 4 and 5. The method mentioned is a training program with horizontal and vertical integration, showing spiral structure (4, 5). In the first, second and third grades, the students ' encounters with forensic subjects begin with the learning objectives in problem-based learning sessions and presentations made in these modules. In grade 1 "forensic approach to cases", in grade 2 "approach to trauma patient " and "the child criminal responsibility", in grade 3, "medical malpractice", "forced treatment in schizophrenia", "the responsibility of the emergency physician", "about end of life ethical issues", "legal and ethical issues in the process of termination of pregnancy" is one of the titles within the module.

In addition, in the first three-semester education period of PAUMF students, Forensic Medicine faculty members are also employed in special study modules (SSM). SSM is educational activities that provide students with opportunities to learn in depth in a field, to establish and develop the foundations of scientific method, to learn self, to reach knowledge, to develop the skills to present the results of the study in written, oral and visual form, and etc. (6). With these practices, the students who choose the SSM opened by the Forensic Medicine faculty members, meet both forensic and forensic faculty members in the first years of medical education and do projects under the guidance of the faculty members. Independent practices such as the SSM make it a good option for students to meet Forensic Medicine in the early years of their medical education. Our students are successful in this field. Our students who prepared the SSM study titled "A look at the theme of death in Turkish Folk Music" which was opened by our department received the poster award at the National Medical Education Symposium 2017 (7) and the presentation made by the students organized by Faculty of Medicine, Dokuz Eylül University. It was met with interest at the 10th SSM Symposium.

Students who pass grade 5, a two-week forensic medicine task in a block called multisystem-II block which consists of tasks belonging to five different disciplines that are not directly related to each other. This task is repeated 4 times during the school year with different groups of students. The forensic medicine task program includes task presentation, task sessions, clinical skill practices, examination of deceased, autopsy and outpatient practices, presentations, independent learning processes and academic activities of the department. This task program is presented in Table 1.

Table 1. The Task Program of Forensic Medicine

(1. WEEK)					
	Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
08:00-08:45		Autonomous Learning	Autonomous Learning	Autonomous Learning	Autonomous Learning
08:55-09:40	Introduction of Task 1st. Task session	Presentation *Death and Postmortem Interval*	Practice	Practice	Practice
09:50-10:35	Presentation *Approach to forensic cases and forensic reports*				
10:45-11:30		Presentation *Wounds*	*Forensic Autopsy G1/ Policlinic G2*	*Forensic Autopsy G2/* Policlinic G3	*Forensic Autopsy* G3/ *Policlinic G1*
11:40-12:25					
12:25-13:30	Lunch Break	Lunch Break	Lunch Break	Lunch Break	Lunch Break
13:30-14:15	Practice	Presentation *Firearm Injuries*	Presentation *Crime Scene Investigation*	Presentation *Traffic Accidents and Forensics*	Presentation *Forensic Psychiatry*
14:25-15:10			Conference *Asphyxia Deaths*	Presentation *Child Deaths*	Presentation *Sudden deaths from natural causes*
15:20-16:05	Preparing of Forensic Report	Presentation *Laboratory and Paternity in Forensic Medicine*	Department Event *Bodies Removed From Water*	Department Event Child Abuse	Department Event Juvenile Delinquency
16:10-16:55		Autonomous Learning	Autonomous Learning	Autonomous Learning	

(2. HAFTA)					
	Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**
08:00-08:45	Autonomous Learning	Autonomous Learning	Autonomous Learning	Autonomous Learning	Autonomous Learning
08:55-09:40	Practice	Practice	Practice	Presentation *Alcohol and Forensics*	Presentation *Identification in Forensics*
09:50-10:35	Forensic Autopsy G1/ *Policlinic G2*	*Forensic Autopsy G2/ Policlinic G3*	*Forensic Autopsy* G3/ *Policlinic G1*	Presentation *Expertness*	Presentation
10:45-11:30					
11:40-12:25					Legal Responsibilities Of The Physician
12:25-13:30	Lunch Break	Lunch Break	Lunch Break	Lunch Break	Lunch Break
13:30-14:15	Practice	Presentation *Human Rights and forensics*	Presentation *Pregnancy-birth and forensics*	Practice *Forensic Examination of Deceased*	Task Evaluation
14:25-15:10		Presentation *Sexual Assaults*	Presentation *Domestic Violence*		
15:20-16:05	*Preparing of Forensic Report*	Department Event *Drug Addiction*	Department Event *Forensic View Of Community Gender Inequality*	Presentation *Poisonings*	
16:10-16:55		Autonomous Learning	Autonomous Learning	Autonomous Learning	

The first session, held on the first day of the task, is the process in which the task program is introduced, information about the program such as practices, presentations, academic activities of the department, as well as routine functioning and expectations of the students are explained. After the introduction part of the task, students are divided into 3 groups as 'autopsy group' who will attend autopsy during practice hours, 'polyclinic group' who will be trained at forensic medicine clinic and 'free group' who is expected to do autonomous learning.

Throughout the task, all students are expected to follow at least two postmortem procedures from beginning to end and perform the examination of deceased process in person, accompanied by a medical examiner. The students in the forensic medicine outpatient clinic are divided into smaller groups and observe the evaluation processes of the patients consulted to clinic and discuss them with the faculty members.

Presentations not only consist of lecture presentations but also are enriched with case discussions. Our program also includes structured skills training for students to acquire the skills that they will use in their medical life. It is aimed that every student who finishes the forensic medicine task, will be able to write a proper forensic report. "Practice of Judicial Report Editing" has been developed for this purpose. On the first day of this two-day practice, students are divided into 4 groups and organize the "general forensic examination form" through 4 different forensic case samples, present these reports to the whole group and discuss the reports together with the faculty member who is the executor of the practice. In the second practice, 'general forensic examination form' is distributed to all students. It is asked to fill out the forms appropriately through projected case example on the board and wound photos. Completed forms are collected and evaluated at the end of the practice, feedbacks are provided to the students. Besides, the scores from this practice contribute to the students for their in-task activity evaluation note.

The second structured skill activity in the task is a dead examination. It is aimed that every student who finishes the forensic medicine task will be able to carry out a proper forensic dead examination. In the practice of forensic dead examination, students gather in the training skills laboratory. Divided into two groups, they move into two different halls. Groups are distributed in two different scenarios similar to those in problem-based learning sessions. In these scenarios, the preparations to be made before moving to the scene and what needs to be considered while at the scene are discussed and at the end of the discussion, the skill application step is taken to perform the dead examination. At this step, students are presented with mannequins dressed according to the script and with wound photographs placed on them. Students perform the dead examination steps to these mannequins accompanied by a practical guide prepared for them. Finally, the two groups combine to present the forms they have filled out throughout the practice and discuss them with the faculty members (8).

With the department events, it is tried to be reached some learning goals by discussing about current events with edited reports and experienced cases. For instance, while mentioned 'Crimes against sexual inviolability', in this regard, a phenomenon that has recently cost society through the media, is addressed in all aspects. The missing forensic reports about this case are reviewed and the students reach the correct conclusion.

Independent learning times are processes in which students meet their learning needs under the guidance of faculty members or from a variety of sources.

4. Assessment and Evaluation Process

Measurement and evaluation is not done with a single exam as in traditional educational processes. All activities of the student during the task are evaluated. Students have 'Study Record Cards' that contain the assignments they need to do during the program. Each student is obliged to complete the activities included in the report card throughout the task. In this way, the regular participation of students in the in-task activities is also provided.

Students ' absentee status in the task, "general forensic examination form" organized in the forensic report practice, mini written exam results made by faculty members in the task and active participations in practices are evaluated. An in-task activity grade is given for the forensic medicine task by the instructor in charge of the task. At the end of the block, a written exam consisting of multiple-choice questions and a structured oral exam are conducted. In the structured oral exam, students are asked questions about cases they may encounter in real life, accompanied by short scenarios and photographs. In all these assessment and evaluation results, it is observed that our students have achieved their learning goals.

5. Feedbacks of Students

Students receive written and oral feedback at the end of each task. In the directions of these feedback, the task program can be reorganized.

Examples of feedback from 154 students who participated in the forensic medicine task in the 2017 - 2018 academic year were presented in order to show students ' reactions to the applied program.

- The majority of students stated that they were satisfied with the task process and the interest of the faculty members in general and that they had an efficient task.

"I think the applications and courses are very efficient, beautiful, instructive and educational. Our teachers and assistants have also been very helpful."

"It was a planned, instructive and very useful task. We conducted one-to-one examinations and autopsies with active training."

"Both the lectures and the narration were very interesting."

"The forensics task was one of the most productive weeks in medical school, where we evaluated every minute of it so well."

- There have been students who have indicated a change in attitudes towards forensic medicine and forensic medicine expertise.

"My perspective on forensics has changed. I understood that I needed to learn my rights and responsibilities."

"Normally I would think of the law as boring, but I loved forensics, and I think our teachers played a big part in it."

"Now, when I see an unpleasant death, my first reaction is not to be shocked, I will think about the technical details we learned to clarify the incident. Now forensics has risen to the top of the list of branches that I seriously intend to specialize in."

"There was an awareness of what a profession we were doing in association with law."

- Some of the students stated that they felt more adequate and secure against future problems related to forensic medicine.

"I learned what problems I could face and what I had to do."

"I'm sure It'll be very useful in my career."

"I feel like we've had our responsibilities, the situations we'll face when we graduate. Seeing these things in advance will add a lot to us."

"I learned important information for my future medical life, and with that information I learned well in this task what I can do in difficult situations."

- Students stated that participation in forensic case assessments and forensic report applications in outpatient clinic were reinforcing to learn about the approach to forensic cases; and, their participation in the autopsy and the practice of the dead examination contributed to the process of learning about this issue; even, they have learned permanently by being given the chance to practice what is told theoretically.

"The practice of autopsy in particular was very instructive. It was one of the most productive tasks I've ever had."

"The faculty was one of the most diverse tasks I've ever taken on in my life. It was quite interesting to be involved in the practices and the fact that the issues were different. "

"It was one of the most instructive and active passing tasks of the fifth grade."

"In polyclinic, we examined patients together, talked about the cases, discussed them, and it was productive."

"It was really instructive and catchy to reinforce the subjects with practices."

"It was very helpful to fill out a forensic case report in class."

- They stated that they learned by doing group work on their practices during the Task, completing each other's deficiencies.

"Our practices in the form of group work were very enjoyable."

- Some of the students suggested that groups consist of fewer people, that more autopsies be performed, that the number and duration of theoretical presentations be shortened.

"The lessons were sufficient but the classes of autopsies could be increased."

"Some of the lessons were exhausting to take long."

"Applications could be made with smaller groups."

When the attendance status of the students was examined, it was seen that the participation rate of the forensic medicine task of 156 students who enrolled in grade 5, was 95.2% in the 2017-2018 academic year.

6. Conclusion

One of the most important differences and advantages of PAUMF forensic medicine education is the beginning of the early years of Education. In accordance with the spiral structured training program, students encounter forensic subjects through patient scenarios in the first years and prepare for clinical training in the following periods (4).

In the early years of medical education, special study modules can also be an opportunity for students to become acquainted with forensic subjects. Special study modules are an increasingly common practice in medical schools in our country. It is recommended that forensic

faculty members take this opportunity and take an active role in the SSM.

The importance of forensic medicine education before graduation in medical faculties is great in order to ensure that physicians do not have problems with the forensic medicine services that are responsible in accordance with the legal regulations in our country. The positive effects of applied skills training on the learning process such as forensic report writing and forensic dead examination have been shown in the studies (8, 9). Forensic report writing and dead examination practices in the task is one of the most important features of our training. These two activities must be carried out in laboratory conditions, as we do, until full learning is achieved in the students. When viewed by the student, it is observed from task feedback that students participate in forensics-related activities with great enthusiasm and give positive feedback. It is seen that they develop a positive attitude towards Forensic Medicine, understand the relationship between medicine and law, and understand that what they learn in the task will be useful in their professional lives. They also found the applications educational and wanted to increase application times. The 95% complete attendance of the task can also be interpreted in favor of students ' interest in the forensics task.

The most important problem we face in the education process is the increasing number of students. Due to the increase in the number of students in recent years, it is known that there are problems especially in the theoretical and outpatient applications of the patient, that large groups force the system and that there is a decrease in the motivations of the faculty members (10). Besides to study in our department, the large increase in the number of students has led to a lack of situations made in previous years such as ''attending the hearing in person in court'', ''application of addictive substances in narcotics branch'' and ''crime scene investigation branch visit''. The forensic medicine task process applied in our department has also adversely affected.

In the Forensic Medicine Education Program in PAUMF, students encounter forensic medicine subjects from the first year onwards. While they learn basic concepts in the early years, in the fifth grade they receive an education that uses active learning methods during the two-week task. This will increase the interest of the students in forensic medicine subjects and enable them to achieve the objectives of gaining knowledge, skills and attitudes in the core program. It is recommended to develop similar student-centered training programs in order to train physicians with the expected proficiency in Forensic Medicine Education and the success of Forensic Medicine Education.

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Review

Methyl Alcohol (Methanol) Intoxication

Tuğçe Koca*, Ahmet Hilal

Abstract: Methanol is a clear, colorless and highly toxic substance obtained from destructive distillation of wood. Methanol, which is generally used as solvent and antifreeze in industrial solvents, paints, varnishes, gasoline mixtures and automobiles, is a type of non-drinking alcohol due to its taste and odor. It can be produced as a by-product during the production of distilled alcoholic beverages. Accidental or suicidal ingestion of methanol may cause intoxication. Methanol often brings about oral intoxications. Methanol intoxication occasionally occurs in epidemics. Metabolites of methyl alcohol are toxic. Most of the symptoms of methanol intoxication are associated with metabolic acidosis. Symptoms are usually related to the central nervous system, eyes and gastrointestinal tract and may occur after a latent period. It may have serious consequences, such as blindness and death. Prognosis is correlated with the degree of metabolic acidosis. The toxic dose of methyl alcohol in human is in a wide range. Hemorrhage and necrosis in the basal ganglia and hemorrhage in the putamen are the findings obtained in radiological examinations and autopsy studies. Methanol levels in the blood of the autopsy cases are quite different. In our country, there has been a significant increase in the number of intoxication cases and deaths as individuals started to produce their own drinks or turned to fake drinks due to the increasing prices of alcoholic beverages. Not to increase the number of intoxication cases and deaths, the government should make the necessary arrangements and take precautions as soon as possible. This paper aims to evaluate all aspects of methanol poisoning and present it as a guide to forensic medicine specialists.

Keywords: Methanol, Methanol Toxicity, Death

Öz Metanol odunun destrüktif distilasyonundan elde edilen berrak, renksiz ve yüksek derecede toksik bir maddedir. Genellikle endüstriyel çözücülerde, boyalarda, verniklerde, benzin karışımlarında ve otomobillerde çözücü ve antifriz olarak kullanılan metanol, tadı ve kokusundan dolayı içilemeyen bir alkol türüdür. Distile alkollü içkilerin üretimi sırasında yan ürün olarak ortaya çıkabilmektedir. Metanolün kazara ya da intihar amacıyla alınması intoksikasyona neden olabilmektedir. Sıklıkla oral yoldan intoksikasyonlara neden olur, nadiren de inhalasyonla veya cilt yüzeyinden emilimle vücuda alınmaktadır. Metanol intoksikasyonu zaman zaman epidemiler halinde ortaya çıkmaktadır. Metil alkolün metabolitleri toksiktir. Metanol intoksikasyonunda semptomların çoğu metabolik asidoz ile ilişkilidir.Semptomlar genellikle santral sinir sistemi, gözler ve gastrointestinal sistem ile ilgilidir ve latent bir periyodun ardından ortaya çıkar. Körlük ve ölüm gibi çok ciddi sonuçları olabilmektedir. Prognoz metabolik asidozun derecesiyle koreledir. İnsanda metil alkolün toksik dozu geniş bir aralıktadır. Radyolojik incelemelerde ve otopsi çalışmalarında bazal ganglion kanaması ve nekrozu, putamende hemoraji elde edilen bulgulardır. Otopsi yapılan olguların kanındaki metanol düzeyleri oldukça farklılık göstermektedir. Alkollü içki fiyatlarında artış ile birlikte bireylerin kendi içkilerini üretmeye başlaması veya sahte içkiye yönelmeleri intoksikasyon vakalarında ve ölümlerde ciddi bir artışa neden olmuştur. İntoksikasyon olgularının ve ölümlerin daha fazla artmaması için toplumun bilgi düzeyini arttırmaya yönelik gerekli düzenlemelerin yapılması gerekmektedir.

Anahtar kelimeler: Metanol, Metanol İntoksikasyonu, Ölüm

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1. Introduction

Methanol was first isolated in 1661 by Robert Boyle by wood distillation and its chemical composition was first discovered in 1834 by Dümas and Peligot (1). Methyl alcohol (methanol) has the simplest structure among aliphatic alcohols. It is also used as a solvent in the industry (2).

Methyl Alcohol (Methanol CH3OH) is colorless, volatile liquid, which has a smell similar to ethyl alcohol and has a burnt flavor. The molecular weight of pure methanol is 32 g / mol, its appearance is colorless and clear. Its boiling point is 65 ° C. It is flammable and the flash point is 10 ° C. It is explosive when found in the air at a rate of 7.3-36.5%, while at 464 ° C it burns. Synonyms of methyl alcohol are as follows: methanol, methyl hydroxide, methyl hydrate, denatured alcohol, wood spirit and wood naphtha. Methyl alcohol is used as lacquer and varnish solvent in industry and as antifreeze in automobiles. It is used in the preparation phase of many organic materials (such as plastic paint, film) and, of course, alcohol denaturation (prepared by adding 5-10% methyl alcohol to ethyl alcohol) (3-5).

Methyl alcohol is a potentially alternative fuel. Therefore, it is predicted that its production will increase gradually. Methanol can be produced using several different carbon-based raw materials, such as natural gas, naphtha, heavy oil fractions and coal (4,5). The risk of exposure may increase due to its entry into the agenda as an alternative automotive fuel, in addition to its use in industrial products (5-7).

According to the Distilled Alcoholic Beverages Communiqué of Turkish Food Codex published in the Official Gazette No. 30014 dated March 21, 2017, distilled alcoholic beverage is a beverage prepared for human consumption, alcohol amount is at least 15% by volume at +20 ºC, produced by direct distillation of natural fermentation products with added or not added flavor and/or maceration of herbal substancesor blending of aromatic substances, sugar or other sweetening products in accordance with the Turkish Food Codex, into ethyl alcohol of agricultural origin or distillate or distillate beverages of agricultural origin.

While producing distilled alcoholic liquids, mainly methanol, aldehydes (acetaldehyde, acetal), esters (ethyl acetate, methyl acetate) and high alcohols (2-butanol, n-propanol, isobutanol, n-butanol 2-methyl-1-butanol, 3-methyl 1-butanol) are existing in the distillate of the alcoholic liquid formed by alcohol fermentation, other than water and ethyl alcohol. The amounts of these compounds, most of which are over a certain dose, toxic and harmful to health, should be kept within the limits considered to be health-safe in the final product. During production, the compounds are separated from each other by the distillation method by making use of the boiling points of these compounds. For this purpose, the distillate is divided into three parts as follows: the head, middle and end (tail) product. By separating the head product (with acetaldehyde, acetal, methyl acetate, ethyl acetate and methanol) with a lower boiling point than ethyl alcohol, and the end product with higher alcohols (2-butanol, n-propanol, isobutanol, n-butanol, 2-methyl-1-butanol, 3-methyl-1-butanol) with higher boiling point medium product rich in ethyl alcohol is taken and processed into raki. However, the compounds other than ethyl alcohol pass into the raki somewhat depending on the time of taking the middle product. Methanol, which is present in distilled spirits, consists of pectin through pectolitic enzymes while fermentation occurs. Pectin is found mostly in the peel and core of raisins and fresh grapes. During the production of alcohol, grape chips are included in fermentation along with the crust, core and stem. Therefore, the soluble pectic substances found in these parts pass into the gravel, are hydrolyzed by pectolitic enzymes, and as a result, methyl alcohol is formed (8).

According to the Tobacco and Alcohol Market Coordination Committee's (TAPDK) data, in our country, fully denatured and T-type denatured ethyl alcohol products contain certain amounts of methyl alcohol. Known by the people as blue spirit or white spirit used for cleaning is not pure methyl alcohol, although it is actually ethyl alcohol, but it also contains methyl alcohol due to denaturation transaction (9).

Household products containing methanol include automotive windshield washer fluids and de-icers, domestic spirits fuels, paints, paints, varnishes, wood dyes, paint reducers and removers, and a variety of other solvents. Also, not to consume ethanol, methanol can be added specially in it, and these products are called denatured alcohol (9,10).

The cost of methanol is much lower compared to other alcohols because it can be easily obtained by destructive distillation of wood. Because of this reason, consumption of products known to contain methanol by imposters into alcoholic drinks or accidental intake of these products by children may cause death (11,12). In addition, intoxications due to inhalation and skin toxicity have been reported rarely (13-16).

In our country, Turla et al. reported 124 deaths due to methanol intoxication in their study between 1992-1997, whereas İnanıcı et al. reported 205 deaths in another study between 1994-1998 (17-19).

In Eke et al.'s study between the years 2001-2004, by determining retrospectively the cases of forensic autopsy, which was performed over a 4-year period, the ethyl alcohol in 18 of and methyl alcohol in 22 of the 40 cases of alcohol intoxication were detected. When the source of methanol was investigated in cases with methyl alcohol intoxication, it was found that there were spirit alcohol in three cases, cologne in 10 cases, and spirit and cologne in one case. It was reported that information was not available in eight cases. In the study of alcohol levels, it was stated that it was in the range of 279-516 mg / dl in ethyl alcohol cases and 74-485 mg / dl in methyl alcohol cases (20).

Gülmen et al. in the retrospective study of autopsy cases between 1997-2003 in Adana, the findings showed that the source of the death of 41 cases was direct methanol poisoning (21).

Sönmez et al. evaluated intoxication cases admitted to the emergency department within four years. In their study, drugs were found as the most used substance. However, methyl alcohol (33%) was found to be the deadliest substance (22). Drugs were found as the most used substance. However, methyl alcohol (33%) was found to be the most fatal substance (22).

Death cases due to methyl alcohol intoxication are very common in forensic medicine practice. However, if we look at the statistics, it is seen that deaths due to methanol intoxication have made periodic peaks in our region since 2016 (23,24). With the deaths that arise from methanol intoxication, many patients are disabled. All this indicates the necessity to bring the methanol intoxications that cause deaths and injuries to the agenda of the physicians.

2. Metabolism

Methanol is easily absorbed from the gastrointestinal tract, and then quickly distributed to body fluids. Methanol does not bind to plasma proteins. Methanol is slowly metabolized with alcohol dehydrogenase (ADH) at a ratio of 1/10 ethanol by 0 degree kinetics. The half-life detected depends on the methanol serum concentration (as the serum level increases, the half-life extends) and whether the metabolism is inhibited (by ethanol, fomepizole). It can vary between 2.5-87 hours. Only approximately 3% is excreted unchanged by the kidneys and less than 10-20% by inhalation (25).

Alcohols are sensitive to chemical or physical oxidation. Thus, alcohol dehydrogenase and aldehyde dehydrogenase, which oxidize alcohols to acids, are the main means of detoxification of ethanol and methanol. With the effects of alcohol dehydrogenase enzyme in the liver, methyl alcohol oxidizes formaldehyde, catalysts are NAD / NADH (26).

Ethanol is a competing substrate for alcohol dehydrogenase and greatly inhibits the metabolism of methanol to formaldehyde (27). Formaldehyde is 33 times more toxic than methanol. However, the formaldehyde cannot be detected in the blood due to the very short half-life (about 1-2 minutes). The return of formaldehyde to formic acid takes a very short time. Formic acid, which is six times more toxic than methanol, is excreted from the body by converting it into CO_2 and H_2O through enzymes bound to folate (10,26,28) (Figure 1). The half-life of endogenous formic acid is between 1.9-9.3 hours, and during dialysis, half-life may decrease up to 1.5-3.1 hours (25).

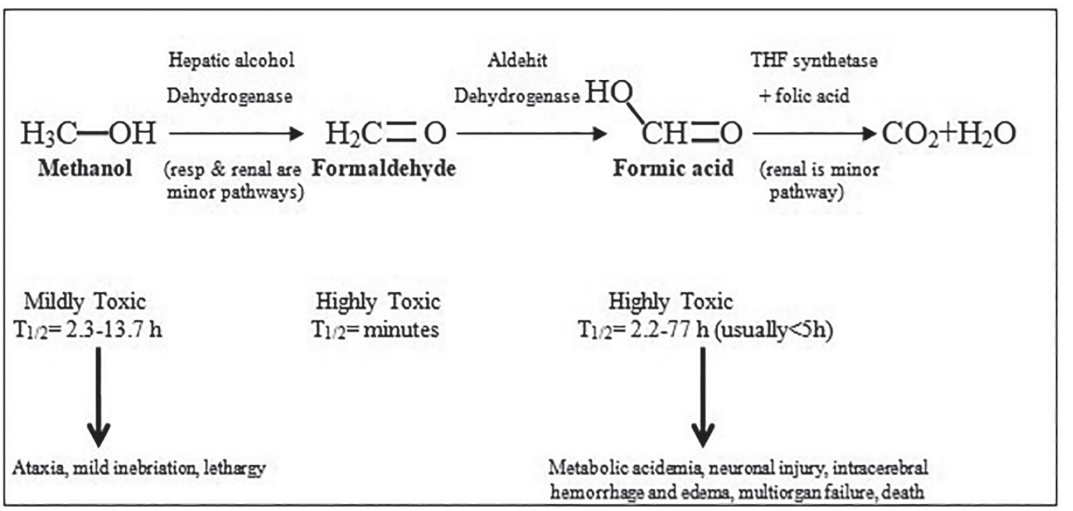

Figure 1. Metabolic biotransformation and clinical manifestations of methanol (28).

3. Intoxication

Methyl alcohol, which is added as a denaturing agent to ethyl alcohol, is the most common cause of intoxication. Alcoholic individuals' consumption of denatured alcohol products such as spirits as a liquor is an example of this (29).

Chronic alcoholics tend to drink anything that contains alcohol. Intoxication may develop as a result of using products containing methanol or consuming illegally prepared alcoholic beverages that should not contain methanol under normal conditions. In young individuals, intoxication may occur accidentally as a result of suicide or using methanol instead of ethanol (27).

Exposure to methyl alcohol steam or dermal exposure may cause intoxication in the industry. The workplace exposure limit (TLV-TWA) for inhalation recommended by ACGIH (Association Advancing Occupational and Environmental Health, USA) is 200 ppm on average over an 8-hour period, STEL: 250 ppm. The level (IDLH) reported to be urgently dangerous to human life and health is 6000 ppm (25,30-32). According to ACGIH data, the maximum permissible concentration for skin contact is 200 ppm (270 mg / m^3) (31-33).

Methyl alcohol may sometimes lead to epidemics. As a result, mass poisoning and mass death may occur (27, 34-36). The most known mass disaster in the world occurred in 1951 in Atlanta. 90-gallon illegal whiskey containing 35-40% methanol was consumed, resulting in 323 poisoning and 41 deaths (10,27,37). In our country, it was reported that 21 people died in 2004, 23 people died in 2005, 28 people died in 2015, and tens of people were hospitalized due to the methanol in fake raki consumed (23,38,39).

Kaya et al. reported that the deaths of 78 cases occurred due to methanol intoxication in the study in which the autopsies were performed retrospectively in Adana Forensic Medicine Institute from May 2016 to 2017 (24).

Methanol is easily and rapidly absorbed in the human body by all contact routes (skin, respiratory tract or gastrointestinal tract). Methanol passes through all membranes, so it is a liquid type that can be distributed evenly to all tissues and organs according to the amount of water. The normal blood concentration in the human body is 0.00015 g/dL or less. This is obtained from endogenous production and dietary sources. (3.40).

The fatal dose for humans has not been established with certainty. However, studies have shown that this rate may vary widely. The minimum fatal dose is reported to be approximately 100 ml (10). In various studies, the lethal dose of oral methanol is reported to be 30-240 ml (25.41), 1gr/kg (41), 300-1000mg/kg (42), 0.5 ml/kg (43). The minimum fatal concentration in the blood is 0.04 g/dL (3).

In Bennett et al.'s study, 323 cases, it was reported that fatal intoxication occurred after only 15 ml intake of 40% methanol (37), Ziegler reported in his study that when taking methyl alcohol pure, one teaspoon caused blindness and one ounce of death (44). On the other hand, in a reported case, oral intake of more than 500 ml of methanol did not cause death or blindness (10). Ocular morbidity is a well-known consequence of methanol poisoning. Cases of blindness have been reported after consumption of up to 4 ml (9,10).

According to an opinion, consuming in ethanol before consumption of methanol or consuming methanol and ethanol together may affect toxicity for a certain dose of methanol. It is also important whether the person has a folate deficiency. Thus, the width of the minimum toxic dose limit in the human body can also be explained (10,45).

As a result of intake of methanol with different exposure patterns, the highest methanol concentration can be found in blood, aqueous-vitreous humor and bile, brain, kidneys, lungs and spleen (40).

In fact, methanol itself is non-toxic, which may cause drunkenness, but it does not have cytotoxic properties. The main cause of toxicity is methanol metabolites (10). Methanol is first metabolized to formaldehyde and then to formic acid by dehydrogenation. Formaldehyde and formic acid are highly reactive, easily bound to tissue proteins, and leads to inhibition of the cytochrome oxidase system, which affects oxidative metabolism (10,46).

Most of the toxicity is thought to arise from formaldehyde. However, it has been reported that formic acid is more responsible for these effects. In studies of serum formic acid concentrations and methanol levels, it has been shown that formic acid concentration is more compatible with clinical findings (10). Studies have shown that ocular symptoms that arise from methanol poisoning can be reproduced in animal models by applying formic acid alone (40,47). Humans and primates are highly sensitive to methanol-induced neurotoxicity because their capacity to oxidize formic acid is limited (40).

At the beginning, formic acid cumulation may directly cause acidosis. There is a cytochrome oxidase complex at the far end of the respiratory chain in mitochondria, and as a result of its inhibition, "histotoxic hypoxia" occurs. Oxidative degrades in phosphorylation, causes accumulation of lactic acid, thereby deepening acidosis. Formic acid interacts with intracellular respiration and promotes anaerobic metabolism, thereby producing lactate. Increased lactate concentrations and tissue hypoxia,

lowers pH and causes further undissociated formic acid formation. Format and lactic acid, both of them, contribute to anion gap increase in methanol poisoning (48).

4. Clinic

The symptoms and signs of methanol poisoning are usually related to the central nervous system, eyes, and gastrointestinal tract. Most symptoms are associated with metabolic acidosis (10,25,48).

The clinic of methanol intoxication contains typically mild central nervous system depression followed by partial dose of methanol a latent time of approximately 12-24 hours. The conversion of methanol to formaldehyde is slow, which causes delay time. The fact remains that, this range can be quite variable and it can be less than an hour or up to 72 hours. If methanol is taken simultaneously with ethanol, the latent period is longer (10,25,48).

Acidosis is usually not seen, as it is not metabolized to toxic products in the first few hours after oral intake of methanol. A marked increase in osmolar space can be observed; an osmolar space of the 10 mOsm/L is correlated with the toxic concentrations of methanol (25).

After a latent period of up to 30 hours, severe anion gap can be detected with metabolic acidosis, visual disorders, blindness, seizures, coma, myoglobinuria, and acute renal failure and death. The primary toxic factor is metabolic acidosis in methyl alcohol intoxication. In this type of intoxication, drunkenness is not an important symptom (9).

Visual impairments are common and diverse. These disorders may lead to blackout, blurred vision, flash, photophobia, hemianopsia, visual disorder expressed as "seeing a snowstorm" of patients, or even to the total loss of light perception. It is reported that, in a large epidemic, some visual symptoms have been detected in all patients with mild acidosis and more than half of patients without acidosis. Abnormal pupil light reflexes; It has a wide range from a decreasing reaction to fixed and dilated pupils (10,25,49,50). Funduscopic examination may detect optic disc hyperemia or paleness, venous enlargement, peripapillary edema, and retinal or optic disc edema. Visual disorders may occur within 6 hours in conscious patients (25,49).

In mild-to-moderate methanol poisoning, headaches, drowsiness, abirritation and confusion can often be seen. Very little euphoria occurs compared to methanol ethanol. In severe cases of methanol poisoning, coma and contractions indicate the presence of brain edema. In addition to blindness, people who survive after severe methanol poisoning may develop a Parkinson's-like extrapyramidal syndrome characterized by rigidity, bradykinesia, mild tremor, mask face, abirritation and mild dementia. These clinical effects are generally associated with radiographic evidence of necrosis and sometimes hemorrhage in putamen and subcortical white matter. Some authors claim that these hemorrhages occur due to heparin used during dialysis; the fact remains that, it has been shown that putaminal hemorrhage develops in patients who have not received dialysis treatment. Rare neurological complications of severe methanol poisoning like transverse myelitis, cognitive deficit and pseudobulbar palsy may occur even without hypoxia and hypotension (17,48,51).

Methanol may typically cause nausea, vomiting and abdominal pain. Abdominal pain, which is a consequence of the development of pancreatitis, can be very severe. Nevertheless, the absence of gastrointestinal symptoms does not exclude serious toxicity. Acute pancreatitis, defined by high serum amylase, is a common complication of severe methanol poisoning, and pancreatitis has been confirmed in autopsy studies. The increase of the level of hepatic aminotransferases is generally mild and temporary (10,48).

Myoglobinuria is a rare complication of methanol poisoning. And also, the presence of myoglobinuria may cause kidney dysfunction (48,52).

Kussmaul breathing may be observed in cases with severe acidosis. Bad prognostic factors are bradycardia, shock, long-term coma, seizure, persistent acidosis and anuria. Deaths that occur during epidemia of methanol poisoning usually occur as a result of respiratory insufficiency and sudden respiratory arrest (10).

5. Laboratory Properties

a. Acid - base disorders

The presence of severe metabolic acidosis with increased anion gap and increased osmolar gap indicates strong methanol or ethylene glycol poisoning. Still, similar laboratory abnormalities can be detected in some clinical situations. Examples are diabetic ketoacidosis, alcoholic ketoacidosis, multiple organ failure, chronic kidney failure, and critical disease (10,48,50).

b. Osmolal gap (OG)

Osmolarity (osmol per liter solution) and osmolality (osmol per kilogram solvent) are measurements of the amount of particles solubilized in the solution. Osmolal gap is a quick estimate of unmetered osmotically active components in serum based on the difference between the measured osmolality and the calculated osmolarity. Osmolal gap is a rapid prediction of unmetered osmotically active components in serum based on the difference

between the measured osmolality and the calculated osmolarity. In the physiological state, there is an osmolal gap of approximately 10 mOsm/kg H_2O. Significant value for OG is greater than 10-15 mOsm/kg H_2O. Consuming methanol may cause significant osmolal cavity (OG) production. For every milligram of methanol per deciliter, OG increases by approximately 0.34 mOsm/kg. A methanol concentration (500 mg/L) of 50 mg/dL increases OG by 17 mOsm/kg H_2O. Methanol metabolites have little effect on OG. Because of that, the maximum OG occurs after the absorption of methanol before metabolism. While methanol metabolism progresses, OG decreases and anion gap increases. During methanol poisoning, OG usually exceeds 20 mOsm/kg H_2O, but OG may be normal at the end of the process. This is because toxic formic acid concentrations develop during methanol metabolism (48).

c. Hematological and biochemical abnormalities

Routine laboratory examinations required for the detection of severe toxicity are as follows: serum methanol and ethanol concentrations, serum electrolytes, serum calcium, complete blood count, serum blood urea nitrogen and creatinine, urine analysis, serum osmolarity, hepatic aminotransferase enzymes, serum amylase and serum creatine kinase (48.50). Factors that make it difficult to relate serum methanol concentrations to clinical effects include sample timing, individual variability, concentration of toxic metabolites, and ethanol intake (48.50).

Peak methanol concentrations below 20 mg/dL (200 mg/L) are generally asymptomatic. However, not to misinterpret the methanol concentration, the time elapsed since consumption, taking with ethanol and acid base status should be considered. Peak methanol concentrations above 50 mg/dL (500 mg/L) indicate severe poisoning, especially if there is an increased anion-gated metabolic acidosis (48,52).

Co-consumption with ethanol reduces the toxicity associated with a certain concentration of methanol. It delays the expression of signs and symptoms correlated with methanol exposure (48.53).

6. Treatment

General precautions should be taken to ensure airway patency, sufficient ventilation and sufficient systemic perfusion, as in the first intervention management for all empoisoned patients. Gastric lavage can be recommended as a traditional method to removing poison residues, but it is useful only when administered immediately after intake, as methanol is absorbed very fast from the gastrointestinal tract (10).

The medication of an antidote in therapy, which blocks the function of alcohol dehydrogenase and thus prevents the formation of toxic metabolites, is the basis of treatment for methanol intoxication. In addition, metabolic acidosis and electrolyte abnormalities may need to be treated. Hemodialysis may also be required. There are two antidotes that block the ADH metabolism used today: ethanol, a competitive ADH substrate, and Fomepizole, a competitive ADH inhibitor (28.54).

Ethanol is a traditional antidote for the treatment of acute methanol poisoning. It has about ten times more affinity for alcohol dehydrogenase than methanol. Ethanol effectively inhibits the conversion of methanol to formaldehyde when the blood serum concentration rises above about 22 mmol. Another effective antidote is fomepizole (4-methylpyrazole). It has several times more affinity for ADH than methanol (39.45). Fomepizole was recently included in the WHO List of Essential Medicines (2013). However, drug supply is limited (29,45,55). Fomepizole is used as an antidote in place of ethanol in many places in the United States (29.55).

Ethanol is a substrate for ADH, fomepizole (4-methylpyrazole) competitively inhibits the ADH enzyme and blocks metabolite formation. (Figure 2) The adverse effects of high doses of ethanol do not result in the treatment of fomepizole. Thus, it is the preferred antidote in severe poisoning (56).

Some reasons to prefer fomepizole as an antidote rather than ethanol are higher affinity for ADH than ethanol, minimal side effects, no necessary to check fomepizole blood levels, no hospitalization in the intensive care unit (29.55).

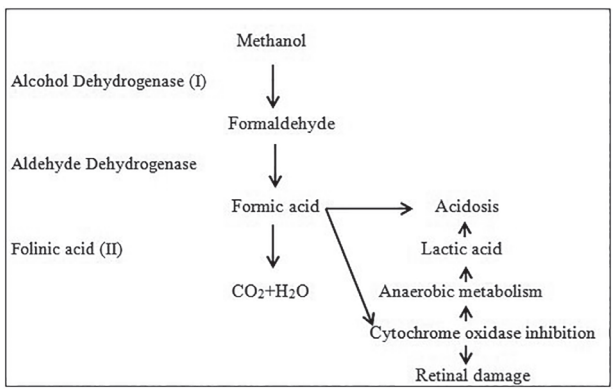

Figure 2. Elimination of the harmful effects of methanol by antidotes: (I) ethanol and fomepizole inhibit both methanol metabolism and the formation of toxic metabolites. This treatment approach is very important. (II) Folinic acid may increase formic acid metabolism; still, in daily clinical practice, this effect is much less important than in (I) (56).

Indications for using antidote treatment using fomepizole or ethanol, in cases of diagnosed or suspected methanol intoxication are; ≥20 mg/dl plasma methanol concentration (6.2 mmol per liter), an osmolal gap of >10 mOsm/L per liter with toxic methanol consumption, arterial pH level <7.3 with suspicion pf methanol poisoning, serum carbon dioxide level <20 mmol/L, osmolal gap >10 mOsm/L. At least two of these indications are required (29,48,55).

The clinical purpose of ethanol therapy is to achieve a therapeutic serum ethanol level between 100-150 mg/dl. Recommended doses of ethanol for methanol poisoning are 0.6-1 g/kg intravenously as maximal tolerable dose (7.5-12.5 ml ethanol/kg in 10% glucose solution) or oral 40% ethanol solution (2.5 ml/kg) (29.48.55).

For the patients who do not receive hemodialysis treatment, fomepizole's maximale tolerable dose of is 15mg/kg and maintenance dose 10mg/kg are administered every 12 hours. They should be used in 30 ml infusion in 100 ml of 0.9% NaCl or 5% dextrose. Fomepizole induces its own metabolism, so after the 48th hour of treatment, the dose is increased to 15 mg/kg. The drug doses administered to the patients who received hemodialysis treatment and who did not are the same. Only, the drug should be administered to the patients receiving hemodialysis treatment six hours after the first dose and then every four hours, too (29,48,55).

Hemodialysis eliminates methanol and toxic metabolite formic acid in the blood. In general, dialysis treatment should be started regardless of symptoms in all cases with ocular symptoms and developing kidney failure. Indications for hemodialysis are 50 mg/dL (15.6 mmol/k) or more serum methanol concentration, presence of metabolic acidosis, seizures, coma and visual disorders (27,28,48).

According to guidelines based on clinical experience rather than evidences, treatment should be continued until the plasma methanol concentration falls below 20 mg per deciliter (6.2 mmol methanol per liter). The exact point to stop the treatment of the patient has not been reported, still, it has been reported that it is safe to stop treatment when the plasma methanol concentration is 25-30 mg per deciliter (9.4 mmol methanol per liter) (29.48).

The described relationship between formic acid metabolism and folic acid-dependent enzyme systems shows that, folic acid can play a therapeutic additive in methanol intoxication. Thus, folic or folinic acid should be administered intravenously every four hours (50-100 mg) to all patients diagnosed or suspected with methanol poisoning (10,48). Also, this is may be necessary that to include very high amounts of bicarbonate ($NaHCO_3$) into the treatment to reach normal pH values (9,48).

7. Prognosis

Methanol poisoning has a quite high mortality ratio. The degree of metabolic acidosis at the first admission (low serum bicarbonate, high anion gap, serum lactate and format concentrations), negative serum ethanol, lack of respiratory compensation when severe acidotic and coma are bad prognostic factors (45).

The time from the first application to a hospital to the diagnosis is very important. There is no consistent coherence between serum methanol concentration at the first application and mortality, but patients with bad results frequently have a higher serum methanol concentration. Stress-induced hyperglycemia in the worsened patients has been claimed as a bad prognostic factor (45).

In the 2007 study of Hassanian-Moghaddam et al., it was reported that the mortality rate was 90% in patients with comatose state at the time of admission, 20% in non-comatose patients, and there was a significant difference in mean pH in the first arterial blood gas values of the deceased patients and survivors (57).

In another study, it was reported that untreated methanol intoxication was associated with a 28% mortality rate and 30% vision deficiency or blindness in survivors (29).

In the study of 725 cases by McNally, it was reported that, 90 cases experienced total blindness, 85 cases had visual defect at some degrees during acute poisoning, 335 people survived. Among the survivors, visual impairment recovery is common (10).

In the epidemic reported by Chew et al., there were 26 people, all of whom were somewhat acidic and 15 had visual impairments in the acute phase, but only two patients had permanent vision loss (58).

The mortality rate is higher in the individuals who survive methanol intoxication in the next six months compared to the normal population (59).

8. Postmortem Findings

a. Macroscopic and histopathological findings

In patients who died due to methanol intoxication, internal and external postmortem findings and anoxia/hypoxia findings are similar in macroscopic examination. In cases, cerebral edema and congestion, intracerebral hemorrhage, pulmonary edema, erosion and hemorrhage in the gastric mucosa can be detected. Cases of subendocardial bleeding are rarely shown. Changes due to chronic alcoholism such as hepatosteatosis, micronodular, macronodular and mixed type cirrhosis are observed in the liver (25,60).

Common histopathological features observed are cerebral congestion and edema, basal ganglion hemorrhage, basal ganglion necrosis. In histology, capillary obstruction in the putamen, hyperemia and hemorrhagic necrosis of the putamen can be detected. Bleeding can be detected in the tissue surrounding the optic nerve. Common histopathological features observed; cerebral congestion and edema are basal ganglion hemorrhage, basal ganglion necrosis, capillary obstruction in the putamen in histology, hyperemia and hemorrhagic necrosis of the putamen. Bleeding can be detected in the tissue surrounding the optic nerve. Alveolar edema and hemorrhages in the lungs, microvesicular and macrovesicular fatty changes in the liver, glomerulosclerosis, tubular degeneration, hydropic changes and interstitial bleeding in the kidneys may occur (20,27,60,61).

In Japan, Mittal et al. published a study on 28 cases that resulted in death. It was reported that, in 85.7% of cases, neuron contraction and degeneration in the parietal cortex. Putamen degeneration and necrosis (7.14%), hemorrhage in optic chiasm (3.5%) and spongy degeneration (7.14%) were also detected in the same study. Severe renal tubular degeneration and patchy necrosis have been reported in all cases (62).

b. Collection, preservation and transportation of postmortem laboratory samples

In cases of methanol intoxication, external pathognomonic findings cannot be detected except non-specific autopsy findings. Because of that, the most important step in the diagnostic process is toxicological examinations. Proper samples should be collected with proper methods and in proper quantities, stored and transport to the laboratory properly. The ideal postmortem blood sample to be used in forensic toxicological analysis should be taken from the femoral or jugular vein area and the sample should have sufficient amount (approximately 10-30 mL). In condition of putrefaction and blood samples deterioration, it is recommended that vitreous fluid should be used for alcohol determination. Blood samples should be collected in clean and capped tubes with protective materials, such as NaN_3, NaF at a rate of 0.5-2% (w/v), labeled. The name, age, gender, type of the sample, date and time of collection should be written on the label. The safety chain should be followed until the samples collected during the autopsy are delivered to the laboratory. Preservation and transportation should be carried out in accordance with cold chain rules. Ideally, samples should be delivered to the laboratory immediately after collecting and toxicological analysis should be carried out. Sometimes, the sample may need to wait a while until analysis. In this situation, antemortem or postmortem samples should be stored at 4°C if analyzed within a few days. If it waits longer, it should be stored at (-20)-(-80) °C (20,63-65).

c. Postmortem laboratory findings

While methanol intoxication in humans, blood methanol and formic acid concentrations are quite variable, various studies of postmortem methyl alcohol levels are in the range of 74-485 mg/dl (20), in the range of 55-479 mg/dl (66), in the range of 151-300 mg/dl (18), in the range of 18.2-465 mg/dl (24), in the range of 50-755 mg/100 ml (67) and in the range of 0-826 mg/100 ml (23).

In Mittal et al.'s studies, they reported that the levels of methanol in the blood and internal organs were variable, the average level of methyl alcohol was 155.87 mg (maximum 420.4 mg), and no alcohol was detected in the blood of seven cases. However in all these situations, they reported that they revealed the presence of methyl alcohol in viscera and stomach contents (62).

Many factors can be claimed as a reason for the variation of the half-life in such a wide range, such as the volume and percentage of methanol consumed, the duration of survival, whether medical intervention was performed, consumption of ethanol simultaneously, time between death and alcohol consumption, material intake, and time to analyze (20,68,69).

If death occurs without medical intervention, postmortem methanol and formic acid levels are high enough to explain death. If death occurs despite medical intervention, postmortem methanol and formic acid levels can be found below the lethal dose. In such cases, the analysis of antemortem samples considerably contributes to the interpretation of the results obtained. For easy interpretation of analytical results, it is important to learn a complete case history including information on medical intervention techniques used and survival time. In case of overdose of methanol consumption that causes death of individuals, postmortem methanol and formic acid concentrations are adequate to explain the cause of death (69).

Hospitalized patients who received hemodialysis treatment, it was reported that when the postmortem methanol levels were compared, the brainstem methanol level was very high compared to the blood. Hemodialysis effectively reduces toxic blood methanol concentrations. Thus, brain methanol concentrations can be many times more than blood levels. Therefore, in addition to blood analysis of patients with longer survival time, brain methanol analysis is recommended after autopsy (68).

In cases with a significant time gap between methanol consumption and death and negative methanol in the blood, methanol intoxication can be confirmed by determining formic acid in vitreous humor or blood samples (70).

9. Conclusion

In our country, the majority of the cases of autopsy and methanol poisoning in recent years consist of distillers or people who consume fake alcoholic products that are known to be cheaper. It is observed that retails of fake alcohol (no record label), as well as the amount of distillers have increased with the escalation of alcohol prices. In addition to licensed ethanol distributors, illegal supply of methanol to the market leads to an increase in the amount of methanol poisoning cases, too. That is why, consumption of uncontrolled/ illegal products and methanol poisoning can be prevented through an effective inspection mechanism over chemicals in question.

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Adli Tıp Bülteni

Review

Evaluation of Sexually Transmitted Diseases in Cases of Sexual Assault and Abuse

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Abstract: It is important to be evaluated cases of sexual assault and sexual abuse in terms of sexually transmitted diseases along with physical and psychological trauma. In these cases, the examination is usually limited to the detection of trauma findings and the taking of samples for the identification of the assailant. There are a large number of sexually transmitted diseases such as *Neisseria gonorrhoeae, Chlamydia trachomatis, Trichomonas vaginalis*, Hepatitis B virus, Human immunodeficiency virus and syphilis; nevertheless, there are no standardized guidelines for screening tests and prophylaxis practices for these agents in our country. Therefore, the risk of transmission should be taken into consideration in all cases and assessment should be made in terms of treatment and prophylaxis practices if necessary. Also, in cases that the assailants can be determined, these people's tests and examinations should be performed for both determination of the victim's need for medical care for sexually transmitted diseases and the assailants' trial process and also establishing the casual relation. In this review, it was aimed to draw attention to the evaluation of sexually transmitted diseases which can be seen in victims of sexual assault and sexual abuse and also the examination of the assailants in the light of the literature by the view of medico-legal aspect.

Keywords: Forensic Medicine; Sexual Assault; Sexual Abuse; Sexually Transmitted Diseases.

Öz Cinsel saldırı ve cinsel istismar olgularının fiziksel ve ruhsal travma ile birlikte cinsel yolla bulaşan hastalıklar (CYBH) açısından da değerlendirilmesi önemlidir. Bu olgularda muayene genellikle travma bulgularının tespiti ve saldırganın kimliğinin tespitine yönelik örnek alımı ile sınırlı olmaktadır. Cinsel yolla bulaşan Neisseria gonorrhoeae, Chlamydia trachomatis, Trichomonas vaginalis, Hepatit B virüsü, Human immunodeficiency virüs ve sifiliz gibi çok sayıda etken mevcut olmakla birlikte ülkemizde bu etkenlere yönelik tarama testleri ve profilaksi uygulamaları ile ilgili standardize edilmiş bir rehber bulunmamaktadır. Bu nedenle, tüm olgularda bulaş riski göz önünde bulundurulmalı, gereklilik halinde tedavi ve profilaksi uygulamaları açısından değerlendirme yapılmalıdır. Ayrıca saldırgana ulaşılabildiği durumlarda gerek mağdurun CYBH için tıbbi bakım ihtiyacının belirlenebilmesi gerekse saldırganın yargılanma süreci ve illiyet bağının kurulabilmesi için bu kişilerin de muayenesi ve tetkikleri yapılmalıdır. Bu derlemede, cinsel saldırı ve cinsel istismar mağdurlarında görülebilecek cinsel yolla bulaşan hastalıkların değerlendirilmesi ve saldırganın muayenesi hususlarının, literatür bilgileri eşliğinde, adli-tıbbi yönden incelenerek sağlık çalışanlarının bu konuya dikkatlerini çekmek amaçlandı.

Anahtar kelimeler: Adli Tıp; Cinsel Saldırı; Cinsel Istismar; Cinsel Yolla Bulaşan Hastalıklar

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1. Introduction and Purpose

Sexual assaults and abuses are important judicial incidents that have serious physical and mental adverse effects on victims. In the United States, it is estimated that approximately 19.3% of women and 1.7% of men suffer sexual assault, which occurs by penetration (1). The recognition, medical treatment and management of these cases is a complex process with forensic, medical, psychological and social aspects (2). In this process, many issues from various aspects should be considered carefully such as evaluation and treatment of physical injury; contraception; evaluation, treatment and prevention of sexually transmitted diseases (STDs); specimen collection and giving psychological support (3,4). Therefore, it is important that the examinations of victims should be carried out by experienced physicians and as a whole to cover all processes.

In our country, examinations of victims of sexual assault and abuse can be carried out by obstetricians and gynecologists, emergency medicine specialists and general practitioners besides forensic medicine specialists. In accordance with "Law of Criminal Procedure" and "Regulation on Physical Examination, Genetic Examination and Physical Identification in Criminal Procedure", the examinations related to sexual assaults, which are organized with special provisions as internal body examination, can be mostly focused on genital examination-hymen and anal region due to the characteristics of the case- and consequently, focus could be on the determination of trauma findings and collection of specimen for forensic purposes. Evaluation according to STDs which is involved in preventative and therapeutic medicine services is one of the most important tasks of the physician who does medico-legal examination. However, STDs evaluation generally falls behind the trauma care and treatment and it can be ignored. In a survey study of adolescent sexual abuse in our country, it has been reported that physicians responded correctly to questions about STDs risk factors 93.6%, questions related to STDs agents 74%, and questions about prophylactic treatment and vaccine practices 58%. Scientific data also support the need to increasing of health care workers' knowledge about STDs (5).

There are many causes of sexually transmitted diseases such as *Neisseria gonorrhoeae, Chlamydia trachomatis, Treponema pallidum, Trichomonas vaginalis,* Human immunodeficiency virus 1/2 (HIV-1/2), Herpes simplex virus (HSV), Human papilloma virus (HPV), Hepatitis B virus (HBV), *Mycoplasma genitalium*, *Haemophilus ducreyi* (chancroid), and *Phthirus pubis* which causes pediculosis pubis (3). Appropriate management of the process for diagnosis, treatment and prevention of diseases and complications caused by these pathogens are important as at least the detection of trauma findings, collection of samples and treatment of physical trauma findings, while these pathogens which sometimes caused irreversible damages in the health of the victim.

In this review, it was aimed to draw the attention of health workers by providing knowledge about STDs and the evaluation of these diseases that can be seen in victims of sexual assault and sexual abuse. In the article, the term of "sexual assault" shall be used to refer to non-consensual sexual acts performed against adults and the term of "sexual abuse" shall be used to refer to sexual acts performed against children in accordance with the legislation of our country. Since STDs can show different qualifications in adults and children, the subheadings created will be dealt with primarily from the point of view of adults and children. Due to the fact that it then contains a separate regulation in the legal legislation, examination of the defendant and suspect will be mentioned separately. Suggestions will also be given on the important points such as in the forensic examinations and evaluations performed about sexual assaults and abuses, prevention of possible transmission and establishment of a casual relation with sexual assault and abuse in case of transmission.

A. Sexually Transmitted Diseases in Adults

A.1. Prevalence:

The rate of transmission of STDs after sexual assaults varies considerably between populations (6). Overall prevalence is reported between 4% and 56%, and the wide range in prevalence may be due to factors such as differences in patient groups, the ages and sex of the victims included in the study and the differences in diagnostic testing procedures (7, 8). Positive culture results depending on methodological methods may also indicate preexisting infection (6). In a research conducted, in three months before the assault, the positive infection results in those who do not have sexual intercourse and those who have recently had intercourse, was reported as 4.3% and 25.6%, respectively, (9), while in another study, the rate of STDs was reported as 26.6% in virgins and 34.2% in non-virgins and there was no significant difference (10).

Jauréguy et al. were reported as the rates of genital chlamydia 13.8%, gonorrhea 3.6%, and coinfection of chlamydia and gonorrhea % 1.6 in females after sexual assault, and also these were detected in males as the rates of anorectal chlamydia 4.8%, gonorrhea 4.8%, and oropharyngeal gonorrhea 14.3% (8). In another study, the chlamydia infection rate was reported as 28.8% and

gonorrhea infection rate as 6.2% in female victims (10). For trichomonas infection, positivity rates were detected as 2.1% and 11.2% in different studies (11, 12).

Although there is not enough data available in the literature on the risk of transmission of Hepatitis B, HIV and genital herpes after sexual assault, van Rooijen et al. reported that the rate of newly diagnosed HIV infection in females admitted after the attack was 0.2%, the rate of HBV infection (HBsAg positivity) 0.6%, the rate of syphilis 0.1%, and in males for HIV, HBV and syphilis were reported as 1.6%, 1%, 3% respectively (6, 13). In another study, it was found that 2.6% of victims had Hepatitis B and HPV and 1.3% had syphilis during their six-month follow-up (11).

A.2. Factors That Increase the Risk of Transmission:

The risk of STDs is associated with the nature of the attack, and penetrating attacks often result in genital traumas, which increase the risk of transmission of infections (14). The seroprevalence of infection in population is also important in terms of risk. According to the some studies in our country, gonorrhea infection was reported as 8.6%, chlamydia infection 9.3% and trichomonas infection 2.8% in male patients with urethritis (15, 16).

For HIV, the type of contact is indicated as a factor that increases or decreases the risk of transmission. Accordingly, sexual intercourse with the consent of either side, the risk of transmission of HIV is reported as 10 for the females in penile-vaginal intercourse for every 10.000 encounters with the infected source; and 50 for the recipient in anal intercourse; and 1 for the recipient in oral intercourse (17). As for that, in sexual assaults, in cases of penetration, bleeding accompanying trauma, viral load in ejaculate, presence of STDs/genital lesions in the victim or assailant may increase the risk of HIV transmission (3).

Most STDs are included in mandatory notifiable diseases in our country (18). Therefore, it is clear that regular reporting and effective surveillance will contribute to the assessment of possible post-attack transmission risk.

A.3. Screening of Pathogens and Diagnostic Tests:

There is no standard recommendation for screening of STDs in the victims of sexual assault. In Australian STI Management Guidelines, it is recommended to be performed initial and control tests for all adult victims for HIV, HBV, syphilis, gonorrhea, chlamydia, trichomonas except HSV and HPV infections which do not have clinical findings (19). In Centers for Disease Control and Prevention (CDC) guidelines for Sexually Transmitted Diseases for 2015, it was taken as a basis that decision about performing tests evaluated on a case-by-case basis. (3). The HCV test is not included in the recommended tests for victims in this guide. It is represented that this is due to the low risk of transmission and lack of prophylaxis protocols (20). However, testing for HCV is also recommended in the CDC's updated guidelines for non-occupational HIV post-exposure prophylaxis and in our country's HIV/AIDS guidance (21, 22).

Tests that could be included in the initial evaluation recommended by the CDC:

- For the examples taken from body regions that penetration or attempted penetration occurred; Nucleic Acid Amplification Tests (NAAT) for chlamydia and gonorrhea,
- For vaginal or urine samples; NAAT for *T.vaginalis*
- For the presence of especially the complaints of vaginal discharge, odor or itching; pH test and direct fresh examinations including KOH tests for bacterial vaginosis and candidiasis,
- For HIV, HBV and syphilis; blood samples may be taken, if the first test results do not detect infection, serological tests may be repeated at the fourth-sixth week and third month for syphilis, at the sixth week and the third and sixth months for HIV (3).

Detection of the infection agent in the sample taken within the first 72 hours may indicate a previously acquired infection or infected semen (23), as well as the possibility that very early tests may not be able to detect the infection. Therefore, many centers where sexual assault cases are evaluated do not routinely recommend screening tests at first examination (24). Taking the necessary samples for the test is especially important in people who initially refuse to receive treatment and want to receive appropriate treatment for pathogens (20). Besides, the negative results detected in the samples taken after the recent attack may be valuable in terms of establishing a basal value in follow-up (23). In addition to diagnosis and treatment, the tests to detect the pathogens also contribute to the psychological management of the victim, the management of the voluntary sexual partner and the reporting of the diseases (24).

A.4. Prophylaxis:

Whether or not to give prophylaxis for infections after sexual assaults is a frequently debated topic. The decision depends on the local prevalence of sexually transmitted infections, the likelihood that the victim will continue to have control, the type of attack, the risk factors of the

assailant, the occurrence of genital injury and the decision of the victim (25). In the studies, the arrival of victims for control examination within 1-2 weeks, is ranged from 53.2-62% (26, 27). Empirical treatment is usually recommended for reasons such as low concordance, undetectable infection agent in the initial evaluation after the attack and need to take samples from all regions in the control examination unless the victims refuse (4).

Antimicrobial treatment for gonorrhea, chlamydia and *T.vaginalis* is stated that it should contain 250 mg ceftriaxone, 1 g azithromycin and 2 g metronidazole/tinidazole (3, 21).

Prophylaxis of viral pathogens in sexual assaults should also be considered. The recommendations for prophylaxis by viral pathogens are as follows:

***Prophylaxis for Hepatitis B Infection*:** It changes according to the victim's immune system condition (3, 20):

- Previously infected by HBV/existence of documentation about immunity to the disease; prophylaxis is not required.
- In cases that vaccination has been performed but the immune response has not been evaluated; a single dose of hepatitis B vaccination is recommended.
- In cases of uncertainty about the completion of the vaccination chart, the persons should be evaluated as unvaccinated.
- If the assailant is either known to be HBV-positive or the presence of infection is unknown and if the victim is not infected/unvaccinated/the history of vaccination is unknown; Hepatitis B immunoglobulin with the vaccine should be recommended, however according to the CDC guidelines, if the assailant's HBsAg status is not known, only the vaccine should be given to non-vaccinated victims.

Prophylaxis for HIV Infection: The number of HIV infections detected in male and female sexual assault victims is minimal (21). There are different practices for post-exposure prophylaxis (PEP) and in the studies, initiation rate of the PEP varies between 18%-76% (28-30). The factors affecting PEP suggestions are the likelihood of the assailant being infected with HIV, the presence of contact characteristics that may increase the risk of transmission, the duration after the event, the benefit/risk assessment of the PEP (31).

- If it is known that the source is HIV-positive and in the situations that exposure of vagina, rectum, eye, mouth, or other mucous membrane, nonintact skin with blood, semen or any body fluid that is contaminated by blood, and applications to the hospitals within the first 72 hours; antiretroviral prophylaxis per 28 days is recommended.
- For the applications after 72 hours; individual evaluation is recommended.
- HIV antibody tests are recommended to be examined in the sixth week, third and sixth months after contact (17).

During the initial examination, since the determination of the status of HIV infection of the assailant is usually not possible, health care workers should consider local HIV/AIDS epidemiology, having vaginal/anal penetration or not, having ejaculate contact with mucous membranes or not, the presence of mucosal lesion in assailant or victim, the number of assailants and their characteristics (such as IV drug use) and they also should take into consideration of any situation that may increase the risk of transmission (3). Expert's opinion on the subject should be taken for PEP. In addition, necessary arrangements must be made for the easy supply of antiretroviral drugs.

Prophylaxis for HPV Infection: HPV vaccination is also recommended for victims of sexual assault. In practice, the age ranges recommended by the Advisory Committee on Immunization Practices (ACIP) should be considered. Routine vaccination schema should start at the ages of 11-12 for females and males, but it can be also started at the age of 9. For those who have not previously been vaccinated properly, females at 13-26 ages and males at 13-21 ages can be vaccinate and homosexual, bisexual and men with immunodeficiency can be vaccinate until the age of 26. Two doses are recommended for those who start to be vaccinated between the ages of 9-14 and three doses for those who start to be vaccinated between the ages of 15-26 (32).

B. Sexually Transmitted Diseases in Children

B.1. Prevalence:

The prevalence of sexual abuse in children varies depending on country, sex, and methodological factors of the studies.

In a systematic review study evaluating the prevalence of sexual abuse; four different types of sexual abuse have been identified and it has been stated that for girls, general prevalence was observed 8-31% and prevalence for the acts of sexual abuse by penetration was 9%; and for boys, general prevalence was observed 3-17% and the prevalence for the acts of sexual abuse was 3% (33). A questionnaire study performed among high school students by Hébert et al.; it was reported that 14.9% of girls and 3.9% of boys were sexually abused, also 5.3% of girls and 1.4% of boys were forced to have sexual intercourse

by penetration (34). In another study, it was reported that the prevalence of sexually transmitted diseases in children after sexual abuse ranged between 5-8% (35). In Girardet and et al.'s study about sexually abused children aged between 0-13, it was reported that at least one STDs pathogen was detected in 485 girls by the rate of 8.2% and no pathogen was detected in 51 boys. Also, in this study, rates were determined for the infections of gonorrhea 3.3%, chlamydia 3.1%, *T.vaginalis* 5.9%, syphilis 0.3% and HIV 0% (36).

The prevalence of STDs was low in prepubertal girls examined for possible sexual abuse (37), and in a study, chlamydia infection was 6.7%, gonorrhea infection was 1.8% (38), while in another study which evaluated trichomonas infection, the rate was 4% (39).

B.2. Examination in Terms of Suspicion of Sexual Abuse:

The detection of STDs in prepubertal children also raises questions about the path of transmission. STDs seen in infants and in early childhood, can be transmitted by vertical transition which can lead to long periods of colonization, through autoinoculation of infections present elsewhere in the body or through heteroinoculation among children (40) and also it may be the evidence of sexual abuse (41). Therefore, the detection of any STDs in children should be a warning to health workers about the possibility of sexual abuse. At this stage, it is important to evaluate the case especially with forensic medicine specialists in a multidisciplinary approach, and to make essential notifications.

The detection of STDs in children after the neonatal period strongly supports sexual abuse, but there are some exceptions of this condition. In the STDs guide of CDC's: gonorrhea, syphilis, and HIV infections which are not transfusion-associated/acquired in perinatal period are pointed out indicators of sexual abuse. In the same guide, it is emphasized that chlamydia infection may be an indicator for sexual abuse in children older than three years and children younger than 3 years of age who are not considered a perinatal acquired infection which can persist for two to three years. If genital warts, *T. vaginalis* or genital herpes are diagnosed, it is stated that abuse should be suspected again (3). In the Adams criteria updated in 2018, genital, rectal or pharyngeal *N. gonorrhea* which is determined by the appropriate test method, excluded perinatal transition, genital or rectal *Chlamydia trachomatis* infections, *T. vaginalis* infections, syphilis, and HIV which transmission by blood/contaminated needles is excluded, are all indicators of sexual contact (37).

It is a common aspect that the main transmission path of HPV, which is the cause of anogenital warts, is vertical and auto-heteroinoculation (42). In a study that HPV was researched by NAAT in prepubertal girls and sexually active and inactive adolescents, the positivity rates detected in vaginal samples were 34.5%, 47.4% and 28.6%, respectively; and also it was emphasized that it should be taken care only if sexual abuse is suspected based on the positive test result due to the prevalence of HPV infection prior to sexual contact (43). On the other hand, in another study, it was shown that HPV was detected in 13.7% of sexually abused cases and 1.3% in children who had not been sexually abused; moreover, as the certainty of abuse increases, the rate of detection increases, too. Increased HPV detection with advancing age, decreased association with maternal genital warts does not support vertical transmission after two years of age (44).

About genital herpes, it has been more reported as sexual transmission when HSV type 2 was isolated and in the presence of only genital lesions at children over the age of five. In the presence of both genital and oral lesions, young children may be infected by infected adults during maintenance such as diapering or autoinoculation (45). In Adams criteria, *Molluscum contagiosum,* condyloma acuminatum (HPV) and HSV type 1/2 infections can occur with other modes of transmissions as well as sexual transmission. In the examination of these infections, additional information may be needed, such as the mother's gynecological history (HPV), the child's oral lesions (HSV) or the presence of lesions in other areas of the body (molluscum).

Genital ulcers caused by viral pathogens such as Epstein-Barr virus and vaginitis caused by fungal pathogens such as *C. albicans* or bacterial pathogens are infections that unrelated to sexual contact (37).

B.3. Pathogen Screening and Diagnostic Tests:

If the child is asymptomatic, it is not routinely recommended to take samples and test for all pathogens from all regions due to not be prevalent of STDs in children examined for sexual abuse. Each case should be evaluated individually for the risk of STDs. In the following cases, clinicians should take in consideration screening (3, 46):

- Oral-anal-vaginal penetration or findings of recent/healed penetration,
- Abuse by a foreign person,
- Abuse by one who is known to have STDs or is at high risk for STDs (such as having IV drug addict and multiple sex partners),
- Having a sibling, relative or household member with STDs,

- Living in an area with a high rate of STDs in the community,
- The child has symptoms or signs of STDs (vaginal discharge, genital ulcers, urinary symptoms, etc.),
- A child who has previously been diagnosed with STDs should be screened for other STDs pathogens,
- The child or his family wants to be tested for STDs.

Because of the psychosocial and legal consequences of false positive results, high-specificity tests should be used in diagnosis. If the test is planned in children, it is the first proposed microbiological culture method (3). However, due to the low sensitivity of culture-based tests, the fact that many laboratories no longer recommend these tests, and especially the difficulties in accessing the culture method for *C.trachomatis*, the use of molecular tests has become widespread in recent years. Concerns about NAAT in children are being cross-reactivity in *N.gonorrhoeae* and having insufficient data for the usage in extragenital (pharynx and rectum) samples (24).

At the CDC STDs guide, it is stated for girls that NAAT may be used in vaginal and urine samples as an alternative to culture method for the detection of *N.gonorrhoeae* and *C.trachomatis* and additional tests can be performed in all positive detected samples. It is also stated for boys and extragenital samples that culture method is still preferred for testing (3). In many centers where the sexual abuse cases examined, urine samples are taken to be studied with NAAT for chlamydia and gonorrhea due to the convenience of its provision (24, 37).

The American Academy of Pediatrics have proposed NAAT for the detection of these agents due to its high sensitivity and close to cultural specificity. In addition, recent studies have reported that NAAT may be used in extra genital samples following sexual abuse (47, 48).

Data on the use of molecular methods for *T.vaginalis* are insufficient. So, direct fresh examination and culture method are recommended for vaginal discharged and asymptomatic children, and direct fresh examination are recommended for bacterial vaginitis (3, 24). The control examination should be conducted approximately two weeks after the last contact, taking into account the incubation periods of possible pathogens if the initial examination was not performed or the pathogen was not detected (3,49).

Although there is not enough data on the risk of HIV transmission after sexual abuse in children, girls may be under risk more than adults because of their vaginal epithelium is thin, there is more cervical ectopia in children, also children may be more exposed to recurrent sexual abuse than adults. Therefore, HIV screening testing in children should be considered and an antiretroviral prophylaxis decision should be made considering the type of attack and the likelihood of infection of the attacker (3, 50). Considering that the HBV vaccine entered the childhood vaccine calendar in 1988, in our country; evaluation should be performed according to the Hepatitis B vaccine. If syphilis, HBV and HIV basal serological tests are detected negative, control examination after 6 weeks and 3 months is recommended for the development of antibodies (3).

B.4. Prophylaxis:

Antimicrobial treatment is not recommended for such reasons that the incidence of STDs after sexual abuse in children is low, prepubertal girls have a lower risk for ascending infection than adults and regular follow-up of children can be provided. However, empirical treatment can be started after samples are taken because some children or their families are concerned about the possibility of infection (3). In addition, HPV vaccination is recommended for unvaccinated children aged 9 and over who have not been vaccinated or whose vaccination scheme has not been completed in accordance with ACIP recommendations (24).

C. Collection of Biological Materials from Clothes and from Skin:

In sexual abuses and sexual assaults, there is a possibility that biological evidence of the assailant may be found on the skin and clothing of the victim. Especially semen and blood within these, play an important role in the transmission of pathogens of STDs. The resistance of microorganisms to environmental conditions is variable and while *Chlamydias* are not susceptible to the external environment, *N. gonorrhoeae* and HIV are highly unstable (51). In cases who the infection agent cannot be isolated and identified by immunologically, DNA, RNA or proteins can be detected by molecular methods and microorganisms can be identified. It can also be studied on chemically fixed samples or extracts, and by these methods, the interrelated origins of pathogens can be distinguished based on their differences in genotypes (52). For these reasons, it should be cooperated with medical microbiologists about studying of tests for pathogens of STDs s from biological materials which found on the victim's skin and clothes except the genital and extragenital organs. In a reported sexual abuse case, the defendant has been sentenced by the way of molecular genotyping of *N.gonorrhoeae* which was detected in the taken samples from the child and from the defendant's underwear who had urethral discharge (53).

D. Points to be Paid Attention during The Examination of the Suspect or Defendant

The examination of the suspect and the defendant after sexual assault or sexual abuse is important as well as the examination of the victim in terms of proving the assault/abuse. The examination of genital region inferred internal body examination must be done by the physicians and the biological samples should be taken by the physicians or health professionals.

During the assailant's examination after sexual assault or abuse, the required examination about STDs should be performed and required tests should be requested. Detection of existing diseases in the assailant is also very important to determine the victim's need for prophylaxis. Besides, medical examinations of suspect or assailant have particular importance to be determined the casual relation of abuse or assault with STDs, when the negative results of the victim before the sexual assault turn to the positive after the assault/abuse. Also, cases have been reported that the identity of assailant was determined by typology of *N. gonorrhoeae* strains with molecular methods (53, 54).

Results

STDs should always be kept in mind in victims of sexual assault and abuse, and if suspect and assailant are known, they should be examined appropriately for these diseases.

Appropriate prophylaxis and follow-up of assault/abuse victims have medico-legal importance to both establishing casual relation with assault/abuse and prevention of STDs. If the assailant attacks to the victim consciously, even he/she predicts that the current disease would transmit to the victim, it should be also evaluated with regards to the crimes of the intentional injury.

There are currently no agreed guidelines for the examination of STDs after sexual assault/abuse in our country. Not carrying out an evaluation for STDs during the examination of the assault/abuse cases should be considered as a medical deficiency. National guidelines and algorithms should be prepared for screening, diagnosis, treatment and prophylaxis of sexually transmitted diseases in cases of sexual assault and abuse, examinations should be carried out at special centers. Accessibility of diagnostic tests and the treatments to be applied should be provided. Until this preparation is made, it is considered to be beneficial to follow recommendations written below:

- In all sexual assault/abuse cases' examinations, the risk of STDs should also be evaluated.
- The assessments should include an appropriate examination, if necessary, consultation with specialists, and the request for the necessary tests.
- Empirical prophylaxis requirements should be evaluated and if necessary should be performed at the risky cases and victims that could not be determined suspect and assailant.
- If the suspect or assailant can be determined, they should be also examined and tested or the judicial authorities should be warned to do so.
- All cases should be followed in terms of STDs and records of the cases should be kept in comprehensively for the evaluations to be made for casual relation in the next process.

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Adli Tıp Bülteni

Case Report

Lighter Fluid Inhalation and Neurological Sequelae as a Forensic Case

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Abstract: The use of volatile substances, also known as inhalant substances, is increasing all over the world. One of the most often encountered misuses of these substances is lighter fluid; which is easily accessible, legally and cheaply purchased, and which has a pleasurable effect in a short period of time.

In this report; 18 years-old case who was found in cardiac arrest on a street after lighter fluid inhalation nearly three years ago, which had been generalized tonic seizure during intensive care monitoring, observed changes in cranial Magnetic Resonance Imaging secondary to hypoxic-ischemic damage and butane gas inhalation and detected a severe motor and mental neurological sequelae was presented.

To our knowledge, in the literature, there were more autopsy studies on sudden death cases due to lighter fluid inhalation. Therefore, this presented case would contribute to the literature as it clearly reveals the neurological sequelae, as a result of lighter fluid inhalation.

Keywords: Lighter Fluid, Volatile Substance, Inhalation, Forensic Medicine, Ventricular Fibrillation.

Öz: Uçucu maddelerin, bir diğer adıyla inhalan maddelerin tüm dünyada kullanımları giderek artmaktadır. Bu maddelerden kötüye kullanımıyla en sık karşılaşılanlardan biri, kolay ulaşılabilmesi, yasal olarak ve ucuza satın alınabilmesi, kısa sürede keyif verici etki göstermesi nedenleriyle çakmak gazıdır.

Bu olgu sunumunda, yaklaşık üç yıl önce çakmak gazı inhalasyonu sonrası sokakta kardiak arrest halinde bulunan, yoğun bakım izlemi sırasında jeneralize tonik nöbet geçiren, kranial Manyetik Rezonans Görüntülemesinde hipoksik iskemik hasar ve bütan gazı inhalasyonuna sekonder değişiklikler izlenen, ağır motor ve mental nörolojik sekelleri saptanan 18 yaşındaki olgu sunuldu.

Literatür taramasında daha çok çakmak gazı inhalasyonuna bağlı ani ölüm olguları ile ilgili otopsi çalışmaları olduğu görüldü. Sunulan olgunun, çakmak gazı inhalasyonu sonucu meydana gelebilecek nörolojik sekelleri belirgin bir şekilde ortaya koyması nedeniyle literatüre katkı sağlayacağı düşünüldü.

Anahtar Kelimeler: Çakmak Gazı, Uçucu Madde, Inhalasyon, Adli Tıp, Ventriküler Fibrilasyon.

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1. Introduction

The volatile substances, also known as inhalant substances, are defined as substances that can easily evaporate at room temperature (1). Among these substances, butane and propane are the most common substances to be abused because of their pleasurable properties, and these fluids are also used in air freshener sprays, deodorants and lighters (2).

There are different ways of administration in the misuse of inhalant substances. They can be used by breathing through the nose of the container they are in, squeezing aerosol sprays directly into the mouth and/or nose, pouring the substance into plastic or paper bag and then breathing through nose and mouth and pouring the substance onto a piece of cloth and sniffing it (3).

Inhaled substances are increasingly being used all over the world due to their ease of access, being legally and cheaply available, having a pleasurable effect in a short period of time (3). In recent years, there have been studies showing an increase in lighter fluid misuse, especially among adolescents in Turkey (4-6).

Volatile substances cause many problems, including acute and/or chronic, physical and/or mental problems (7). Volatile substances may lead to sudden death due to their effects; such as cardiac arrhythmias, hypoxia, and respiratory depression in the acute period, and often cause neuropsychiatric disorders in the chronic period (7,8).

This case report aims to evaluate the findings and neurological sequelae that arise from lighter fluid inhalation from a forensic-medical perspective.

Ethical Declaration

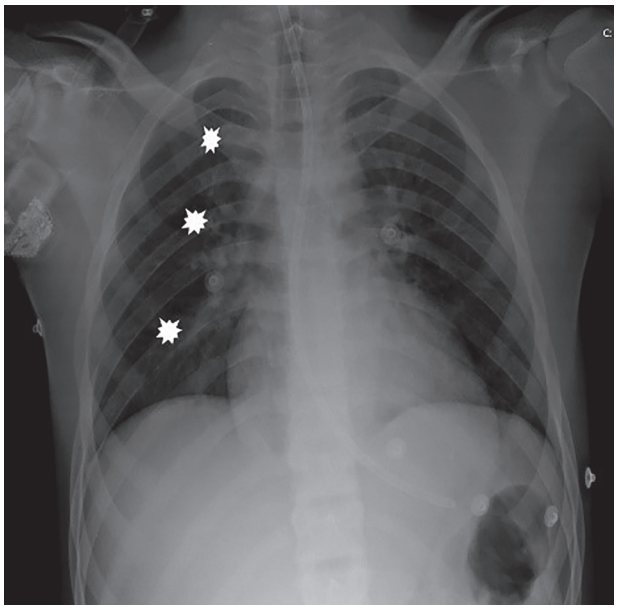
Informed consent was obtained from the participant and Helsinki Declaration rules were followed to conduct this study.

2. Case

After the lighter fluid inhalation, 18 years old male case consulted our Forensic Medicine outpatient clinic with the request to be arranged the forensic report.

From the examined document, it was noted that the patient smelled lighter fluid about three years ago before he consulted the clinic, he was found in cardiac arrest on a street, intervened by 112 ambulance services, defibrillated upon taking ventricular fibrillation rhythm in cardiopulmonary resuscitation, then, he was taken to a State Hospital Emergency Department. He was intubated, and activated charcoal was applied. The case was defibrillated twice more during follow-up, returned to a normal rhythm. His general medical condition was not good and was transferred to the University Hospital on the same day.

In Child Intensive Care Service documents after referral, it was noted that the case was followed up as intubated, the light reflexes were bilaterally taken, there were the coarse crackles (rales) in the lung auscultation, activated charcoal was present in the tracheal aspiration, and the appearance was consistent with possible charcoal aspiration on the right side of the chest X-ray (Picture 1). It has been observed in Echocardiography (Echo) that there was a minimal smear type of pericardial fluid, and ventricular functions were normal.

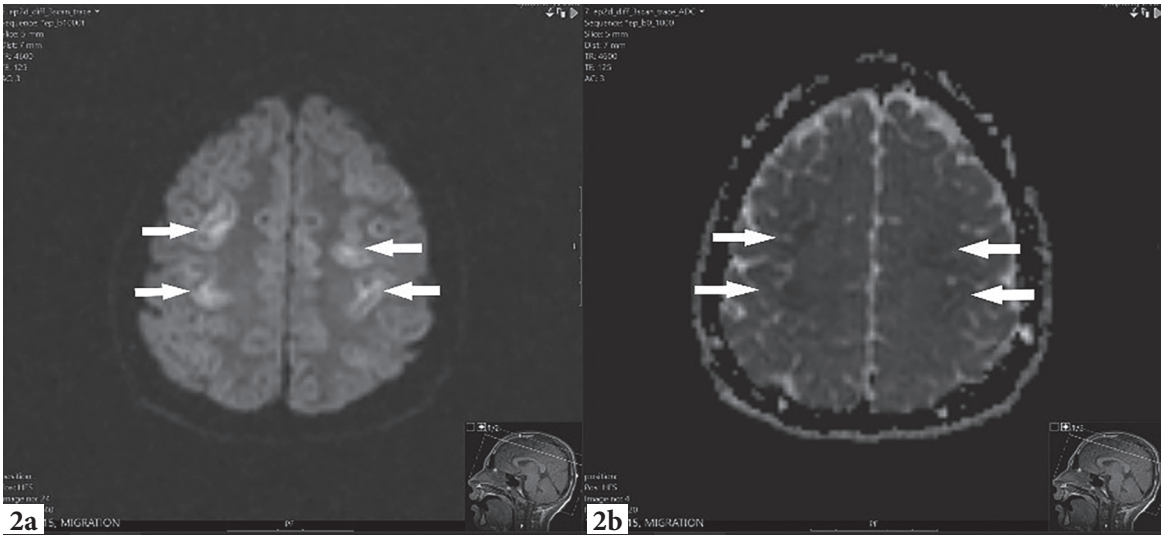


Picture 1. Appearance consistent with activated charcoal aspiration in the right lung.

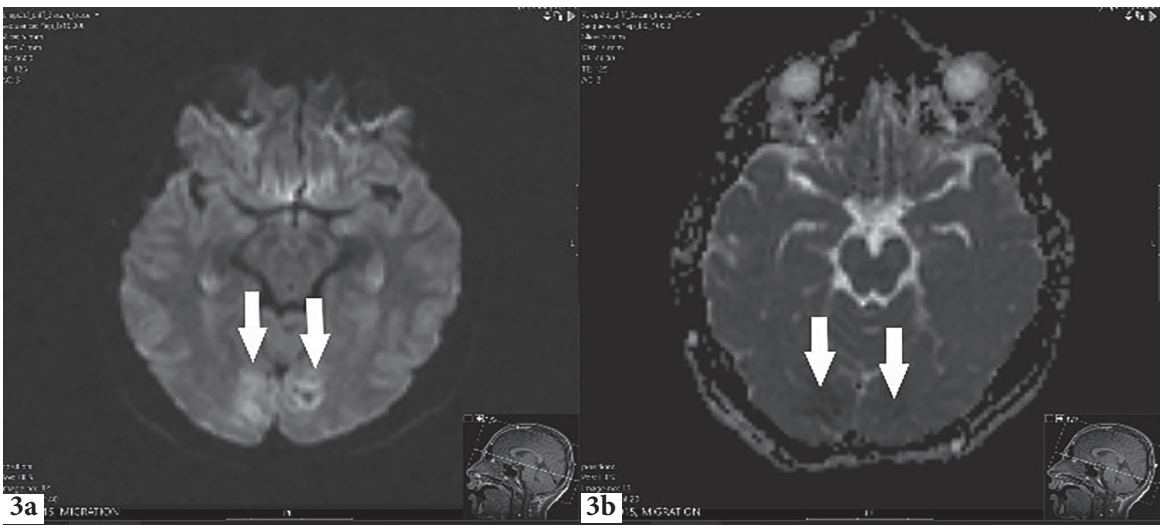
On the fourth day of the follow-up, it was reported that antiepileptic treatment was started due to generalized tonic-clonic seizure lasting 20-30 seconds, contractions increased as a spasm, and he had dystonia in the form of opisthotonos position and the way legs crossed.

In electroencephalography of the case (EEG), it was stated that bilateral synchrony of slow waves at theta frequency was recorded in parietooccipital regions, the basic rhythm was slow, and its clinical movements were thought to be non-epileptic. Deep tendon reflexes decreased, and no pathology was detected in electromyography (EMG).

In the Cranial Magnetic Resonance Imaging (MRI); in the bilateral frontoparietal cortex (Picture 2) and the occipital region, adjacent to calcarine sulcus (Picture 3), there were changes secondary to primarily hypoxic-ischemic damage and in bilateral putamen secondary appearance to inhalation of toxic gas (butane gas) (Picture 4).



Picture 2. Hyperintense in the diffusion sequence (2a) and hypointense regions in the ADC map (2b) in the diffusion MRI examination.



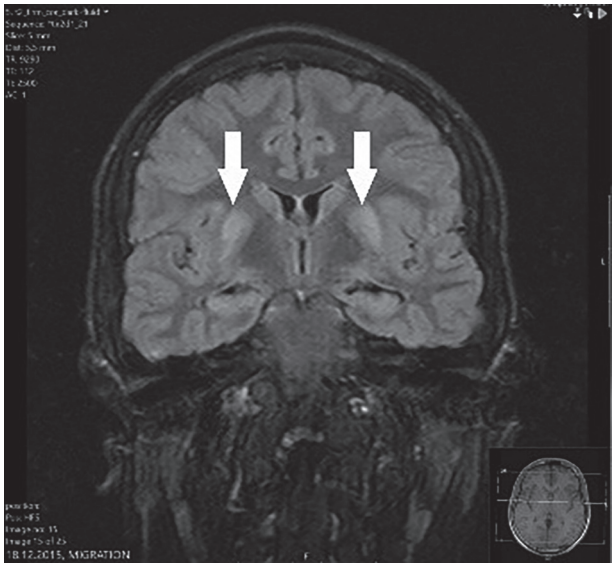
Picture 3. Hyperintense in the diffusion sequence (3a) and hypointense regions in the ADC map (3b) in the diffusion MRI examination.

Anamnesis and examination of the case were taken in our department (approximately three years after the incident), his family described that he had forgetfulness and we determined gait and speech disorders. No external lesions were observed due to the incident. A neurology consultation was requested. As a result of the consultation, the following problems were detected: dysarthria, dystonic posturing of the extremities and the myocloni, sometimes athetoid movements, impairment in fine hand skills, ataxia and dystonic movements, performance decrease in semantic fluency skills, orientation in space and time, complex attention-concentration, complex calculations, mental flexibility, construction, immediate visual memory, abstraction, disorder of naming skills and significant losses in close memory functions.

It is stated that in the forensic report of the case that the injury due to lighter fluid inhalation causes a situation that endangers the person's life, it can't be cured by a simple medical treatment, it causes an incurable illness and a permanent speech defect.

3. Discussion and Conclusions

All over the world, hypnotic substances and drugs are a growing public health problem with the physical and mental problems they cause. This is particularly affecting children-young people who are the future of the societies. In this regard, volatile substances have also been added among the substances commonly used, such as heroin, cocaine, ecstasy and synthetic substances. According to



Picture 4. Hyperintense areas in the bilateral putamen in T2a flair sequences.

the "National Survey on Drug Use and Health", which evaluated the use of volatile substances in children, adolescent and young adult age groups by the U.S. National Institute on Drug Abuse, since 2017, the rate of volatile substance use at least once in life was 9.3% at the age of 12 and below; 8.6% in the 12-17 age group; 9.5% among the 18-25 age group; 9.3% for individuals aged 26 and over were detected (9).

In another report presenting the prevalence of drug use in American youth, the rate of volatile substance use at least once in life for 2018 was stated as 8.7% in eighth grades, 6.5% in tenth grades, and 4.4% in twelfth grades (10). In a meta-analysis study, which looked at the prevalence of lifelong use of different substances among street children and young people living in low socioeconomic environments, it was reported that once-in-a-lifetime use of inhaled substances was 47% (11). When we look at this situation from the perspective of our country, it is seen that the usage rates are slightly lower. For instance, a study which was conducted in Kocaeli in 2017, found that the rate of volatile, drug and stimulant substance use in high schools was 3.6% (12). Again, in our country, one who used volatile substances at least once in their lifetime was determined to be 8.8% in another study, which investigated the prevalence of volatile substance use among high school students in 15 separate provinces. (13). However, it may be considered that these studies may not reflect the actual usage rate because the population with certain characteristics (such as high schools, patients working in occupational groups with volatile substances, patients applying to clinics for treatment) was selected (12-14).

Volatile substances are commonly used in everyday life products, such as adhesives, gasoline, paint thinner, spray paints, deodorants, hair sprays and lighter fluids (7). People often inhale gas to cheer up or enjoy it, or because of curiosity, they prefer lighter filling tubes that contain butane gas, which are easily supplied and cheap (5, 15). Although the presented case was injured as a result of lighter fluid inhalation, it was not possible to obtain information about the method by which lighter fluid was inhaled and how long it was inhaled.

It is reported that patients who use volatile substances, begin to use another addictive substance eventually and that it is common to use volatile substances in combination with another addictive substance (15). Our case has a history of inhalation bally in addition to lighter fluid.

In the literature, it is emphasized that volatile substance usage is the most common in males and adolescents (15). The age and sex of the case presented are in line with the literature. In addition to child/adolescent age group and male sex, the presence of family problems, low socioeconomic level, living on the street, working in occupational groups using volatile substances, are among the other risk factors of volatile substance addiction (16).

Volatile substance abuse is a major cause of morbidity and mortality, pathologies that arise from abuse are diverse (1,2), which may cause sudden death by causing suffocation, vagal inhibition, respiratory depression, and cardiac arrhythmias such as ventricular fibrillation (8). It has been stated that more than 50% of sudden deaths are due to direct toxic (especially cardiac) effects (17-19). The case presented was found in cardiac arrest in the street after inhalation of lighter fluid, and defibrillation was performed on ventricular fibrillation rhythm after cardiopulmonary resuscitation.

Neuropsychiatric sequelae are often seen in chronic volatile substance users. Neurological and behavioral findings and symptoms, peripheral neuropathy, headache, paresthesias, cerebellar symptoms, permanent motor dysfunction, Parkinsonism, apathy, lack of concentration, memory loss, visual-spatial dysfunction, distortion in the processing of verbal material and lead encephalopathy can be considered (1,7). In studies brain atrophy have been shown by Computed Tomography (CT) and; white matter degeneration, deterioration in subcortical structures, such as the thalamus, pons, basal ganglia and cerebellum shown by MRI (1,7). Our patient had seizures on the fourth day of follow-up, and cranial MRI showed changes secondary to hypoxic-ischemic damage and toxic gas (butane gas) inhalation. In the examination of our case conducted by the us and Department of Neurology after about three years, severe motor and mental,

neurological sequelae were detected. In the literature review, it was noted that mostly studies about lighter fluid inhalation were autopsy studies of sudden death cases (20,21). It was thought that our case would contribute to the literature because it clearly reveals the neurological sequelae that may occur as a result of lighter fluid inhalation.

As in this case, it is thought that the ease of access to addictive substances, such as lighter fluid, especially in the childhood age group, will result in a further increase in the use of such substances. Thus; especially under the age of 18, restriction of access to substances that are or may be abused, controlling the sale of such substances are only a few of the precautions that can be taken. In our country, volatile substances are defined by "*The Regulation on the Protection of Human Health From The Damages of Volatile Substances"* published in the Official Gazette dated 05.08.2010 and numbered 27663 and regulations have been made on the sale and possession of volatile substances. Some governorates have also issued resolutions prohibiting the sale of lighters and lighter fluids to children(22,23). It is also considerable importance that families fulfill their obligations of taking attention and care towards their children.

The situation that occurred in the case presented in this study attracts attention with its permanent neurological sequelae; and it has been endangering a person's life, causing an incurable illness and a permanent speech defect; caused severe damage (24). Simple and small precautions that can be taken, they will prevent situations that may bring about such a severe disability.

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Adli Tıp Bülteni

Case Report

Suicide with Like Hara-kiri Method: A Case Report

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Abstract: Suicide is defined as "a person's giving an end to his own life due to emotional, psychological, or social effects". Many factors such as cultural structure, ethnic group, age, gender and accessibility are effective in the choice of suicide method. The most common suicide method is hanging, followed by firearms, jumping from heights and chemical intake. While the suicide with the sharp instruments constitutes %2 of all suicides, the incidence of suicide with the sharp instruments which is similar to Hara-kiri is % 0.2. What makes our case valuable is that the person belongs to the Turkish race and has chosen a suicide method as hara-kiri that is special to the Japanese race. A 56-year-old man diagnosed with psychotic disorder died of peritoneal, small intestine and mesenteric injuries due to abdominal and chest penetrating stab wounds and hypovolemic shock due to bleeding.

Our case is compatible with similar cases in the literature in terms of age and sex. In addition, the presence of a known psychiatric diagnosis and history of suicide attempts were significant.

As a result, suicide with hara-kiri method is not common and it is important to determine the origin of hara-kiri death cases as well as all other medical cases. The medical history of the deceased and the information of relatives should be obtained before the autopsy.

Keywords: Suicide, Hara-kiri**,** Forensic Medicine, Abdominal Injury

Öz: İntihar 'bireyin duygusal, ruhsal ya da sosyal nedenlerin etkisiyle kendi yaşamına son vermesi' olarak tanımlanmaktadır. İntihar yöntemi seçiminde kültürel yapı, etnik grup, yaş, cinsiyet, ulaşılabilirlik gibi birçok faktör etkilidir. En sık intihar yöntemi ası olup, bunu ateşli silah, yüksekten atlama ve kimyevi madde alımı takip etmektedir. Kesici-delici alet ile intihar tüm intiharların % 2'sini oluştururken, neredeyse Harakiriye eş değer olan batına yönelik kesici-delici aletlerle meydana gelen intihar oranı % 0,2'dir. Olgumuzu değerli kılan, şahsın Türk ırkına mensup olması ve Japon ırkına özgü olan nadir rastlanan harakiriye benzer bir intihar yöntemi seçmiş olmasıdır. 56 yaşında psikotik bozukluk tanılı erkek olgu, batına nafiz kesici-delici alet yaralanmalarına bağlı periton, ince bağırsak ve mezenter yaralanması sonucu kanama ve hipovolemik şok nedeniyle ölmüştür.

Olgumuz yaş ve cinsiyet itibariyle literatürdeki benzer olgularla uyumluluk göstermektedir. Bunun yanında tıbbi geçmişinde ve yakınlarından alınan öyküde bilinen psikiyatrik tanısının bulunuşu ve yaşanmış intihar girişimlerinin varlığı anlamlı bulunmuştur.

Sonuç olarak harakiri yöntemiyle intihar çok sık karşılaştığımız bir olgu türü olmayıp, diğer tüm medikolegal ölüm olgularında olduğu gibi harakiri şeklindeki ölüm olgularının orijininin belirlenmesinde de, ayrıntılı otopsi işlemi ile beraber olay yerindeki bulgular, ölenin tıbbi özgeçmişi ve yakınlarından alınan bilgilerin bir arada değerlendirilmesi önemlidir.

Anahtar Kelimeler: İntihar, Harakiri, Adli Tıp, Batın Yaralanması

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1. Introduction

Suicide is defined as 'the individual's ending his/her own life under the influence of emotional, spiritual or social motives' (1). Many factors such as cultural structure, ethnic group, age, gender, accessibility are effective in the selection of suicide method. Although the suicide method percentages used differ from each other in studies conducted until today, hanging is the most commonly used suicide method in the medical literature, it is followed by a firearm, high jump and chemical substance intake (2). When we look at the distribution of suicide methods; in one study, while hanging was ranked first with 232 (52.3%) cases, it was followed by the use of firearms with 126 cases (28.4%), chemical use with 40 cases (9%) (medicine and pesticide), high jump with 33 cases (7.4%) (3). In a study involving cases who committed suicide between 2002 and 2009, it was observed that 47% of the cases used hanging, 23.5% used firearms, 14.2% used chemical substances, 9% used jumping from the height method (4). While suicide with a cutting-piercing device constitutes 2% of all suicides, suicide rate with abdominal cutting-piercing tools, which is almost equivalent to Harakiri, is 0.2%. This low incidence trend remained unchanged from 1983 to 2016 in the literature reviewed (5).

The origins of deaths depending on cutting-piercing tool injuries are mostly accident and murder (6). Unless proven otherwise, it is difficult to say that the deaths caused by the cutting-piercing tool are suicide. Before accepting the deaths that occurred through this method as suicide, wounds must be carefully examined. Suicide wounds are usually found in the parts within the hand reach of the body (7). The presence of hesitation cuts is one of the findings supporting suicide (8).

Harakiri is a suicide method used mostly by the Japanese people. The word harakiri means "to slash the belly" (8). Historically, the first harakiri was practiced by a samurai who committed suicide after being caught by enemies. Harakiri is considered to die with pride; however, it was banned by the government in 1873 (9). Classical harakiri involves inserting a knife into the lower-left area of the abdominal wall and moving the knife horizontally to the right. The blade is then pulled strongly upward so that it cuts an L-shaped line on the abdominal wall. In addition to its being very painful, this method causes a slow death (8).

In this study, a detailed review of the literature is presented to help illuminate a case who was belonged to the Turkish race and used a rare harakiri-like method for suicide and similar cases.

Ethical Declaration

Helsinki Declaration rules were followed to conduct this study.

2. Case

A 56-year-old male was evaluated by us medicolegally for the death incident occurred with a cutting-piercing tool injury from his abdomen. At the crime scene; it was observed that the corpse was found lying face down on the floor, and the upper body garments were lifted upwards, that there was a bed and quilt with heavy blood contamination on its right side, that there was a knife with blood contamination between the bed and the body, which was thought to be used for suicidal purposes. When the knife is examined; it was found that the total length of the blade part was 25 cm, the blade length was 13 cm, the blade width was 3 cm, the one side of the blade was sharp, the other was blunt and with a wooden handle. It was found that no additional examination in terms of blood and fingerprints on the knife was conducted since it was stated that it was not required by the Public Prosecutor's Office during the judicial investigation process.

Based on the statements taken from the relatives, it has been declared that; he was living alone in the village house and diagnosed with psychosis, there was a 3-day hospitalization in Manisa Psychiatric and Neurological Diseases Hospital approximately 45 days before the incident in question, and conducted repeated suicide attempts approximately 6 months ago with the use of cutting-piercing tools and drugs and he does not have any knowledge and curiosity about Japanese culture.

In the autopsy procedure on the body; it was seen that there is 5 cm long incision wound with skin, subcutaneous and muscular tissue line that is thought to occur in at least 2 strokes on the left-hand wrist inner face, two 1 cm long skin and subcutaneous cutting line wound on the right-hand wrist inner face, numerous mature cutting wound scars on the left anterior surfaces of the chest and abdomen. In the left hemithorax, a 7 cm inferolateral of the nipple, a 1.5 cm long, skin subcutaneous tissue line cutting device wound. Also, in the left lower quadrant of the abdomen, 7 cm inferolateral to the umbilicus It was found that there was an 8 cm long and 4 cm wide cutting-piercing tool wound, which was thought to be advanced by turning it after penetration.

Small intestines and mesentery were protruded through this cutting-piercing tool wound. When the intestinal tissue protruding to the outside was examined, it was determined that there was a full cut incision in three different places at the level of ileum, and hematomas were present in the mesentery. In the abdomen, 600 cc of free blood

was observed apart from the hematoma of the presence of hematomas in addition to this 600 cc of bleeding and considering the presence of dried blood, which cannot be measured at the scene, absorbed by environmental factors. It was concluded that our case died of bleeding and hypovolemic shock depending on the peritoneum, small intestine and mesentery injury caused by injury to the abdomen.

In a toxicological analysis of blood, urine and intraocular fluid samples taken during an autopsy, it was determined that there were no substances in the blood and intraocular fluid samples and tramadol, and that one of the drug active substances analyzed in the urine. It was found that the body was not under the influence of any drunk or drug-stimulating substance at the time of death.

3. Discussion

Suicide with a cutting-piercing tool is a rare method of suicide. The origins of deaths by means of cutting-piercing tool injuries are mostly accident and murder (6).

When examined in terms of gender and age in studies, the numerical superiority of men aged 35-70 years was observed in self-injuries with cutting-piercing tools (10). In studies when the examination was conducted in terms of gender and age, the numerical superiority of men aged 35-70 years was observed in self-injuries with cutting-piercing tools (10). In one study, individuals who chose harakiri were shown to be relatively older than those who chose other methods. Previous studies suggested that there was a relationship between the fatality of suicide attempts and the age of those who attempted suicide. It was found that older individuals use methods that are less likely to survive (11). The fact that our case is a 56-year-old man is compatible with the general literature.

Picture 1. Knife used for suicide purposes

Some morphological criteria have been defined in suicide cases caused by cutting-piercing tools. These were stated as: targeting easily reachable body points, mainly the heart spot, the clothes have been removed where the cutting-piercing tool is applied, the wounds were seen on the left side of the body for right-handers, wounds were limited as irregular and grouped in a small area, a rare puncture in the costa and sternum, absence of defensive wounds, less than 10 deep cutting-piercing instrument wounds. In our case, there are many cutting wounds with skin and subcutaneous tissue lines on the left side of the thorax wall. This suggests that the heart spot may have been targeted first and the sweater of the individual has been lifted upwards in order to facilitate access to the targeted area. Besides, there is no defense wound in our case. In the same study, 40% of 23 cases were shown to be localized in the right upper quadrant and 23% in the right lower quadrant (6). In another study, it was found that the injury was most common in the periumbilical region and was followed by the epigastric region (9). In our case, a wound to the abdomen, cutting-piercing instrument is on the left side.

In a study conducted in Japan, cutting tools used by men for suicide; razors (43%), knives (22%), cutting-piercing kitchen tools (16%), and those used by women

Picture 2. The position of the corpse when the crime scene was arrived.

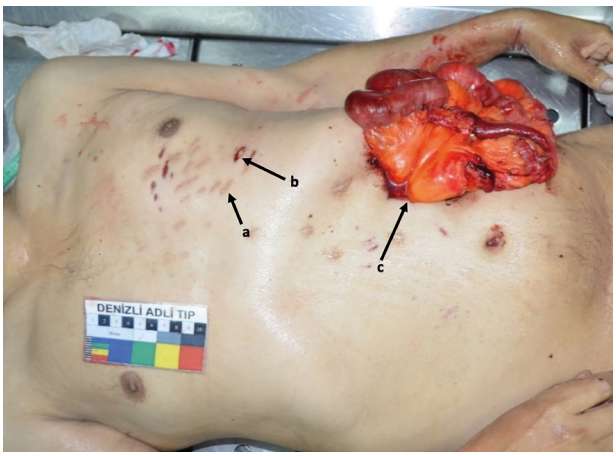
were shaving knives (43%), 22% kitchen knives, 8% short swords, 8% scissors. In terms of usability, the most commonly used sharp tools are the tools that can be found easily, appropriately sized and appear sharp. In terms of profession, carpenters can mostly use a chisel, doctors and nurses can use surgical tools (12). Our case used a knife with a wooden handle with a total length of 25 cm, blade length of 13 cm, blade width of 3 cm, one end of the blade was sharp, the other end was blunt.

By Di Nunno et al. four cases who committed suicide by the method of Harakiri in 40 years have been examined. It has been revealed that it is important to make a differential diagnosis between suicide and murder in cases of death by harakiri and the presence of hesitation cuts helps in this distinction (8). In our case, there are shallow wounds of cutting tools, which can be described as hesitation cuts in the abdomen and wrists.

Kemal et al. examined the deaths depending on the cutting-piercing device injury, which applied to the Bexar Forensic Medicine Unit from January 1988 until May 2010. It was stated that a total of 418 deaths was originated from 349 murders, 54 suicides, 12 accidents, and the origin of 2 deaths could not be determined. While head, chest and back injuries are more common in murders, injuries in the abdomen and extremities have been proven to be more common in suicides. It has been determined that hesitation incisions were detected in 35% of suicides (13). Neck injuries were the most common in cases of both genders. It was detected that the ratio of abdominal injuries was higher in males than in females. In cases of suicide caused by cutting tools, it was found that wounds were not limited to one area, but also applied to the other areas of the body (12). In our case, there were cutting wounds caused the lethal injury in the abdomen, there were also non-lethal hesitation incisions in the bilateral wrist and left chest anterior wall.

The suicide cases were examined by Byard et al. In which cutting tools were used from January 20, 1981, to December 2000 of Forensic Science Center in Adelaide, South Australia. It has been shown that in 1.6% (51 cases) of total suicides, a cutting-piercing device was used, in 54% (23 cases) of these cases, there were hesitation scars and in five cases there were wrist scars stemming from the previous suicide attempts. Injuries caused by cutting-piercing tools are most common in extremities in both genders, and male gender superiority has been identified in abdominal and thoracic injuries (14). In our case, there are old and new cutting-piercing tool wounds in the thorax, lethal cutting-piercing instrument wounds in the abdomen and non-lethal cutting instrument wounds in the bilateral wrist. These results are consistent with the literature in terms of suicide.

Suicide cases were examined occurred by the use of cutting-piercing tools between 1997-2007 in the North Branch of the National Institute of Law (Portugal) by Assunção et al. It was shown that depression symptoms were observed in five cases, a total of nine people had previously expressed some kind of suicidal ideation and eight attempted suicide. The most frequently used object was found to be the kitchen knife and the most common anatomical spot which was fatally injured was the neck area. In six cases, hesitations incisions have been shown in the immediate vicinity of the fatal wound (15). In a study conducted by Kato et al., 647 suicide attempts were examined, it was determined that 25 of these cases attempted suicide with harakiri, In this case group, the ratio



Picture 3. **a)** mature scar tissues caused by old suicide attempt **b)** newly occurred cut did not reach the thoracic cavity and other superficial cuts **c)** protruded bowel loops.

Picture 4. Hesitation cuts on the right wrist made with a sharp-piercing tool.

of males to females and the proportion of patients with mood disorders were found to be significantly higher compared to the other methods (16). In our case, scar tissues from the above-mentioned suicide attempts are seen in the left chest spot and in the upper right quadrant of the abdomen. In addition to that, it was found out that our patient had a psychotic disorder and that he was hospitalized in Manisa Mental and Neurological Diseases Hospital 45 days before his death.

Consequently, suicide by the harakiri method is not a type of case that we encounter frequently. As with all other medicolegal death cases, in determining the origin of death cases in the form of harakiri. It is extremely important to evaluate the findings of the incident, the medical history of the deceased and the information received from the relatives along with the detailed autopsy procedure. It is possible that every finding has the nature of evidence. Starting from the incident scene, careful attention at every stage of the process, the complete and accurate evaluation of the findings shed light on the judicial investigation process.

Picture 5. Cutting-piercing wound on the left wrist that did cause major vascular injury.

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Manuscript submission: All manuscripts should be submitted by online system of journal at www.adlitipbulteni. com For consideration, all articles must be submitted online. Articles submitted in other forms will not be considered.

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The Bulletin of Legal Medicine publishes the following types of articles:

1. **Original Articles:** Original prospective or retrospective studies of basic or clinical researches in areas relevant to medicine.
   Abstract of Original Article: Turkish and English, 250 words maximum, the structured abstract should contain the following sections: objective, material and methods, results, conclusion. Editorial office will write Turkish abstract for non-native Turkish speakers.
   Structure of Original Article: 1. Introduction, 2. Materials and Methods, 3. Results, 4. Discussion, 5. Conclusion, Acknowledgements, References section must be included.
2. **Review Articles:** The authors may be invited to write or should be expert in that subject of review article.
   Abstract of Review Article: Turkish and English, 250 words, without structural divisions. Editorial office will write Turkish abstract for non-native Turkish speakers.
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3. **Case Reports:** Brief descriptions of a previously undocumented disease process, a unique unreported manifestation or treatment of a known disease process, or unique unreported complications of treatment regimens. They should include an adequate number of images and figures. Case reports should be accompanied by "Informed Consent" whether the identity of the patients is disclosed or not.

   Abstract of Case Reports: Turkish and English, 150 words maximum, without structural divisions. Editorial office will write Turkish abstract for non-native Turkish speakers.

   Structure of Case Reports: 1. Introduction, 2. Case Report, 3. Discussion, References.
4. **Editorial:** Special articles are written by editor or editorial board members. Abstract is not required for editorials.
5. **Letter to the Editor:** These are letters which include different views, experiments and questions of the readers about the manuscript that were published in this journal in the recent year and should not be more than 1000 words. The answer to the letter is given by the editor or the corresponding author of the manuscript and is published in the journal. Please contact the Editor at editor@adlitipbulteni.com for sending this type of papers.

3. Manuscript Preparation

This journal follows a double-blind reviewing procedure. Authors are therefore requested to submit; a blinded manuscript, a separate title page and a copyright form.

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Abbreviations: Abbreviations that are used should be defined in parenthesis where the full word is mentioned. For commonly accepted abbreviations and usage please use "Scientific Style and Format" (The CBE for Manual for Authors Editors and Publishers, 6th ed. New York: Cambridge University Press, 1994). Abbreviations should not be used in Abstract section.

Keywords: They should be written at least three and also should written in Turkish and English. The words should be separated by comma (,) from each other. Keywords should be appropriate to "Medical Subject Headings" (MESH) (please see www.nlm.nih.gov/mesh).

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