Orginal Article
Eurasian Journal of Critical Care

Evaluation of fatal trauma cases presented to the emergency room

Abdullah Algın[1], Ertuğrul Altınbilek[2], Ahmet Burak Erdem[3], Miray Tümer[3]
[1]Department of Emergency Medicine, University of Health Sciences, Umraniye Training and Research Hospital, Istanbul, Turkey
[2]Department of Emergency Medicine, University of Health Sciences Hamidiye Sisli Etfal Training and Research Hospital, Istanbul, Turkey
[3]Department of Emergency Medicine, Ministry of Health Ankara City Hospital, Ankara, Turkey

Abstract

Objective: The aim of this study was to investigate the demographic and clinical characteristics of fatal trauma cases presenting to the Emergency Department of XXX Training and Research Hospital in Turkey.

Methods: In this retrospective study, the forensic cases of fatal trauma patients admitted to the emergency department between 15.06.2017 and 15.06.2019 were obtained from the hospital's automation system, and the patient files and hospital police records were evaluated.

Results: The most common cause of forensic trauma cases was pedestrian accidents (n=18; 25%), and the least common cause was crush injuries by a heavy object (n=2; 2.8%). The most common site of trauma was the cranial region (n=45; 62.5%). Forty-six patients died (63.9%) in the emergency room and 26 (36.1%) at various clinics. The average duration of active dying was 3.7 ± 17.9 hours. Fifty-four cases (75%) were found to be ethanol-negative and 18 (25%) were ethanol-positive.

Conclusion: The most common forensic trauma cases are pedestrian accidents and seen in male patients. Most of these patients die in the emergency room, where they are first admitted. The most important factor in reducing mortality is preventing the occurrence of trauma. In addition to giving the person adequate and appropriate treatment, physicians also have the responsibility of writing clear and intelligible forensic reports in accordance with the laws and hospital rules.

Keywords: emergency, forensic case, death

Introduction

Injuries due to all kinds of firearms, explosives, blunt, perforating and penetrating objects, traffic accidents, falls, physical and sexual assault, work accidents, poisoning, burns (inflammable and hot objects, incendiary-abrasive substances, etc.), electric shocks, lightning strikes, mechanical asphyxias, suicide attempts, possible torture, all deaths suspected to be associated with murder, suicide or accidents, and sudden and unexpected deaths are considered as forensic cases that should receive immediate attention and evaluation by the physician[1-3]. In addition to being a health problem affecting the young population, traumas cause serious loss of labor. After cancer and cardiovascular diseases, traumas are the third leading cause of death in all age groups, ranking first in the 1-44 years age group. According to the USA data, approximately 60 million trauma-related injuries occur annually, of which around 36 million (60%) present to emergency department[4]. The Turkish Statistical Institute (TUIK) reports that in Turkey, trauma and poisoning together constitute the fifth leading cause of death in all ages, and they are also the most frequent causes of death for people aged 1 to 34 years. TUIK data also indicates a slight increase in traumatic death at all ages in Turkey from 2010 to 2012.

It has been shown that 25-50% of trauma-related deaths are preventable[5]. Trauma-related deaths are grouped into early and late periods. Post-traumatic deaths are usually caused by large vessel, cardiac and central nervous system injuries. Early post-traumatic deaths occur within minutes to an hour usually upon admission to hospital due to hemorrhagic shock, inadequate end-organ perfusion, serious central nervous system injuries, and cardiovascular collapse while late deaths are usually caused by sepsis and multi-organ failure within days or weeks after the event[6]. Trauma, which is an important reason for admission to the emergency department, is divided into blunt and penetrating groups, with the former being more common. In Turkey, blunt traumas are, in order of frequency, in-vehicle traffic accidents, extravehicular traffic accidents, falling from height, work accidents, and assault[7]. Penetrating traumas, on the other hand, cause more morbidity and mortality and are caused by penetrating injuries, blunt-penetrating injuries and gunshot wounds. In Turkey, the penetrating trauma type is seen at a rising fre-

Corresponding Author: Ahmet Burak Erdem **e-mail:** drabe0182@gmail.com
Received: 05.03.2020 • **Accepted:** 30.03.2020

quency with the increase in violence, and blunt-penetrating injuries are most common in the young population[8]. This study aimed to investigate the demographic and clinical characteristics of trauma-related mortality cases admitted to the emergency department.

Materyal and Metod

This study retrospectively evaluated forensic cases with complete records of patients that were admitted to XXX Hospital Emergency Medicine Clinic between 15.06.2017 and 15.06.2019 and died. The cases were identified by screening the hospital police records and the hospital automated system. The demographic data of the cases, events leading to forensic cases, vital signs, Glasgow coma scale (GCS) score, revised trauma score, body area exposed to trauma, consultations requested, clinical, hemogram, platelet, lactate and blood ethanol levels, and the time from admission to the emergency department or hospital clinics to death were recorded. The mean, standard deviation, median lowest and highest, frequency and ratio values were used as the descriptive statistics. SPSS software version 22.0 was used for analysis.

Results

In the current study, of the 72 forensic cases, 58 (80.6%) were male and 14 (19.4%) were female. The mean age was 43.6 ± 20.9 years. The most and least frequent months of forensic incidents were August (n = 11; 15.3%) and December (n = 3; 4.2%), respectively (Table 1). The mean GCS score of the patients was 4.6 ± 3.3 at the time of presentation, while the mean revised trauma score was 3.8 ± 4.1. The mean systolic and diastolic blood pressure values were 60.2 ± 46.0 and 36.6 ± 29.3, respectively, and the mean arterial pressure was 45.0 ± 34.7 mmHg. At the time of presentation, the mean values for blood parameters were 8.11 ± 4.95 g/dl for hemoglobin, 175.3 ± 83.3 10^9/L for platelet count, and 8.7 ± 5.7 mmol/L for lactate. Fifty-four cases (75%) were found to be ethanol-negative and 18[25] were ethanol-positive (Table 2).

The trauma mechanisms causing the forensic situation were extravehicular accidents in 18 patients (25%), fall from height in 17 (23.6%), firearm injuries in 10 (13.9%), blunt-penetrating wounds in eight (11.1%), physical assault in five (6.9%), motorcycle accidents in five (6.9%), in-vehicle traffic accidents in four (5.6%), hanging in three (4.2%), and being crushed under a heavy object in two (2.8%) (Figure 1).

The most common part of the body affected by trauma was the cranial region (n = 45; 62.5%), followed by the thorax (n = 42; 58.3%), lower extremities (n = 19; 26.4%), pelvis (n = 16; 22.2%), upper extremities (n = 14; 19.4%), abdomen (n = 10; 13.9%), and vertebra (n = 9; 12.5%), and the least affected area was the neck (n = 5; 6.9%). Of the forensic cases that presented to the emergency department, 46 died in this department (63.9%) and 26 (36.1%) died in the clinic to which they had been admitted (Figure 2).

The presence/absence of surgical operations or procedures prior to death was also investigated, and 48 (66.7%) patients did not undergo any operation while 24 (33.3%) cases underwent surgery in various clinics before they died. Types of procedures were brain surgery in 13 patients

Table 1: Patients' age, gender, and month of presentation to hospital

		Min-Max			Median	Mean±SD n-%		
Age		2.0	-	90.0	39.5	43.6	±	20.9
Gender	Female					14		19.4%
	Male					58		80.6%
Month	January					4		5.6%
	February					5		6.9%
	March					4		5.6%
	April					8		11.1%
	May					5		6.9%
	June					10		13.9%
	July					10		13.9%
	August					11		15.3%
	September					7		9.7%
	October					1		1.4%
	November					4		5.6%
	December					3		4.2%

SD: standard deviation

Figure 1: Trauma mechanism

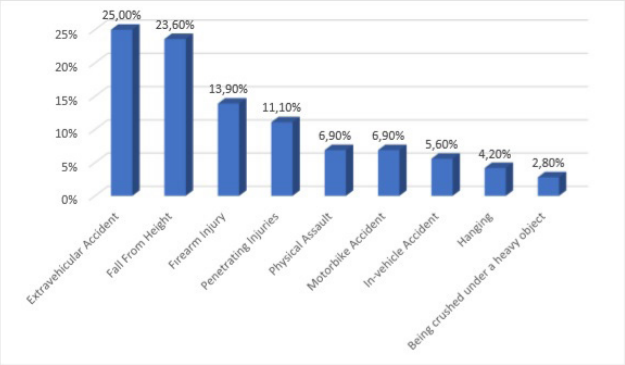


Figure 2: Body part affected by the trauma

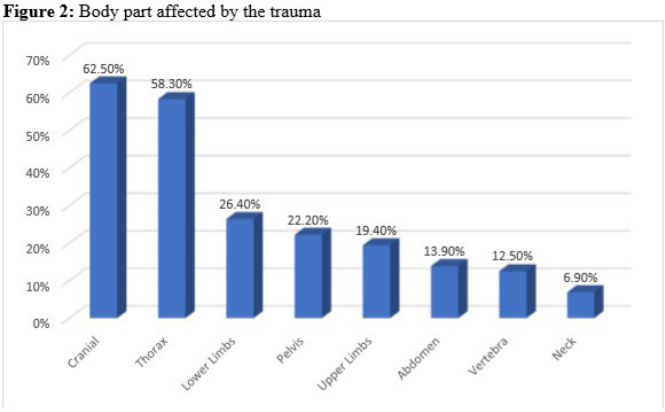


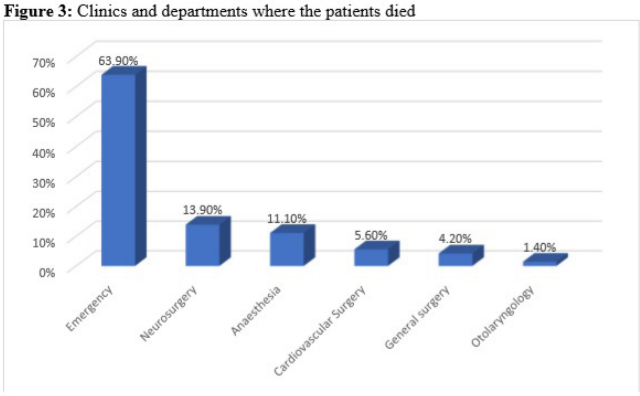
Table 2: Trauma scores, vital parameters, laboratory values and ethanol test results of the patients

Glasgow Coma Scale Score	3.0	-	15.0	3.0	4.6	±	3.3
Revised Trauma Score	0.0	-	12.0	2.0	3.8	±	4.1
Respiratory Rate	0.0	-	30.0	0.0	4.4	±	8.1
Systolic Blood Pressure (mmHg)	0.0	-	170.0	60.0	60.2	±	46.0
Diastolic Blood Pressure (mmHg)	0.0	-	100.0	40.0	36.6	±	29.3
Mean Arterial Pressure (mmHg)	0.0	-	123.0	47.0	45.0	±	34.7
Pulse per minute	0.0	-	2.0	1.0	0.8	±	0.8
Hemoglobin g/dl	6.0	-	151.0	90.5	81.1	±	49.5
Platelet 10^9/L	40.0	-	370.0	158.5	175.3	±	83.3
Lactate mmol/L	1.0	-	29.0	8.0	8.7	±	5.7
Ethanol (-)					54		75.0%
Ethanol (+)					18		25.0%

(18.1%), general surgery in three (4.2%), cardiovascular surgery (CVS) in three (4.2%), otolaryngologic surgery in two (2.8%), plastic surgery in one (1.4%), and anesthesia in one (1.4%). In terms of consultations, 28 patients died before other departments were consulted whereas 44 patients were referred to various clinics for a consultation, with most requiring more than one consultation. The consulted clinics and units were anesthesia and reanimation in 33 cases (45.8%), general surgery in 27 (37.5%), brain surgery in 24 (33.3%), orthopedics in 20 (27.8%), CVS in 10 (13.9%), urology in eight (11.1%), pediatric surgery in three (4.2%), and plastic surgery in one (1.4%). The mean time from admission to death was calculated as 3.7 ± 17.9 days (Table 3).

In terms of where the death occurred, it was mostly the emergency department to which the patients first presented to (n = 46; 63.9%). This was followed by brain surgery (n = 10; 13.9%), anesthesia and reanimation (n = 8; 11.1%), CVS (n = 4; 5.6%), general surgery (n = 3; 4.2%), and otolaryngology (n = 1; 1.4%) (Figure 3).

Figure 3: Clinics and departments where the patients died



Discussion

Since the emergency departments of health institutions are one of the first units authorized about forensic cases, they play an important role in the detection of these cases. In this study, we planned to analyze forensic cases that resulted in death. Trauma is still one of the most important causes of morbidity and mortality throughout the world. Globally, the incidence of trauma-related mortality is known to be 56/100,000[9]. According to the 2007 TUIK data, in Turkey, 26% of the deaths that occurred due to motor vehicle accidents belonged to the 20-55 age group, and 74% were seen in men[5]. In a study evaluating trauma-related deaths, Avcı et al. reported that 76.2% of the patients were male, and the mean age was 48.9 ± 20 years[10]. In a study by Angela et al., the male population constituted 79% of the sample, and the

Table 3: Details of operations performed, consultations requested, and day of death

		Min-Max	Median	Mean±SD/n-%
Operating department	(-) No operation		48	66.7
	(+) Operated		24	33.3
	Anesthesia		1	1.4
	Brain surgery		13	18.1
	General surgery		3	4.2
	Cardiovascular surgery		3	4.2
	Orthopedics		1	1.4
	Otolaryngology		2	2.8
	Plastic surgery		1	1.4
Consultation request	(-) Not requested		28	38.9
	(+) Requested		44	61.1
	Brain surgery		24	33.3
	General surgery		27	37.5
	Orthopedics		20	27.8
	Cardiovascular surgery		10	13.9
	Anesthesia		33	45.8
	Otolaryngology		3	4.2
	Urology		8	11.1
	Plastic surgery		1	1.4
	Pediatric surgery		3	4.2
	Thoracic surgery		6	8.3
Day of Death (from first presentation)		0.0 - 150.0	0.0	3.7 ± 17.9 days

SD: standard deviation

mean age was calculated as 36.8 ± 1.2 years. Two studies were conducted in the same trauma center in two different years and it was found that trauma-related deaths were seen in men at a rate of 73% in 1992 and 70%, and the mean age was 41.7 and 47.3 years, respectively[11-12]. In the current study, 58 of the cases (80.6%) were male, and the mean age was 43.6 ± 20.9 years, similar to the literature. The high incidence of forensic incidents in men and the young age group may be due to their higher presence in traffic, working at high-risk jobs, aggressive nature, and higher rate of alcohol use.

In a study conducted by Varol et al., the highest accident rate was observed in August at 17.9%. The higher incidence of traffic accidents in summer months is consistent with the literature[13]. In our study, forensic trauma was most frequent in August, involving 11 cases (15.3%). The least number of presentations related to forensic trauma was in December (n = 3; 4.2%). Concerning the evaluation of trauma scores, Avcı et al. reported the GCS score as 5.11 ± 4.10 and the revised trauma score as 5.874 ± 1.849 while determined that the former was ≤8 in 60.3% of the patients and the mean value of the latter was 5.24 ± 2.05[14]. In the current study, the mean GCS score of the patients at the time of presentation was 4.6 ± 3.3, and the revised trauma score was 3.8 ± 4.1. In previous studies, the mean systolic blood pressure at the time of presentation was reported to be 42.95 ± 59.34 mmHg[10] and below 90 mm Hg in 37.6% of the cases[14]. We calculated the systolic blood pressure as 60.2 ± 46.0, diastolic blood pressure as 36.6 ± 29.3 and arterial pressure as 45.0 ± 34.7 mmHg.

Cothren et al. reported that traumatic deaths due to blunt trauma that occurred within 24 hours of presentation in the same trauma center in 1992 and 2002 were at the rates of 56% and 74%, respectively, and the most common cause was motor vehicle accident for both years[12]. In their case series, Avcı et al. found that 85% of the patients were injured due to isolated blunt trauma and 45.8% of these cases had been involved in an extravehicular traffic accident[10]. Similarly, Trajano et al. reported these accidents as the most common cause of traumatic death[14]. Seviner et al. evaluated the causes of death in forensic incidents and found traffic accidents to rank first (27.3% of cases)[15]. In our study, we also demonstrated that the most common trauma mechanism resulting in death was extravehicular traffic accidents involving a total of 18 patients (25%). Seviner et al. noted that the most frequently injured body part was the extremi-

ties in forensic cases at a rate of 41%, and 27% of the sample presented with multiple system injuries[15]. In two other studies, head and neck injuries were reported in 44.6%[17] and 21%[18] of forensic cases, and extremity injuries in 18.8% and 72%, respectively. In our study, the most commonly affected body region was cranial (n = 45; 62.5%), and the least affected area was the neck (n = 5; 6.9%). The higher rate of head trauma in our series may be due to our hospital being a special trauma center to which specific and severe trauma cases are referred by the 112-emergency ambulance service.

Avcı et al. observed head and neck injuries in 71 patients that went into cardiac arrest and 43 patients without cardiac arrest[10]. Arslan et al. reported that the most common cause of trauma-related deaths was traumatic brain injury [19]. Evans et al. revealed that the most common causes of death due to high-energy trauma were central nervous system injuries (33%) and hemorrhage (33%)[20]. Similarly, according to our results, 46 patients (63.9%) died in A&E. Of the patients that did not die in the emergency service and underwent surgery in other clinics, 13 (18.1%) had been referred to the brain surgery, followed by three (4.2%) referred to general surgery. These results are consistent with the literature. In our series, 28 patients died at the emergency department before consultation. During follow-up in the emergency department, various clinics were consulted for 44 patients, of whom most required more than one consultation. The departments from the highest to the lowest rate of consultation were anesthesia and reanimation (n = 33; 45.8%), general surgery (n = 27; 37.5%), brain surgery (n = 24; 33.3%), orthopedics (n = 20; (27.8%), CVS (n = 10; 13%), urology (n = 8; 11.1%), pediatric surgery (n = 3; 4.2%), and plastic surgery (n = 1; 1.4%).

In the series examined by Avcı et al., 100 cases (46.7%) were evaluated as pre-hospital death in the group of patients that did not respond to arrest and cardiopulmonary resuscitation[10]. Arslan et al. reported 38% pre-hospital deaths associated with trauma[19]. Evans et al. showed that 66% of deaths due to high-energy trauma occurred before presentation to hospital[20]. In the current study, in terms of where the deaths occurred, more than half of the patients (n = 46; 63.9%) died at the emergency department where they were first admitted, and 26 (36.1%) patients died in other departments after their hospitalization, with the least number of deaths being seen in the otolaryngology clinic (n = 1; 1.4%). Concerning the time to mortality, Avcı et al. determined that 11 of the patients that did not have cardiac arrest died within the first hour, 25 in one to three hours, 18 in three to six hours, eight in six to 12 hours, and three in 12 to 24 hours[10]. Gunst et al. reported that 84% of early deaths due to trauma occurred within the first 12 hours[21], and Hamzeh et al. revealed that most post-traumatic deaths occurred within the first hour [22]. In our study, the day of death was found to range from 0 to 150 days, with the mean time to death being statistically calculated as 3.7 ± 17.9 days.

When studies investigating the relationship between trauma and drinking and driving were examined, it was found that in a study evaluating traffic accident cases, 46.8% of the drivers had consumed alcohol, and similarly, another study found that 32% of drivers injured in a traffic accident had at least 0.1% blood alcohol concentration and that the rate of accidents involving patients that drank and drove was 2.6 times higher compared to those that did not drink and drive[23]. In the current study, 54 cases (75%) were found to be ethanol-negative and 18 (25%) were ethanol-positive. However, we analyzed ethanol positivity/negativity in all trauma cases. In another study, Baydın et al. showed that the lactate level was associated with the severity of trauma and mortality[24]. In our cases, the lactate value at the time of presentation was found to be high at 8.7 ± 5.7 mmol/L, and this was associated with mortality.

Conclusion

Emergency services constitute the most important step in patients presenting to the hospital due to traumatic forensic causes. As revealed by our study, a large percentage of the trauma-related deaths occurred at the emergency department. In addition, especially in patients requiring consultation with multiple clinics, the emergency department acts as a bridge and a link between all the hospital services. Determining the time and location of deaths indicates where to focus on to improve our knowledge of trauma. The most important way of reducing trauma-related deaths remains to be prevention. We also need to continue research to improve our knowledge of trauma management. In addition, ensure that forensic reports are properly completed is one of the main tasks of reporting life-threatening situations.

Ethics Committee Approval: The study was conducted in accordance with the principles of the Declaration of Helsinki and Ethical Board approved the study protocol. (17/12/2019-1375)

Informed Consent: Due to the retrospective design of the study, informed consent was not taken.

Conflict of Interests: The authors have no conflict of interests to declare.

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

REFERENCES

1. Adli Tıp Uzmanları Derneği Birinci Basamak İçin Adli Tıp El Kitabı. Türk Tabipleri Birligi Merkez Konseyi. 1999;83–5.
2. Beyaztaş FY. Adli Rapor Konusunda Hekim Sorumluluğu. Anadolu Psikiyatri Dergisi. 2000;1:231-4.
3. Birinci Basamak İçin Adli Tıp El Kitabı. Adli Tıp Uzmanları

Derneği-TTB. Ankara: Polat Matbaası. 1999;14-115.

4. Brunett PH, Cameron PA. Trauma. In: Tintinalli JE, Stapczynski JS, Ma OJ, Cline DM, Cydulka RK, Meckler GD, editors. Tintinalli's Emergency Medicine. A Compre-Hensive Study Guide. 7th ed. New York: Mc Graw Hill; 2011.p.1671-6.

5. Death Statics" in Turkish Statistical Institute. http://www.tuik.gov.tr/PreHaberBultenleri.doid=15847. Accessed 19 September 2013

6. Trunkey DD. Trauma. Accidental and İntentional İnjuries Account For More Years of Life Lost İn The U.S. Than Cancer And Heart Disease. Among the Prescribed Remedies are İmproved Preventive Efforts, Speedier Surgery And Further Research. Sci Am 1983;249:28-35.

7. Ateşçelik M, Gürger M. Acil Servise Künt Travma ile Başvuran Hastaların İncelenmesi. Firat Med J 2013;18:103-108.

8. Ateşçelik M, Gürger M. Acil Servise Penetran Travma ile Başvuran Hastaların İncelenmesi. Konuralp Tıp Dergisi 2014;6:40-46.

9. Lyn-Sue J, Siram S, Williams D, Mezghebe H. Epidemiology of Trauma Deaths in an Urban Level-i Trauma Center Predominantly among African Americans Implications for Prevention. J Natl Med Assoc 2006;98:12.

10. Avcı S, Arslan ED, Büyükçam F. Acil Serviste Travmatik Ölümlerin Retrospektif Değerlendirilmesi Sakarya tıp dergisi 2017;7(1):15-19

11. Angela S, Frederick MA, Ernest ME, Kathe MS, Regina BRN, Readrobert A et al. Epidemiology of Trauma Deaths: A Reassessment. J Trauma 1995;38(2):185-93.

12. Cothren CC, Moore EE, Hedegaard HB, Meng K. Epidemiology of Urban Trauma Deaths: A Comprehensive Reassessment 10 years later. World J Surg 2007;31(7):1507-11.

13. Varol O, Eren H, Oğuztürk H, Korkmaz İ, Beydilli İ, " Acil Servise Trafik Kazası Sonucu Başvuran Hastaların İncelenmesi". Cumhuriyet Üniversitesi Tıp Fakültesi Dergisi, 2006;28(2):55-60.

14. Trajano AD, Pereira BM, Fraga GP. Epidemiology of in-Hospital Trauma Deaths in a Brazilian University Hospital. BMC Emerg Med 2014; 14:22.

15. Seviner M, Kozacı N, Ay MO, Açikalın A, Çökük A, Gülen M, Acehan S, Karanlık M, Satar S, Acil Tıp Kliniğine Başvuran Adli Vakaların Geriye Dönük Analizi Cukurova Medical Journal 2013; 38 (2):250-260.

16. Yavuz MS, Özgüner IF. Süleyman Demirel Üniversitesi Tıp Fakültesi Acil Servisi'ne 1999-2001 Yılları Arasında Müracaat Eden Adli Olguların Değerlendirilmesi. Adli Tıp Dergisi. 2003; 17: 47-5.

17. Güven FMK, Bütün C, Beyaztaş Y, Eren ŞH, Korkmaz İ. Cumhuriyet Üniversitesi Tıp Fakültesi Hastanesine Başvuran Adli Olguların Değerlendirilmesi. ADÜ Tıp Fakültesi Dergisi. 2009; 10: 23-8.

18. Türkmen N, Akgöz S, Çoltu A, Ergin N. Uludağ Üniversitesi Tıp Fakültesi Acil Servisine Başvuran Adli Olguların Değerlendirilmesi. Uludağ üniversitesi tıp fakültesi dergisi. 2005; 31: 25-9.

19. Arslan ED, Kaya E, Sönmez M, Kavalcı C, Solakoğlu A, Yılmaz F et al. Assesment of Traumatic Deaths in a Level One Trauma Center in Ankara, Turkey. Eur J Trauma Emerg Surg 2015;41(3):319-23.

20. Evans JA, Wessem KJP, McDougall D, Lee KA, Lyons T, Balogh ZJ. Epidemiology of Traumatic Deaths: Comprehensive Population- Based Assessment. World J Surg 2010;34:158-163.

21. Gunst M, Ghaemmaghami V, Gruszecki A, Urban J, Frankel H, Shafi S. Changing Epidemiology of Trauma Deaths Leads to a Bimodal Distribution. Proc 2010;23(4):349–354.

22. Hamzeh B, Najafi F, Karamimatin B, Ahmadijouybari T, Salari A, Moradinazar M. Epidemiology of Traffic Crash Mortality in West of Iran in a 9 year period. Chinese J Traum 2016; 70–74.

23. Horwood LJ, Fergusson DM. Drink Driving And Traffic Accident İn Young People. Accident Analysis and Prevention 2000; 32: 805-814.

24. Baydın A, Yardan T, Guven H, Dervişoğlu A, Otal Y, Eden A, Karataş Ad Travmada Laktat, Baz Açığı Seviyesi ve Travma Ciddiyet Skoru'nun (Injury Severity Score) Mortalite ile İlişkisi Turk J Emerg Med 2007;7(3):97-101.