ORIGINAL ARTICLE

Investigation of fatal traumatic head injuries

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ABSTRACT

BACKGROUND: Traumatic head injuries (THIs) are one of the major causes of death in forensic cases. The aim of this study was to investigate the characteristics of patients with fatal THIs.

METHODS: In this study, a total of 311 patients with fatal THIs, who underwent postmortem examinations and/or autopsies, were retrospectively analyzed. Cases were evaluated based on sex, age group, incident origin, cause of the incident, presence of skull fracture, type of fractured bone (if any), fracture localization and pattern, presence and type of intracranial lesion (if any), and cause of death.

RESULTS: Out of the patients, 242 (77.8%) were male and 69 (22.2%) were female. Accidents accounted for 235 (75.6%) of the incidents, with in-vehicle traffic accidents causing 117 (37.6%). In 221 cases (71.1%), intracranial lesions and skull fractures were observed together. The most common fractures were base fractures (171 cases) and temporal bone fractures (153 cases). The rate of intracranial hemorrhage was lower in the adult age group (69.7%) compared to the older age group (92.6%).

CONCLUSION: The results obtained in this study indicate that the cause of the incident, type of fracture, presence of skull base fracture, and multiple skull fractures increase the likelihood of fatalities. The occurrence of skull fractures reduces intracranial pressure, thereby decreasing the incidence of intracranial lesions. The development and effective enforcement of road traffic safety policies and regulations will reduce the incidence of fatalities.

Keywords: Head injuries; intracranial lesions; skull fractures; traffic accidents.

INTRODUCTION

A traumatic head injury (THI) encompasses any traumatic injury to the scalp, skull, or brain. The severity of these injuries can range from minor trauma to fatal injuries.[1] Scalp injuries range from simple abrasions to severe lacerations, often accompanied by significant bleeding due to the scalp's rich blood supply.[1-3] Skull fractures may occur at either the dome or the base of the skull, manifesting as linear, compression, or comminuted fractures. Depending on the integrity of the skin, these fractures can be classified as either open or closed.[1, 3] While even sufficient force applied to the skull can cause linear fractures and joint separations, higher velocity and more concentrated trauma can result in comminuted fractures and compression fractures.[3] Mortality and serious morbidity due to THIs are rarely caused by isolated skull fractures; these injuries usually involve damage to brain tissue and hemorrhage.[1,2]

Serious brain injuries can develop in either a static or dynamic manner. Static injuries, less common among fatal THIs, include high-force impact and compression with a heavy object; these are more common in children. Conversely, dynamic injuries, more prevalent in adults, are caused by trauma from fast-moving objects, such as cars and bullets.[4]

Cite this article as: Sehlikoğlu K, Türkoğlu A, Bork T, Batbaş M. Investigation of fatal traumatic head injuries. Ulus Travma Acil Cerrahi Derg 2024;30:160-166.

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Ulus Travma Acil Cerrahi Derg 2024;30(3):160-166 DOI: 10.14744/tjtes.2024.32463
Submitted: 13.11.2023 Revised: 25.11.2023 Accepted: 26.02.2024 Published: 05.03.2024

The aim of this study was to examine the data of patients with fatal THIs, including the cause of the incident, trauma localization, and injury characteristics, and to discuss the relationship between these parameters.

MATERIALS AND METHODS

In this study, 311 forensic patients with fatal THIs, who underwent postmortem examination and/or autopsy over a 3-year period, were retrospectively analyzed. All the patients had suffered head injuries due to an attack or accident, with or without injuries to other parts of the body. This study was based on data available from crime scene investigation reports and/or images, forensic investigation files, eyewitness or relative statements, and medical and autopsy records from hospitals.

During autopsies performed in our clinic, it was routine practice to first examine the skull bones primarily from the outer surface after removing the scalp and periosteum. The skull bones were then cut with a chainsaw, and the inner surface was examined again to evaluate the dura and the presence of intracranial hemorrhage. The brain tissue was removed, sliced, and macroscopically examined for signs of edema, hemorrhage, and contusion within the brain parenchyma. This procedure was adhered to throughout the study.

Cases were evaluated based on several criteria: sex, age group, origin of the incident (accident, suicide, or homicide), cause of the incident, presence of skull fracture, type of fractured bone (if any), localization and pattern of fracture, presence and type of intracranial lesion (if any), and cause of death. Patients were categorized into age groups by decades. Additionally, due to low frequencies in certain age groups, statistical analysis was conducted for pediatric (≤17 years), adult (18-60 years), and elderly (≥61 years) age groups. Cases were also classified according to the site of injury, including head/neck, thorax, abdomen/pelvic, or extremities. The cause of death was determined based on the results of radiologic imaging and postmortem macroscopic and/or microscopic evaluations.

Categorical variables were presented as frequency and percentage. Descriptive statistics and continuous variables were presented as mean ± standard deviation. Categorical variables were grouped, percentages calculated, and frequencies compared using Pearson's chi-square or Fisher's exact test, as appropriate. Post hoc analysis methods for the chi-square test and Bonferroni correction were applied to assess significance between multiple groups. The Kolmogorov-Smirnov test was used to check the normality of continuous variables ($p>0.05$). The independent samples t-test was utilized to evaluate mean differences between two groups. All statistical analyses and tables were generated using the Statistical Package for the Social Sciences (SPSS) 22 (IBM Corp, Armonk, NY). A p-value of <0.05 was considered statistically significant for all analyses. The relationships between variables were examined statistically.

Ethical approval for conducting the research was obtained from the local Ethics Committee. This study was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

RESULTS

Among the patients, 242 (77.8%) were male and 69 (22.2%) were female. The youngest case involved a 1-year-old, and the oldest a 93-year-old. The mean age of the patients was 39.4±23.0 years. For males, the mean age was 39.4±22.1 years, and for females, it was 39.1±26.3 years; no difference

Table 1. Distribution of the cases according to age groups and sex

	Male	Female	Total
Age Group			
0-10	22 (9.1%)	11 (15.9%)	33 (10.6%)
11-20	21 (8.7%)	8 (11.6%)	29 (9.3%)
21-30	52 (21.5%)	16 (23.2%)	68 (21.9%)
31-40	43 (17.8%)	3 (4.3%)	46 (8.8%)
41-50	30 (12.4%)	7 (10.1%)	37 (14.8%)
51-60	26 (10.7%)	4 (5.8%)	30 (9.6%)
61-70	23 (9.5%)	11 (15.9%)	34 (10.9%)
71-80	14 (5.8%)	3 (4.3%)	17 (5.5%)
81-90	9 (3.7%)	5 (7.2%)	14 (4.5%)
91-100	2 (0.8%)	1 (1.4%)	3 (1.0%)
Total	242 (77.8%)	69 (22.2%)	311 (100.0%)

Percentages were calculated by column.

Table 2. Distribution of the origins and causes according to sex

	Male	Female	Total	P values
Origin of the Incident				p>0.05
Accident	178 (73.6%)	57 (82.6%)	235 (75.6%)	
Homicide	40 (16.5%)	5 (7.2%)	45 (14.4%)	
Suicide	24 (9.9%)	7 (10.1%)	31 (10.0%)	
Total	242 (77.8%)	69 (22.2%)	311 (100.0%)	
Cause of the Incident				p=0.017
IVTA	90 (37.2%)	27 (39.1%)	117 (37.6%)	
NVTA	41 (16.9%)	16 (23.2%)	57 (18.3%)	
FI	46 (19.0%)	6 (8.7%)	52 (16.7%)	
FFH	30 (12.4%)	16 (23.2%)	46 (14.8%)	
Others	35 (14.5%)	4 (5.8%)	39 (12.5%)	
Total	242 (77.8%)	69 (22.2%)	311 (100.0%)	

Percentages were calculated by column. IVTA: In-vehicle traffic accidents; NVTA: Non-vehicle traffic accidents; FI: Firearm injuries; FFH: Falling from a height.

in age was observed between the sexes (p=0.924). Mortality was most common in the 21-30-year age group (n=68; 21.9%). The mortality rate at the distribution tails was striking, with 10.9% of deaths occurring in patients aged ≥ 71 years and 10.6% in patients aged ≤10 years (Table 1).

It was determined that 235 patients (75.6%) suffered fatal head injuries due to accidents, 45 (14.4%) due to homicide, and 31 (10.0%) due to suicide. The distribution of cases by sex was found to be similar across the origins of the incident (p>0.05) (Table 2). When the age groups were classified as pediatric, adult, and elderly, it was found that deaths due to accidents occurred at higher rates in pediatric and elderly patients, and homicides were more frequent in the adult age group ($\chi 2$=23.767, SD=4, p<0.001). Regarding the causes of incidents, in-vehicle traffic accidents were the most common, accounting for 117 cases (37.6%). It was observed that the falls from heights were more common among female cases, and firearm injuries were more common among male cases ($\chi 2$=12.054, SD=4, p=0.017) (Table 2).

Table 3. Distribution of fatal traumatic head injury findings in cases

Findings	n	%
1+2	59	19.0
1+2+3	55	17.7
2	49	15.8
1+3	42	13.5
1+2+3+4	24	7.7
2+4	15	4.8
1+2+4	12	3.9
1	11	3.5
Others	44	14.1
Total	311	100.0

1: Skull fracture, 2: Intracranial hemorrhage, 3: Cerebral contusion/laceration, 4: Cerebral edema.

Intracranial lesions and skull fractures were observed together in 221 patients (71.1%), whereas 79 patients (25.4%) had only an intracranial lesion and 11 patients (3.5%) had only a skull fracture. Among the findings in fatal THIs, skull fractures and intracranial hemorrhages were the most common, observed in 59 cases (19.0%). In 55 cases (17.7%), a combination of skull fracture, brain contusion/laceration, and intracranial hemorrhage was present (Table 3). When analyzing THIs by cause of incident—excluding cases with only skull fractures due to their small number—the presence of only intracranial lesions was more commonly associated with fatalities from falls from a height, while the combination of intracranial lesions and skull fractures together was more common in fatalities from gunshot wounds ($\chi 2$=39.837, SD=4, p<0.001) (Table 4). It was also found that the occurrence of skull fractures significantly reduced the incidence of intracranial lesions ($\chi 2$=16.366, SD=1, p<0.001).

Skull fractures were identified in 232 cases (74.6%). Fractures of both the skull vault and base were observed together in 144 cases (46.3%), whereas only vault fractures were observed in 61 cases (19.6%), and only skull base fractures were observed in 27 cases (8.7%). Skull fractures were more common in the pediatric and adult age groups (80.0% and 79.3%, respectively) and relatively less common in the elderly age group (57.4%) ($\chi 2$=13.671, SD=2, p=0.001). The most frequent types of fractures were base fractures (in 171 cases) and temporal bone fractures (in 153 cases) with occipital bone fractures being the least common (in 112 cases).

Table 4. Distribution of traumatic head injury findings according to cause of incident

Findings	IVTA	NVTA	FI	FFH	Others	Total
1	6 (5.1%)	2 (3.5%)	-	1 (2.2%)	2 (5.1%)	11 (3.5%)
2	31 (26.5%)	19 (33.3%)	2 (3.8%)	21 (45.7%)	-	73 (23.5%)
3	80 (68.4%)	36 (63.2%)	50 (96.2%)	24 (52.2%)	37 (94.9%)	227 (73.0%)
Total	117 (37.6%)	57 (18.3%)	52 (16.7%)	46 (14.8%)	39 (12.5%)	311 (100.0%)

1: Solely skull fracture, 2: Solely intracranial lesion, 3: Skull fracture + intracranial lesion. Percentages were calculated by column. IVTA: In-vehicle traffic accidents; NVTA: Non-vehicle traffic accidents; FI: Firearm injuries; FFH: Falling from a height.

Overall, 156 patients (67.2%) had bilateral skull fractures, 44 patients (19.0%) had right-sided skull fractures, and 32 patients (13.8%) had left-sided skull fractures. Additionally, 197 patients (84.9%) exhibited displaced/comminuted fractures, and 35 patients (15.1%) had linear fractures. The distribution of head fracture types was similar between men and women ($p=0.486$). A significantly higher rate of displaced/comminuted fractures was observed in cases with combined skull vault and base fractures ($\chi 2=18.725$, SD=2, $p<0.001$). When analyzing the causes of incidents in terms of the presence of skull fractures, it was discovered that skull fractures occurred at higher rates in incidents involving gunshot wounds and other causes. In contrast, they occurred at lower rates in incidents involving falls from a height and non-vehicle traffic accidents ($\chi 2=40.457$, SD=4, $p<0.001$).

In the study, intracranial hemorrhage was observed in 240 patients (77.2%). Among the types of intracranial hemorrhage, subarachnoid hemorrhage (SAH) was the most common, noted in 123 cases (39.5%) (Table 5). The incidence of intracranial hemorrhage was lower in the adult age group (69.7%) and higher in the elderly age group (92.6%) ($\chi 2=16.536$, SD=2, $p<0.001$). No difference was found in the incidence of intracranial hemorrhage with respect to the cause of the incident ($p=0.197$).

When analyzing the causes of death, it was observed that 113 patients (36.3%) had an isolated fatal head injury, and 198 patients (63.7%) had a fatal head injury accompanied by fatal injuries to other systems.

Table 5. Distribution of type of intracranial hemorrhage

Type of Intracranial Hemorrhage	n	%
SAH	123	39.5
SAH + SDH	61	19.6
SDH	10	3.2
SAH + SDH + EDH	10	3.2
SAH + EDH	9	2.9
Others	27	8.7
Cases without Intracranial Hemorrhage	71	22.8
Total	311	100.0

SAH: Subarachnoid hemorrhage; SDH: Subdural hemorrhage; EDH: Epidural hemorrhage.

DISCUSSION

THIs are one of the significant causes of fatal forensic cases.[1] The presence or absence of a skull fracture, the type of fracture (if any), and the presence or absence and type of intracranial hemorrhage are important medical findings that influence the clinical outcome of head injuries.[5] The greater the force of the trauma, the more severe and fatal the damage it causes.[5,6]

In this study, 77.8% of the cases involved men, aligning with similar studies conducted in Turkey and Greece, which reported percentages ranging from 74.1% to 75.4%.[3,6,7] Studies from India indicated even higher rates of male THI victims, between 83% and 88.4%.[8-11] In the research conducted by Patil et al. and Evaggelakos et al., the study sample consisted of cases of fatal blunt head trauma from all causes, whereas other studies focused solely on injuries resulting from traffic accidents.[3, 6-8,10] A common finding across all mentioned studies is the predominance of males, likely due to their higher involvement in forensic traumatic events and workforce participation, increasing the risk of THIs. Sociocultural and economic differences between societies may also play a role in the observed sex distribution.

When evaluating the cases according to age groups, it was observed that THIs were most common in the 21-30 years age group, with 68 cases (21.9%), followed by the 31-40 years age group with 46 cases (14.8%). In similar studies conducted in Istanbul in western Turkey and Van in eastern Turkey, it was reported that fatal THIs were most commonly observed in the 0-20 years age group.[3,6] Consistent with the present study, research conducted in India and Greece reported that fatal head injuries were most common in the 21-40 age group.[7,8,10,11] In another study by Rao et al. in India, fatal THIs were most frequently reported in the 31-50 years age group.[9] The variances observed between countries and even within different regions of the same country can be attributed to the differing population distributions in the locations where the studies were conducted. These findings indicate that fatal THIs generally occur in males and young adults, likely due to higher rates of interpersonal interactions as these groups are more likely to be active in social environments and the workforce. Moreover, the pediatric and elderly age groups, who generally prefer to stay at home, exhibited relatively lower rates of THIs.

In a study examining the frequency of skull base fractures in fatal head trauma cases resulting from forensic incidents, 66.9% of the incidents were attributed to accidents, 26.0% to suicides, and 5.4% to homicides, with traffic accidents being the most common cause of death (62.5%).[12] Examining the causes of fatal blunt head injuries, Alexis et al. found traffic accidents, and Patil and Vaz identified railway accidents as the most frequent causes.[10,11] In the present study, which analyzed all fatal THIs, the majority of incidents were accidents (75.6%), with traffic accidents being the predominant cause of death (55.9%), aligning with the findings in the literature. In a study examining fatal head injuries among homicide victims, it was found that firearms were the most frequently used weapons, followed by blunt objects.[5] This suggests that the causes of incidents leading to fatal head injuries may vary depending on the study sample. It was observed that cases resulting from falls from heights were more common among pediatric, female, and elderly patients, whereas firearm injuries were predominantly observed in the adult male age group. In a study by Türkoğlu et al. focusing on fatal falls from heights, it was reported that such falls were more frequent at the extremes of the age distribution, with head/neck injuries being the most common cause of death, aligning with the findings of the present study.[13] Similarly, a study by Solarino et al. on fatal firearm injuries found that adult males were more often the victims.[14] The causes of fatal THIs may differ based on the habits of various populations such as the prevalence of firearm use in social life or preferences for individual vehicle use during travel.

When analyzing the patterns of craniocerebral trauma among the cases, it was observed that 221 patients (71.1%) had both intracranial lesions and skull fractures, whereas 79 patients (25.4%) had only intracranial lesions, and 11 patients (3.5%) had only skull fractures. Aşırdizer et al., in their study on head trauma cases resulting from traffic accidents, reported these rates as 47.5%, 41.4%, and 11.1%, respectively.[3] The higher incidence of concurrent intracranial lesions and skull fractures was attributed to the greater energy traumas involved in these cases. In this study, the most frequent injury findings were the co-occurrence of skull fracture and intracranial hemorrhage in 59 cases (19.0%), followed by the combination of skull fracture, brain contusion/laceration, and intracranial hemorrhage in 55 cases (17.7%). Rao reported that skull vault fractures, intracranial hemorrhages, and skull base fractures typically appeared together in cases of fatal head trauma, a pattern that could be explained by fractures initiating at the point of maximum impact and then spreading towards the base of the skull.[9] In the present study, cases of falls from height more frequently resulted in intracranial lesions, whereas the co-occurrence of intracranial lesions and skull fractures was more common in cases involving gunshot wounds. Similar studies have indicated that the greater the force exerted, the more significant the force transmitted to the brain and the resulting damage.[5,6] Gunshot wounds are more fatal as they cause comminuted fractures.[5] Consistent with the observations in our study, it is suggested that multiple head injuries are more common in cases with gunshot wounds due to the higher energy involved. In instances of falls from height, the brain may sustain injury from impacting the inner surface of the skull during acceleration and deceleration, as a result of the trauma's indirect effects.

In this study, skull fractures were identified in 232 cases (74.6%). Both skull vault and base fractures were observed together in 144 cases (46.3%), while only skull vault fractures were found in 61 cases (19.6%), and only skull base fractures in 27 cases (8.7%). The most frequent fractures were base fractures (171 cases) and temporal bone fractures (153 cases), with occipital bone fractures being the least common (112 cases). Patil and Vaz, in their examination of fatal blunt head traumas, reported a skull fracture rate of 87.3%, with 58.2% of cases featuring both vault and base fractures.[11] Menon et al.'s study also found base and temporal fractures to be the most common, with occipital bone fractures being the least common, aligning with the findings of the present study.[8] The occurrence of skull fractures and the severity of the injury depend not only on the magnitude of the force applied but also on factors such as the trauma's contact point on the skull, the individual's hair density, and the skull's thickness and elasticity.[6] A study conducted in India highlighted that impacts transmitted to the skull base, where vital centers are located, may result in fractures and consequently, death due to injury to these centers.[5] A large amount of force is required to fracture the occipital bone. The occurrence of this condition is clinically significant and is often fatal.[5] The data obtained in the present study regarding skull fractures were consistent with those of similar studies mentioned above.

Overall, 156 patients (67.2%) had bilateral skull bone fractures. In 197 patients (84.9%), displaced or comminuted fractures were observed. A significantly higher rate of displaced or comminuted fractures was observed in cases where vault and base fractures occurred together. The common feature of these findings is that they reflect high-force trauma experienced by the cases examined in the present study. In contrast, studies investigating head trauma patients injured in traffic accidents reported a higher rate of linear skull fractures (67.4%-76.8%). Aşırdizer et al. observed bilateral skull fractures in only 9.5% of their cases, which is significantly lower compared to this study.[3] It was reported that the cause of the incident, the type of fracture (comminuted/linear), the occurrence of skull base fractures, and multiple skull fractures increase the likelihood of fatality.[5] In this regard, the results obtained in this study were consistent with the literature, suggesting a correlation between these and the severity of trauma.

Aşırdizer et al.[3] reported that skull fractures were detected at the highest rate (64.5%) in the 1-20 years age group, decreased relatively in the 21-40 years age group (50%), and increased again in the ≥41 age group. This variation between age groups was attributed to changes in skull thickness, which increases until the age of 21 years, reaches its peak within the 21-40 years age group, and slightly decreases after the age of 40 years.[3] In the current study, skull fractures were observed at a higher rate in both the pediatric and adult age groups (80.0%-79.3%), but at a relatively lower rate in the elderly age group (57.4%). It is believed that the occurrence of skull fractures depends not only on the developmental stage of the victim's skull but also on other factors, such as the severity of the trauma and the cause of the incident.

In studies investigating head trauma resulting from traffic accidents, subdural hemorrhage (SDH) was identified as the most common type of intracranial hemorrhage, followed by SAH.[8,9] Conversely, in studies focused on blunt head trauma, SAH was the most frequently observed hemorrhage, with SDH following.[10,11] In the current study, the most common finding was SAH (39.5%). Similar to other studies, the incidences of epidural and intracerebral hemorrhage were significantly lower in this study.[8-11] It was noted that intracranial hemorrhage occurred at a higher rate, while skull fracture was less common, in the elderly age group. Similar studies have explained this observation by citing atherosclerosis-related changes in the cerebral arteries at older ages and the easier rupture of cerebral vessels secondary to brain atrophy.[3,6] The occurrence of skull fractures decreases intracranial pressure, thus reducing the incidence of intracranial lesions.[3,6,15] In the current study, it was found that the presence of skull fractures significantly decreased the incidence of intracranial lesions, consistent with the literature.

Limitations

The present study investigating fatal THIs has several limitations. First, the time between the incident and death, which is a parameter for understanding the magnitude of trauma experienced by patients, was not available in our study. Factors such as eyewitness accounts, crime scene camera recordings, and the presence of a suicide note aid in determining the cause. In cases lacking these resources, pinpointing the origin of the incident becomes difficult. To minimize the margin of error arising from this situation, all available information and findings from judicial investigations were examined in detail.

Secondly, radiological imaging was not routinely performed on all cases included in the study. Only those cases admitted to hospitals with injuries underwent radiological imaging, as deemed necessary by the attending specialists. Lastly, the comorbid diseases of the victims, significant factors affecting mortality, were unknown.

CONCLUSION

The present study, which examined fatal head traumas, found that the cases predominantly involved men and young adults. The incidents were mostly accidental and caused by traffic accidents. Skull vault fractures, intracranial hemorrhages, and skull base fractures were commonly observed together in the cases. It was observed that intracranial lesions were more common in cases of falls from height, whereas the co-occurrence of intracranial lesions and skull fractures was more prevalent in cases of gunshot wounds. The greater the force of the trauma, the greater the force transmitted to the brain, causing damage. The results indicated that the cause of the incident, the type of fracture (comminuted or linear), the presence of a skull base fracture, and the occurrence of multiple skull fractures increased the likelihood of fatality. The presence of skull fractures reduces intracranial pressure, thereby decreasing the incidence of intracranial lesions. Road traffic accidents remain a significant cause of fatal THIs. The incidence of fatalities can be reduced by developing comprehensive road traffic safety policies and the effective enforcement of traffic rules and regulations.

Ethics Committee Approval: This study was approved by the Firat University, Faculty of Medicine Ethics Committee (Date: 18.01.2018, Decision No: 02/17).

Peer-review: Externally peer-reviewed.

Authorship Contributions: Concept: K.S., A.T., T.B., M.B.; Design: K.S., A.T., T.B., M.B.; Supervision: K.S., A.T., T.B.; Resource: K.S., A.T., T.B., M.B.; Materials: K.S., A.T., T.B., M.B.; Data collection and/or processing: A.T., M.B.; Analysis and/or interpretation: K.S., M.B.; Literature search: K.S., T.B.; Writing: K.S.; Critical review: K.S., T.B.

Conflict of Interest: None declared.

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

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ORİJİNAL ÇALIŞMA - *ÖZ*

Ölümcül travmatik kafa yaralanmalarının incelenmesi

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AMAÇ: Travmatik kafa yaralanmaları, ölümlü adli olaylarda önemli nedenlerden biridir. Bu çalışmada fatal travmatik kafa yaralanmalı olguların özelliklerinin incelenmesi amaçlanmaktadır.
GEREÇ VE YÖNTEM: Bu çalışmada ölümcül travmatik kafa yaralanması bulunan ve ölü muayene ve/veya otopsi yapılan 311 adli olgu retrospektif olarak incelendi. Olgular cinsiyet, yaş grubu, olay orijini, olay nedeni, kafatası kırığı varlığı, varsa kırılan kemik çeşidi, lokalizasyonu ve kırık şekli, intrakranial lezyon varlığı, varsa lezyon çeşidi ve ölüm nedeni değişkenleri açısından değerlendirildi.
BULGULAR: Olguların 242'si (%77.8) erkek, 69'u (%22.2) kadındı. Olayların 235'i (%75.6) kaza orijinliydi ve 117 olgu (%37.6) araç içi trafik kazası nedenliydi. 221 olguda (%71.1) intrakranial lezyon ve kafatası kırığı birlikteydi. En sık olarak, 171 olguda kafa tabanı kırığı ve 153 olguda temporal kemik kırığı izlendi. Erişkin yaş grubunda daha düşük (%69.7), ileri yaş grubunda ise daha yüksek oranda (92.6%) intrakranial kanama meydana geldiği saptandı.
SONUÇ: Çalışmamızda mağduru olunan olay nedeni, meydana gelen kırık çeşidi, kafa tabanı kırığı meydana gelmesi ve çoklu kafatası kırığının meydana gelmesi gibi durumların fatalite ihtimalini arttırdığı saptandı. Kafatası kırıklarının meydana gelmesi, kafa içi basıncını azaltmakta ve böylece kafa içi lezyonların görülme sıklığını azalmaktadır. Karayolu trafiği güvenlik politikalarının geliştirilmesi ve trafik kurallarının/düzenlemelerinin etkili bir şekilde uygulanması ile ölümlerin insidansı azalacaktır.

Anahtar sözcükler: kafa yaralanması; intrakraniyal bulgu; kafatası kırığı; trafik kazası.

Ulus Travma Acil Cerrahi Derg 2024;30(3):160-166 DOI: 10.14744/tjtes.2024.32463