ORIGINAL ARTICLE

Etiological factors of maxillofacial traumas in forensic cases: A four-year retrospective study

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ABSTRACT

BACKGROUND: Maxillofacial traumas are often associated with significant morbidity, disfigurement, functional impairment, and costly treatments. This study aimed to analyze the frequency and causes of forensic cases involving maxillofacial trauma.

METHODS: A total of 356 forensic reports indicating maxillofacial trauma were retrospectively reviewed and analyzed using a medical records database. Data collected over a four-year period included age, gender, time of admission, injury mechanism, fracture location, consultations, and surgical procedures. Forensic cases were categorized into six age groups: 18-20, 21-30, 31-40, 41-50, 51-60, and over 61 years. The Glasgow Coma Scale and Injury Severity Score were recorded. The Mann-Whitney U and Kruskal-Wallis tests were used to compare scale score variables across categories, with statistical significance set at $p<0.05$.

RESULTS: The mean age was 37.63±15.01 years, with a predominance of males (80.3%). Cranial bone fractures were the most frequently observed injuries. The mean Glasgow Coma Scale score was 14.68±1.88 and the mean Injury Severity Score was 5.03±9.21. Maxillofacial trauma was most common among individuals in their third decade of life (34.55%). Forensic cases occurred most frequently in the summer (33.4%), particularly in July (14.3%), on weekdays (65.7%), and between 16:00 and 00:00 (56.7%). The majority of cases (80.9%) were managed without surgical intervention. Violence was the cause of 68.8% of all maxillofacial traumas. Maxillofacial traumas resulting from violence were associated with significantly higher Injury Severity Score values compared to other causes ($p=0.001$). Additionally, patients with maxillofacial traumas who required consultation had higher Injury Severity Score values ($p=0.001$).

CONCLUSION: The vast majority of forensic cases involving maxillofacial trauma occurred in males in their twenties. These traumas were most frequently caused by violence, particularly on summer weekends, between 16:00 and 00:00. Injury Severity Scores were higher when consultation was requested or in cases involving violence, underlining the severity of such traumas.

Keywords: Maxillofacial trauma; forensic case; etiology; Glasgow Coma Scale; Injury Severity Score.

INTRODUCTION

Maxillofacial traumas (MFTs) are among the most serious health concerns globally, often accompanied by significant morbidity, deformity, functional impairment, and high treatment costs.[1] MFTs remain a major clinical challenge due to the sensitivity of the facial region.[2] The frequency and patterns of MFT vary across populations and are influenced by various factors, including cultural and environmental conditions.[3] Therefore, identifying the origin, severity, temporal distribution, and incidence of MFT is essential for prioritizing preventive measures and guiding treatment strategies.[4]

Several quantitative rating methods have been developed to measure the degree of trauma and predict prognosis, but most are not age-specific and each has its shortcomings.[5] The Injury Severity Score (ISS), which focuses on anatomical conditions, was created to evaluate various physiological components in adults and to estimate outcomes.[6] Although several

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updates and alternative rating systems have been proposed, the ISS is still the most widely used method for assessing critically injured patients.[7] Another commonly used scoring system is the Glasgow Coma Scale (GCS), which measures the extent of consciousness impairment in all types of trauma patients.[8] The GCS categorizes patients based on three types of responses: eye-opening, motor, and verbal.

Assault, especially interpersonal violence, can result in MFT, leading to forensic cases in which police authorities refer victims to physicians to obtain medical evidence for investigations. This study aimed to analyze the prevalence and etiology of forensic MFT cases admitted to the emergency department (ED) of a training and research hospital, contextualizing the findings within existing research.

MATERIALS AND METHODS

The study was approved by the Non-Interventional Clinical Research Ethics Committee of the local university, in accordance with the Declaration of Helsinki (No: 2024/61). Potential MFT cases presenting to EDs, particularly those referred by judicial or police authorities for forensic evaluation, were classified as forensic cases. In Türkiye, hospital EDs collect data on most MFT cases to support criminal and judicial investigations conducted by law enforcement agencies. The study included all forensic reports of adult participants with comprehensive medical records confirming a clinical diagnosis of MFT. MFT was defined as any trauma to the head or facial area. Trauma cases under police investigation for suspected criminal activity were also included in the study. Due to legal regulations, cases involving individuals under the age of 18 were excluded. Forensic cases with incomplete hospital data were also excluded.

Records were collected from forensic cases identified in the hospital database and referred to the ED of a training and research hospital between March 1, 2020 and May 24, 2024. MFT-related keywords were searched using the hospital's digital medical records system. Clinical assessments were obtained from medical documentation and consultation reports recorded during each patient's initial ED visit.

Table 1. Distribution of forensic cases by age group

Age Group (years)	N (%)
18-20	20 (5.61)
21-30	123 (34.55)
31-40	98 (27.52)
41-50	56 (15.73)
51-60	28 (7.86)
≥61	31 (8.7)

The collected data were analyzed in relation to age, gender, time of admission, mechanism of injury, location of MFT, consultations, and surgical procedures. Treatment, whether surgical or non-surgical, was determined at the discretion of the emergency physician. Based on age at the time of the MFT, forensic cases were categorized into six groups: 18-20, 21-30, 3140, 41-50, 51-60, and over 61 years. Fracture sites were classified as mandibular, maxillary, zygomatic, orbital, cranial, or nasal.

Table 2. Number of consultations, departments involved, and distribution of admissions by day, time, and month (N (%))

Consultation Status	
Consultation not requested	268 (75.3)
Consultation requested	88 (24.7)
Consultation by Department	
Otolaryngology	
Not Consulted	315 (88.5)
Consulted	41 (11.5)
Neurosurgery	
Not Consulted	311 (87.4)
Consulted	45 (12.6)
Plastic Surgery	
Not Consulted	352 (98.9)
Consulted	4 (1.1)
Ophthalmology	
Not Consulted	345 (97.2)
Consulted	10 (2.8)
Thoracic Diseases and Surgery	
Not Consulted	344 (96.6)
Consulted	12 (3.4)
Orthopedics	
Not Consulted	342 (96.1)
Consulted	14 (3.9)
General Surgery	
Not Consulted	343 (96.9)
Present	11 (3.1)
Anesthesiology	
Not Consulted	355 (99.7)
Consulted	1 (0.3)
Admission Day	
Weekday	234 (65.7)
Weekend	122 (34.3)
Admission Time	
00:00-8:00	77 (21.6)
8:00-16:00	77 (21.6)
16:00-00:00	202 (56.7)
Admission Month	
January	19 (5.3)
February	21 (5.9)
March	35 (9.8)
April	29 (8.1)
May	37 (10.4)
June	31 (8.79)
July	51 (14.3)
August	37 (10.4)
September	25 (7)
October	17 (4.8)
November	29 (8.1)
December	25 (7)

Table 3. Distribution of trauma mechanisms by admission time

Mechanism of Trauma	Admission Time			Total
	00:00-8:00	8:00-16:00	16:00-00:00	
Traffic accident	2 (2.6)	3 (3.9)	4 (2)	9 (2.5)
Violence	53 (68.8)	46 (59.7)	146 (72.3)	245 (68.8)
Occupational accident	0 (0)	2 (2.6)	3 (1.5)	5 (1.4)
Fall	9 (11.7)	15 (19.5)	24 (11.9)	48 (13.5)
Sports-related injury	0 (0)	1 (1.3)	1 (0.5)	2 (0.6)
Firearm injuries	5 (6.5)	2 (2.6)	6 (3.0)	13 (3.7)
Unknown	8 (10.4)	8 (10.4)	17 (8.4)	33 (9.3)
Burn	0 (0)	0 (0)	1 (0.5)	1 (0.3)

Injury parameters such as the GCS and ISS were also recorded. The ISS was calculated by summing the squares of the highest Abbreviated Injury Scale scores in the three most severely injured body regions. An ISS of 16 or higher indicated severe trauma and an increased risk of mortality. For cases evaluated using the GCS, scores ranged from 3 (indicating deep unconsciousness) to 14 on the original scale or 15 on the widely used modified scale. GCS component scores ranged from 1 (no response) to a maximum of 4 for eye-opening, 5 for verbal response, and 6 for motor response.

Statistical Analysis

Descriptive statistics for the study's data included mean, standard deviation, median, minimum, and maximum values for numerical variables, as well as frequency and percentage analyses for categorical variables. The Shapiro-Wilk test was used to assess whether ISS and GCS values followed a normal distribution. The Mann-Whitney U and Kruskal-Wallis tests were used to compare the ISS variable with categorical variables. The significance level was set at $p<0.05$, and all analyses were conducted using SPSS software (version 22.0, Chicago, USA).

RESULTS

During the study period, 39,326 individuals presented to the emergency department for various reasons. Of these, 3,435 cases were related to MFT, but only 356 met study's inclusion criteria based on the availability of forensic reports. The mean age of the patients was 37.63±15.01 years (median=33.50; range: 18-92), with a male predominance (80.3%), corresponding to a 1:4 female-to-male ratio. The highest prevalence of MFT was observed in the 21-30 age group (34.55%), followed by the 31-40 age group (27.52%) (Table 1).

Forensic cases peaked in July (14.3%). Most applications occurred on weekdays (65.7%) and between 16:00-00:00 (56.7%) (Table 2). The majority of MFT-related forensic cases were treated without surgical intervention (80.9%). A total of 1.4% of forensic cases resulted in death. In most instances, no consultation from hospital departments was requested (n=88, 24.7%). When consultations were required, they were most frequently requested from the neurosurgery (n=45, 12.6%) and otolaryngology (n=41, 11.5%) departments (Table 2).

Violence was the leading cause of MFT, accounting for 68.8% of cases. Falls were the second most common cause, at 13.5% (Table 3). Males were predominant across all groups in the study. The rate of forensic case applications due to violence was 65.4% on weekdays, increasing to 75.4% on weekends. Falls accounted for 15.4% of weekday cases, dropping to 9.8% on weekends. There was no statistically significant relationship between the day or time of application and the mechanism of trauma. Violence-related MFT was most common on weekends between 16:00-00:00 (77.9%) (Table 2). Mean ISS and GCS values are presented in Table 4. The distribution of ISS and GCS scores did not vary by age or sex. However, statistically significant associations were found between the ISS score and both the trauma mechanism (p=0.001) and the

Table 4. Mean scores of Injury Severity Score (ISS) and Glasgow Coma Scale (GCS)

	Mean	Standard Deviation	Median	Minimum	Maximum
ISS	5.03	9.21	2.00	1.00	75.00
GCS	14.68	1.88	15.00	3.00	15.00

ISS: Injury Severity Score; GCS: Glasgow Coma Scale.

Table 5. Relationship between Injury Severity Score and consultation, trauma mechanism, day, and time of admission

	Injury Severity Score			
	Median	**25th Percentile**	**75th Percentile**	**p**
Consultation				
Not requested	2.00	2.00	3.00	0.001*
Requested	9.00	3.00	11.00	
Mechanism of trauma				
Violence	2.00	2.00	3.00	0.001*
Other types	3.00	2.00	10.00	
Admission day				
Weekday	2.00	2.00	3.00	0.755
Weekend	2.00	2.00	3.00	
Admission time				
00:00-8:00	2.00	2.00	3.00	0.102
8:00-16:00	3.00	2.00	3.00	
16:00-00:00	2.00	2.00	3.00	

*p<0.05; Mann-Whitney U test, Kruskal-Wallis test.

need for consultation (p=0.001) (Table 5). MFT caused by violence was associated with higher ISS values compared to other trauma mechanisms (p=0.001). ISS values were also significantly higher in MFT patients who received consultations compared to those who did not (p=0.001). However, no statistically significant association was found between ISS scores and the day (p=0.755) or time (p=0.102) of emergency department admission in forensic cases (Table 5).

The most common fractures were located in the cranial bones (5.04%) (Table 6). No significant association was found between the trauma mechanism and the type of MFT-related bone fracture (p>0.05).

Table 6. Distribution of bone fractures

Fracture Type	**N (%)**
Mandible	6 (1.68)
Maxilla	8 (2.2)
Zygoma	2 (0.6)
Orbital	1 (0.3)
Cranial	23 (5.04)
Nasal	16 (4.5)

DISCUSSION

Epidemiological data should be taken into account when planning to improve healthcare services for MFT patients. The incidence and patterns of MFT are influenced by a population's socioeconomic status and geographic location.[9] Brasileiro et al.[10] reported a higher incidence of violence-related trauma among individuals from lower socioeconomic backgrounds. Supporting this, a study conducted during the economic crisis in Greece found an increase in assault-related MFT cases.[11] Socioeconomic problems in developing countries may explain why violence-induced MFT ranked first, accounting for 68.8% of cases in the current study. Another possible explanation for this finding is that MFTs resulting from non-violent mechanisms may not be classified as forensic cases by security forces or ED staff.

In most studies conducted in Türkiye, traffic accidents, falls, and violence have been reported as the leading causes of MFT.[12-15] However, Akkoç et al.[16] found that falling from height was the most common cause, with a rate of 41.7%. In contrast, Balandız et al.[17] and Arslan et al.[18] reported violence as the most frequent cause of MFT, which aligns with the findings of the current study.

The results of this study showed a predominance of MFT among male patients (80.3%). Male-to-female ratios for MFT cases worldwide range from 2:1 to 11:1.[4,19] In studies conducted in Türkiye, this ratio typically ranges between 2.05:1 and 6:1, with the present study (4:1) falling within this range.[13-15,20] In the current study, data on factors such as social background, drug use, and alcohol consumption were not collected. Therefore, the underlying causes of MFT remain unclear and require further investigation. Consistent with previous studies, the most frequently affected age group in the current study was 21-30 years, accounting for 34.55% of cases.[18,21-25] Individuals in this age group are more likely to engage in physical activity and hostile interpersonal inter-

actions. Their active involvement in risky, adventurous, and exploratory behaviors likely contributes to this trend. Young males were the most affected by violence-related fractures, with incidence rates ranging from 12.7% in Asia to 32% in Europe and Australia.[9] Many studies conducted in Türkiye on the distribution of fractures in MFT frequently reported isolated mandibular fractures as the most common.[12,15,16,20] However, Ahmedov et al.[13] identified nasal fractures as the most prevalent, while Altay et al.[24] reported blow-out type orbital fractures at the most frequent. In contrast to these findings, the current study found that mandibular fractures were the fourth most common, with cranial bone fractures being more frequent (5.04% of cases), followed by nasal bone fractures.[12,26,28] This result suggests that direct trauma to the craniofacial skeleton is common in violence-related MFT.

Regarding the GCS scale, the mean value in this study (14.68) indicated that brain injuries among the forensic cases were generally minor. Hospitalization duration following trauma, mortality rates, and morbidity are all correlated with the ISS value. In this study, mortality was low among forensic MFT cases (1.4%). Supporting this finding, the mean ISS score was 5.03 (within the 1-8 range), indicating injuries of mild severity. Additionally, the mean GCS value at the time of emergency department presentation also fell within the range for mild traumatic brain injury, typically defined as a concussion. However, in two separate studies examining patients with MFT, the mean GCS value was approximately 11, indicating traumatic brain injury (25, 27). Taken together, the ISS and GCS values suggest that the forensic traumas in the current study were generally low-energy. This context may reduce the severity of MFT, potentially influencing the outcomes of forensic cases. Such a setting allows for more targeted management of maxillofacial fractures, often resulting in fewer surgical interventions when treatment is necessary. Consequently, only one in ten forensic cases in the current study required surgical management, while four out of five were treated non-surgically based on clinical evaluation and physician judgment.

This study also demonstrated a significant seasonal pattern in forensic cases involving MFT. In Gaziantep, there was a clear association between the rise in MFT cases (33.4%) and increased criminal activity during the summer months. According to a survey conducted in Türkiye, the highest monthly MFT attendance occurred in July (n=51, 14.3%) and August (n=37, 10.4%).[16] The increase in MFT during the summer may be attributed to a rise in interpersonal violence and other forms of violent crime, which are key contributors to MFT. This seasonal increase may be linked to a rise in interpersonal violence and crime; however, more data are needed to confirm this association. The literature suggests that temperature has a strong positive effect on criminal behavior, with little evidence of delayed or lagged effects.[26]

Treating MFT can be more complex and difficult than managing other types of trauma in the body. The maxillofacial region includes structures responsible for vital functions, such as breathing, speaking, mastication, vision, and olfaction. Therefore, great care must be taken in the event of MFT. While most medical procedures for trauma in other regions of the body focus on restoring function, cosmetic considerations often take precedence in the maxillofacial region, presenting additional challenges for healthcare professionals. There are several treatment options for MFT; however, the choice depends on the nature and location of the injury, the patient's specific needs, and the practitioner's expertise and clinical judgment.[27] A standardized approach to MFT is ineffective, as each case involves unique patient and trauma characteristics. Research has shown that MFT is associated with significant psychological and physiological concerns, with depression frequently reported when facial aesthetics are impaired.[28] As a result, MFT management requires an interdisciplinary and collaborative approach. Plastic surgery, otolaryngology, anesthesiology, neurosurgery, and dentistry are all essential components of this care model. Each case of MFT should be treated individually, with personalized management plans and expert care.

In the present study, 75.4% of forensic cases did not require consultation. This may be attributed to the generally mild or moderate nature of the injuries, as indicated by the patients' GCS and ISS values, allowing treatment to be completed without additional specialist input. Additionally, the high rate of consultations requested from the neurosurgery department was likely due to the high prevalence of cranial bone fractures observed in the current study.

The study had several inherent limitations. First, its retrospective design introduced a risk of bias due to reliance on digital data extraction and incomplete or partial record-keeping. Second, only MFT victims classified as forensic cases were included in the dataset. However, it is possible that many forensic cases, particularly those with minor injuries, were unintentionally excluded if individuals chose not to present to the ED. Another limitation is that, despite the potential for a thorough investigation into the epidemiological features of forensic cases in our region, it is challenging to determine the overall pattern of MFTs across all forensic cases in Türkiye. Due to institutional restrictions, follow-up data on judicial proceedings, court decisions, or official judicial evaluation systems were not accessible. This limitation stems from the fact that data were obtained solely from patients' anamnesis records provided during the registration process. Victims may intentionally conceal the causes of MFT out of fear or to avoid legal consequences, particularly in cases involving interpersonal violence. In such situations, inaccurate information regarding the origin of MFT cases may be recorded.

CONCLUSION

On average, the MFT cases included in this study could be classified as concussions. The majority of forensic MFT cases involved males in their twenties. Most injuries were caused

by violence and occurred on weekends, particularly between 16:00 and 00:00. A seasonal trend was observed, with an increase in MFT-related forensic cases during the summer months. ISS values were higher in cases involving violence or when specialist consultation was required.

Ethics Committee Approval: This study was approved by the Gaziantep University Ethics Committee (Date: 13.03.2024, Decision No: 2024/61).

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ORİJİNAL ÇALIŞMA - *ÖZ*

Adli olgularda maksillofasiyal travmaların etiyolojik faktörleri: Dört yıllık retrospektif bir çalışma

AMAÇ: Maksillofasiyal travmalar sıklıkla ciddi morbidite, malformasyon, disfonksiyon ve maliyetli tedaviler ile birliktedir. Bu çalışmanın amacı maksillofasiyal travma içeren adli olguların sıklığını ve nedenini analiz etmektir.

GEREÇ VE YÖNTEM: Maksillofasiyal travma düşündüren 356 adli rapor retrospektif olarak elde edildi ve tıbbi kayıt veri tabanı kullanılarak analiz edildi. Dört yıl içinde toplanan veriler yaş, cinsiyet, başvuru zamanı, yaralanma mekanizması, kırık yeri, konsültasyonlar ve cerrahi prosedürleri içeriyordu. Adli vakalar altı kategoriye ayrıldı: 18-20, 21-30, 31-40, 41-50, 51-60 ve 61 yaş üstü. Glasgow Koma Skalası ve Yaralanma Şiddeti Skoru elde edildi. Mann-Whitney U/Kruskal Wallis testleri, $p<0.05$ anlamlılık eşiği ile kategorik değişkenler arasında skala puan değişkenini karşılaştırmak için yapıldı.

BULGULAR: Ortalama yaş 37.63±15.01 olup, erkeklerin üstünlüğü (%80.3) vardı. En sık kraniyal kemik kırıkları gözlendi. Glasgow Koma Skalası ortalaması 14.68±1.88 idi. Ortalama Yaralanma Şiddet Skoru 5.03±9.21 idi. Maksillofasiyal travma en sık yaşamın ikinci on yılındaki kişilerde (%34.55) görüldü. Adli vakalar en sık yaz aylarında (%33.4), özellikle Temmuz ayında (%14.3), hafta içi günlerde (%65.7) ve 16.00-00.00 saatleri arasında (%56.7) görüldü. Adli vakaların büyük çoğunluğu (%80.9) cerrahi müdahale olmaksızın çözüldü. Tüm maksillofasiyal travmaların %68.8'inin nedeni şiddetti. Şiddet ile tetiklenen maksillofasiyal travma, diğer gruplara göre anlamlı derecede daha yüksek Yaralanma Şiddeti Skoru değerlerine sahipti ($p=0.001$). Konsülte edilen maksillofasiyal travma hastalarının Yaralanma Şiddeti Skoru değerleri daha yüksekti ($p=0.001$).

SONUÇ: Maksillofasiyal travmalı adli olguların büyük çoğunluğu yirmili yaşlardaki erkeklerden oluşmaktadır. Maksillofasiyal travmalar en çok yaz hafta sonlarında, 16:00 ile 00:00 saatleri arasında şiddet nedeniyle meydana gelmiştir. Yaralanma Şiddet Skoru, konsültasyon talep edildiğinde veya şiddet içeren vakalarda daha yüksekti ve bu tür travmaların ciddiyetinin altını çiziyordu.

Anahtar sözcükler: Adli vaka; etiyoloji; Glasgow Koma Skalası; maksillofasiyal travma; yaralanma şiddet skoru.

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