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Pattern of maxillofacial trauma in children and adolescents: a three-year retrospective study

Obrazac maksilofacijalne traume kod dece i adolescenata: trogodišnja retrospektivna studija

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Abstract

Background/Aim. Understanding the epidemiological aspects associated with maxillofacial traumas (MFTs) is necessary to develop effective preventive and protective strategies. The aim of this study was to assess the age-related characteristics and pattern of MFTs in patients under 18 years of age. **Methods.** A retrospective study analyzed clinical data from individuals aged 0–18 years with MFTs presenting to the emergency department over a three-year period. Data were related to epidemiological aspects such as age, gender, types of trauma, and type of bone fracture. A descriptive statistics of a data set and a χ^2 test for categorical variables were used. **Results.** A total of 418 patients with MFT were included in this retrospective study. The mean age of the patients was 8.5 ± 5.5 years, and the mean Glasgow Coma Scale score was 14.7 ± 1.4. The most common type of bone fracture was cranial fracture (87.31%). The most common reasons for admission were assault (24.8%) in male patients and fall (79.2%) in female patients (p = 0.009 in both cases). Admissions peaked in August (11%), on weekdays (73.6%), and between 4:00 pm and midnight (49.4%). Consultations were requested for 63.4% of the cases, and the most frequent requests were at the Plastic Reconstructive and Aesthetic Surgery Department (51.67%), especially for females (54.7%), and due to falls (67.4%). More consultation requests were sent for the patients from the 0–6 age group (66.5%). Conservative treatments were applied to 61% of all cases. The patients from the 0–6 age group (58.9%) were treated more frequently in surgical and intensive care units (p = 0.001), while the patients from the 7–12 (40%) and 13–18 (35.7%) age groups received conservative treatment more frequently (p = 0.001). The majority of patients aged 0–3 years (49.7%) were treated in surgical and intensive care units (p < 0.05). **Conclusion.** In pediatric patients in Türkiye, MFTs were most prevalent in the 0–3 age group, and MFTs were most often caused by falls. The fractures most frequently involved cranial bones. The findings of the study provide significant insights for defining preventive and health-promoting policies.

Key words:
adolescent; age factors; child; maxillary fractures; sex factors; türkiye; wounds and ınjuries.

Apstrakt

Uvod/Cilj. Za razvoj efikasnih preventivnih i zaštitnih strategija neophodno je razumevanje epidemioloških aspekata povezanih sa maksilofacijalnim traumama (MFT). Cilj rada bio je da se procene karakteristike vezane za uzrast i obrazac MFT kod pacijenata mlađih od 18 godina. **Metode**. Retrospektivnom studijom analizirani su klinički podaci osoba uzrasta 0–18 godina koje su zadobile MFT i javile se u hitnu pomoć tokom tri godine. Podaci su se odnosili na epidemiološka obeležja kao što su starost, pol, vrste traume i tip preloma kostiju. Korišćeni su deskriptivna statistika skupa podataka i χ^2 test za kategoričke varijable. **Rezultati**. Retrospektivnom studijom obuhvaćeno je ukupno 418 pacijenata sa MFT. Prosečna starost pacijenata iznosila je 8,5 ± 5,5 godina, a srednji skor Glazgovske skale kome 14,7 ± 1,4. Najčešća vrsta preloma bila je fraktura lobanje (87,31%). Najčešći razlozi za prijem bili su napad (24,8%) kod pacijenata muškog pola, a kod pacijenata ženskog pola pad (79,2%) (p = 0,009 u oba slučaja). Najveći broj prijema bio je u avgustu (11%), radnim danima (73,6%) i između 16 časova i ponoći (49,4%). Konsultacije su zatražene za 63,4% slučaja, a najčešći zahtevi bili su na Odeljenju plastične, rekonstruktivne i estetske hirurgije (51,67%), posebno za pacijente ženskog pola (54,7%) i zbog padova (67,4%). Za pacijente uzrasta 0–6 godina (66,5%) poslato je više zahteva za konsultacije. Konzervativni tretman primenjen je kod 61% svih pacijenata. Pacijenti uzrasta 0–6 godina (58,9%) češće su lečeni u hirurškim jedinicama i jedinicama intenzivne nege (p = 0,001), dok su pacijenti uzrasta 7–12 godina (40%) i 13–18 godina (35,7%) češće lečeni konzervativno (p = 0,001). Većina pacijenata

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uzrasta 0–3 godine (49,7%) lečena je u hirurškim jedinicama i jedinicama intenzivne nege ($p < 0,05$). **Zaključak**. Kod pedijatrijskih pacijenata u Turskoj, najčešće MFT bile su kod pacijenata uzrasta 0–3 godine, a MFT su najčešće bile izazvane padom. Prelomima su najčešće bile zahvaćene kosti lobanje. Nalazi studije pružaju značajne uvide u definisanje preventivnih politika, kao i politika koje unapređuju zdravlje.

Ključne reči:
adolescenti; životno doba, faktor; deca; maksila, prelomi; pol, faktor; turska; povrede.

Introduction

Maxillofacial trauma (MFT) is relatively rare in children [1]. However, traumatic brain injury is currently the leading cause of disability and mortality among children worldwide [2]. The etiology and characteristics of pediatric MFT vary by region due to differences in social, environmental, and economic factors [3].

Physiologically, children are particularly vulnerable to facial fractures due to the flexibility of their developing skeletons, the presence of unerupted teeth, and the lack of paranasal sinus pneumatization compared to adults [4]. MFTs are significant because children's faces are difficult to protect during falls, and such injuries can adversely affect maxillofacial development and dental health.

Inappropriate treatment of MFT in children may lead to complications such as temporomandibular joint ankylosis and developmental problems [5]. These concerns are compounded by the potential for severe long-term effects, which can result in functional impairments and negatively impact the quality of life for affected individuals [1]. Understanding the epidemiological aspects associated with MFT is essential for developing effective clinical treatment strategies.

This study aimed to analyze the type and incidence of MFT in individuals aged 0–18 years.

Methods

The retrospective study was conducted at a tertiary hospital. It was approved by the Ethics Committee of Gaziantep University, more precisely, the Non-Interventional Clinical Research Ethics Committee (No. 2024/61, from March 13, 2024). The research adhered to the Declaration of Helsinki and good clinical practice guidelines. Medical records were reviewed by matching treatment and diagnosis codes within the hospital information management system.

The study included all injured individuals aged < 18 years, regardless of gender, who presented with a history of trauma and had complete medical records of clinical and radiographic diagnoses during the specified study period. Individuals with incomplete hospital records were excluded from the analysis. Data from the Gaziantep Training and Research Hospital Emergency Department (ED) were examined for cases admitted between April 12, 2021, and April 28, 2024. Out of 2,355 cases, 1,617 had a history of MFT, with 417 cases meeting the inclusion criteria for the study. The patients were categorized into six age groups: 0–3 years old (infants), 4–6 years old (preschoolers), 7–9 years old (school-age children), 10–12 years old (preadolescents), 13–15 years old (early adolescents), and 16–18 years old (teenagers). The age groups were combined into three broader categories for a more balanced representation: preschool period (0–6 years old), school period (7–12 years old), and adolescents (13–18 years old).

The hospital records of all eligible patients were reviewed and classified into the following categories: age and gender of the patient, type of trauma, presence and type of bone fractures, mandibular fracture sites, consulting department, type of treatment, date and time of admission, and the Glasgow Coma Scale (GCS) scores. The type of fractured cranial bone was not recorded separately as frontal, parietal, temporal, occipital, sphenoid, and ethmoid bones. Due to the fast registration system implemented in the ED, all the data about cranial bones were recorded under the more general term "cranial bone fracture". In the current study, treatment procedures in which surgical interventions were not performed during the MFT treatment were considered conservative treatment. The GCS scoring system comprised three parameters: eye-opening, verbal response, and motor response. The GCS scores were calculated by summing the points from each parameter, ranging from 3 to 15 points. The GCS was categorized as follows: a score ≤ 8 indicated severe injury (coma), 9–12 suggested moderate damage (a pre-coma state), and 13–15 represented mild trauma (the patient is conscious).

Descriptive statistics for the data obtained from the study were presented, including the mean, standard deviation, median, minimum, and maximum values for numerical variables, along with frequency and percentage analyses for categorical variables. The Chi-square test was employed to compare categorical variables. Analyses were conducted using the statistical software SPSS v. 22.0 (Chicago, USA), with a significance level set at $p < 0.05$.

Results

The distribution of age groups, bone fractures, and trauma reasons is given in Table 1.

The mean age was 8.5 ± 5.5 years (median 8 years, minimum 1, maximum 18). In the current study, there were 312 males and 106 females, and the male-to-female ratio was 2.94 : 1. The mean GCS score was 14.7 ± 1.4 (median 15, minimum 3, maximum 15). The most commonly diagnosed type of bone fracture among those presenting to the ED was cranial fracture in 303 patients (87.3%) (Table 1). Mandible fractures were reported in 7 (2%) patients who presented to the ED, with 4 occurring in the corpus region, 2 in the condyle region, and 1 in the ramus region. A statistically significant relation was found between gender and the reasons for MFT ($p = 0.009$). The most common reason for ED visits in males was assault (24.8%), and the most common MFT type in females was falls (79.2%) ($p = 0.009$) (Table 2).

Table 1

The distribution of age groups, bone fractures, and types of trauma in children and adolescents with maxillofacial traumas

Parameters	Values
Age groups (years)	
0–3	128 (30.6)
4–6	47 (11.2)
7–9	55 (13.2)
10–12	64 (15.3)
13–15	60 (14.4)
16–18	64 (15.3)
Types of bone fracture	
mandible	7 (2)
maxilla	4 (1.1)
zygoma	2 (0.6)
orbita	14 (4)
nasal	17 (4.9)
cranial bones*	303 (87.3)
Types of trauma	
traffic accident	6 (1.4)
assault	86 (20.6)
occupational accident	1 (0.2)
fall	275 (65.9)
sport activity	24 (5.7)
not clear	24 (5.7)
firearm injuries	2 (0.4)

Values are given as numbers (percentages).
***No bone type is specified in these records.**

Table 2

Relationship between age and gender of children and adolescents and trauma types

Characteristics	Traffic accident	Assault	Occupational accident	Falls	Sport activity	Not clear	Firearm injuries	Total
Age groups (years)								
A (0–6)	0 (0)	6 (3.8)	0 (0)	138 (87.3)	2 (1.3)	12 (7.6)	0 (0)	158
B (7–12)	3 (2)	25 (16.7)	0 (0)	104 (69.3)	12 (8)	5 (4)	1 (0.7)	150
C (13–18)	3 (2.8)	55 (50.5)	1 (0.9%)	33 (30.3)	9 (8.3)	7 (6.4)	1 (0.9)	109
Gender								
male	6 (1.9)	**77 (24.8)**	1 (0.3)	191 (61.4)	18 (5.8)	18 (5.8)	1 (0.3)	312
female	0 (0)	9 (8.5)	0 (0)	**84 (79.2)**	6 (5.7)	6 (5.7)	1 (0.9)	106

Bolded values: $p = 0.009$ (Chi-Square tests) for gender and trauma types; $p < 0.001$ for trauma type "falls": A vs. B, A vs. C, and B vs. C; $p < 0.001$ for trauma type "assault": B vs. A, C vs. A, and C vs. B; $p < 0.05$ for trauma type "sport activity": B vs. A and C vs. A.

Patients in the 0–3 age group were admitted to the ED due to MFT significantly more often [128 (30.6%)] than patients from other age groups ($p < 0.05$) (Table 1). A statistically significant relation was observed between age groups and types of trauma ($p < 0.05$).

There were statistically more fall-type MFTs in the 0–6 age group (87.3%) than in the other two age groups ($p = 0.001$). In the 7–12 age group, MFTs due to falls were statistically more common than in the 13–19 age group ($p = 0.001$). MFTs due to assault or sports activity were statistically more common in the 7–12 and 13–18 age groups than in the 0–6 age group ($p < 0.05$). Statistically more assault-related MFTs were observed in the 13–18 age group than in the 7–12 age group ($p = 0.001$) (Table 2).

ED visits for MFTs peaked in August, 46 (11%) patients, followed by May, 43 (10.2%) patients. Lower admission rates were noted in February (5.9%), November (4.3%), and in winter (19%). MFTs happened predominantly on weekdays in 308 (73.6%) patients, and between 4:00 pm and midnight in 206 (49.4%) patients. A statistically significant difference was noted between age groups and ED visit times ($p = 0.001$). Compared to other age groups, the 0–6 age group primarily visited the ED between midnight and 08:00 am [24 (77.4%)], the 7–12 age group between 4:00 pm and midnight [79 (38.3%)], and the 13–18 age group between 08:00 am and 4:00 pm [61 (33.9%)].

The patients from the 0–6 age group experienced MFTs more frequently on weekends (45%), while the patients from the 13–18 age group were more affected on weekdays

(28.9%). No statistically significant difference was found between age groups and admission days ($p > 0.05$).

Consultations from other medical departments were requested for 265 (63.4%) cases. The most frequent requests were made to the Plastic Reconstructive and Aesthetic Surgery Department – 216 (51.6%) cases (especially for females – 54.7%, and due to falls – 67.4%), followed by the Ear, Nose, and Throat Department – 39 (9.3%) cases, and the Ophthalmology Department – 28 (6.7%) cases. No statistically significant relation was found between age groups and consultation requests ($p = 0.448$). However, the 0–6 age group received more consultation requests (66.5%) than other age groups. Consultations were most frequently requested for cases resulting from falls (67.4%), followed by assaults (17.4%).

Conservative treatments were applied to 255 (61%) MFT cases. A significant correlation was found between age categories and treatment types ($p = 0.001$). Patients from the 0–6 age group (58.9%) were treated more frequently in surgical and intensive care units for MFT compared to other groups, while patients from 7–12 (40%) and 13–18 (35.7%) age groups were more likely to receive conservative treatment ($p = 0.001$). Most patients treated for MFT in surgical and intensive care units (49.7%) were aged 0–3 years, while those treated conservatively were predominantly aged 13–15 (19.6%) and 16–18 years (21.6%) ($p < 0.05$).

Discussion

The results of this research revealed a significant frequency of MFT among children and the 16–18 age group visiting the ED of the university hospital. The GCS is a widely used assessment tool for comatose patients, allowing for the rapid diagnosis of changes in consciousness following head trauma [6]. Although cranial fractures were the most common type identified in this study, and MFTs were primarily caused by falls, the mean GCS score was 14.7, indicating mild head trauma. This suggests that very severe cases were infrequent in the ED focus of this study. Periodic monitoring is essential to identify and prevent early facial asymmetry or malocclusion in developing children [7]. Furthermore, the findings can provide crucial insights for defining preventive and health-promoting policies, as well as for raising community awareness.

To gain deeper insights into the causes and treatment of pediatric MFTs, the present study relies on epidemiological data. However, the crowding of EDs and staffing shortages often result in incomplete records, complicating trauma studies. For instance, only 25.8% of the patients included in this study had sufficient information in their files to meet the research criteria. In 303 cases, the specific cranial bones involved in fractures were not documented, leading to a general classification as “cranial bone fracture”.

The inclusion criteria for this study were based on the global standard for children aged 18 years and under. The mean age of the patients included in the present study was 8.5 years, and the 0–3 age group had the highest incidence of MFT, likely due to their limited protective awareness during this developmental stage. Their active engagement in daily activities contributes to the high prevalence of trauma in this age category, compounded by underdeveloped balance skills and difficulties in maintaining control.

Significant differences were noted according to age and gender in the present study, with behavioral patterns and developmental stages influencing these results. Of the total cases evaluated, 312 (74.8%) were male. Generally, the incidence of MFT is higher in males than females, and the present study found a male-to-female ratio of 2.94 : 1. This aligns with previous studies reporting a ratio of 3 : 1, with one female affected for every three males [1, 8]. Some studies have noted even higher ratios, reaching 13 : 1 [9, 10]. These trends may relate to physiological changes and increased activity levels associated with secondary sexual traits. Findings of the present study revealed that MFTs were more prevalent in the 0–3 age group. A Chilean study also indicated that 56.3% of children under 5 years of age most frequently experienced facial trauma [11], while a global study noted that facial injuries were rare below this age, with occurrences increasing from school age to puberty [12].

The mechanisms of trauma significantly influenced the extent of damage. Consistent with Ulusoy et al. [13], the present study found that the majority of MFTs resulted from falls (65.9%), followed by assaults (20.6%). However, a meta-analysis indicated that road traffic accidents were the leading cause of MFT in individuals under 18 years [14]. Similarly, Kelimu et al. [15] reported that road accidents and falls were the most common causes of pediatric maxillofacial fractures, followed by assaults. The meta-analysis by Mohammadi et al. [14] showed that 9.9% of MFTs in children and the 13–18 age group were due to violence, and violence was increasing, especially in the Americas, exceeding sports-related MFTs. The present study noted that assaults constituted the second most common medical-legal issue, which has reportedly increased over time and correlates with older age [13]. The 13–18 age group was more susceptible to interpersonal violence, with one Turkish study showing a median age of 14.0 years for hospitalized cases [13]. Interpersonal violence among children, especially in the 7–12 and 13–18 age groups, has risen, attributed to preventative measures in developed nations, while falls and vehicle accidents remain prevalent in developing countries [11, 14]. Therefore, local strategies must be tailored to address the unique challenges posed by MFTs in specific regions.

Facial bone fractures are less common than cranial fractures in children due to the frontal projection of the skull and the relative retrusion of the face. Facial bones become more prominent with age, increasing fracture risk [16]. On the other hand, Khan et al. [16] reported that 46% of patients with MFT-related fractures between the ages of 1 and 12 were younger than 4 years. Furthermore, in a retrospective study of children younger than 12 months, the most common fracture was skull fracture [17]. Similarly, cranial bones were the most frequently fractured bones in the current research (87.3%). One study identified nasal fractures as the second most prevalent maxillofacial fracture type (30.2%), similar to the findings of the present study, although at a considerably lower rate

(4.8%) [18]. Variability in nasal fracture occurrences in children is likely due to differences in anatomical features, ethnicity, and geography. Thus, preventive measures should focus on reducing incidence and minimizing injury severity. Proper education and implementation of safety standards can significantly decrease MFT morbidity among children and the 13–18 age group. Public health professionals should provide expert guidance and recommendations to parents, educators, and caregivers.

In the current study, ED visits occurred predominantly on weekdays (73.6%), similar to the results of a Brazilian study (64%) [1]. When considering a longer time frame, monthly trauma frequency was highest in May (10.2%) and August (11%). In a Pakistani study, similar to the current study, the number of pediatric patients with facial fractures was highest in June, July, and August [16]. Although some studies reported no significant variation between months [12, 19], lower admission rates were noted in February (5.9%), November (4.3%), and in winter (19%). Climatic factors are believed to contribute to the reduced prevalence of cases during winter. Additionally, summer is the time when primary, secondary, and high schools in Türkiye are closed, and therefore, recreational activities of the 7–9 and 13–18 age groups increase. Fasola et al. [20] investigated the timing of MFT occurrences, finding most incidents between 6:00 am and 6:00 pm. In the present study, most ED visits occurred between 4:00 pm and midnight, aligning with times when children and the 13–18 age group are typically at home, indicating that MFTs were more common in domestic settings for those under 18.

Previous studies indicated that surgical interventions were primarily utilized for MFTs [18, 21]. In the present study, most patients aged 7 years and older with MFT received conservative treatment (61%). However, half of the children aged 0–3 years continued treatment in surgical and intensive care units. Consultation was sought in 63.4% of cases, primarily from the Plastic Reconstructive and Aesthetic Surgery Department (51.67%). The 0–3 age group had the highest consultation requests (32.1%), possibly due to heightened caution among healthcare professionals when treating younger patients. Additionally, plastic surgery consultations were more frequently requested for females (54.7%), likely reflecting higher aesthetic expectations.

Limitations of the study

This retrospective analysis included several limitations. First, the patients' conditions could not be extensively assessed immediately following the incidents. Additionally, the study was conducted at a single location, which may affect the generalizability of the findings. Moreover, the present study did not evaluate treatment outcomes, which limits the understanding of the long-term effects. Finally, insufficient patient data in the ED records could result in inconsistent and inaccurate information regarding MFT.

Conclusion

The incidence of maxillofacial trauma in patients under 18 years was influenced by age, gender, and types of trauma. The highest incidence of maxillofacial trauma was observed in the 0–3 age group, with falls identified as the primary cause. Males experienced maxillofacial trauma more frequently, primarily resulting in cranial bone fractures. Consultations with the Plastic Reconstructive and Aesthetic Surgery Department were more common for females, and children aged 0–3 were the ones who were most likely to require consultations. Notably, the 0–6 age group tended to receive less conservative treatment. Future multicenter studies on the etiology of maxillofacial trauma in children and more detailed records kept in emergency departments may enable the design of protective measures.

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