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Research Article

Maxillofacial Fracture and Treatment Patterns: A Retrospective Study

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Abstract

The epidemiology of maxillofacial fractures varies from country to country. Population density, lifestyle, cultural background, and socioeconomic status can affect the prevalence of maxillofacial injuries. Therefore, in this study, we evaluated the epidemiology and treatment plans of maxillofacial fractures in hospitalized patients in a way that would be beneficial for better policymaking strategies**.** In this retrospective study, medical records of 50 patients who were operated for hospitalization and maxillofacial injury were evaluated. Age, gender, fracture types, causes, treatment plans, and post-treatment complications were recorded. Most of the patients were male (78%). Most of the cases were in the 21-30 age range. Fractures were mostly caused by falls (40%) and accidents (38%), particularly motorcycle accidents, and the most common site of involvement was the parasymphysis region of the mandible. ORIF + IMF (combine technique) (63%) was preferred as a treatment plan. The findings of our study supported the view that the cause and incidence of maxillofacial fractures were different in each country. In contrast to many developed countries, falls and traffic accidents are the most common cause of maxillofacial fractures in Erzincan.

Keywords: Maxillofacial Injuries, Therapy, Epidemiology

Erzincan' da Maksillofasiyal Fraktür ve Tedavi Paternleri: Retrospektif Çalışma

Öz

Maksillofasiyal kırıkların epidemiyolojisi ülkeden ülkeye değişir. Nüfus yoğunluğu, yaşam tarzı, kültürel arka plan ve sosyoekonomik durum maksillofasiyal yaralanmaların prevalansını etkileyebilir. Bu nedenle bu çalışmada, yatan hastalarda maksillofasiyal kırıkların epidemiyolojisi ve tedavi planlarını daha iyi politika oluşturma stratejileri için faydalı olacak şekilde değerlendirdik. Bu retrospektif çalışmada, hastaneye yatış ve maksillofasiyal yaralanma nedeniyle opere edilen 50 hastanın tıbbi kayıtları değerlendirildi. Yaş, cinsiyet, kırık tipleri, nedenleri, tedavi planları ve tedavi sonrası komplikasyonlar kaydedildi. Hastaların çoğu erkekti (% 78). Olguların çoğu 21-30 yaş aralığındaydı. Kırıklara çoğunlukla düşme (% 40) ve kazalar (% 38), özellikle de motosiklet kazaları neden olmuştur ve en sık tutulum yeri, mandibulanın parasemfiz bölgesidir. Tedavi planı olarak ORIF + IMF (% 63) tercih edildi. Çalışmamızın bulguları, maksillofasiyal kırıkların neden ve insidansının her ülkede farklı olduğu görüşünü desteklemektedir. Birçok gelişmiş ülkenin aksine, Erzincan'da düşme ve trafik kazaları maksillofasiyal kırıkların en yaygın nedenidir.

Anahtar Kelimeler: Maksillofasiyal Yaralanmalar, Tedavi, Epidemiyoloji

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1. Introduction

The maxillofacial region is an important part of the body that includes structures between the skull base and the hyoid bone. Maxillofacial trauma can be life-threatening, especially if it compromises the airway. Also, facial trauma can significantly relate to the deterioration of important functions such as vision, smell, chewing and deterioration. Permanent deformities may occur which can cause serious psychological adverse effects on patients. Moreover, these traumas are an important financial burden for individuals and societies[1,2].

The most common causes of facial soft and hard tissue injuries are occupational injuries, falls, motor vehicle accidents (MVA), sports injuries and assault. The epidemiology of maxillofacial trauma varies in different parts of the world and is influenced by population density, lifestyle, cultural background, and socioeconomic status. For example, in areas where there is greater participation in heavy-contact sports, such as rugby, the frequency of face-related sports injuries is higher [2]. Similarly, the incidence of violent trauma and traffic accidents is higher in regions with a low socioeconomic profile [3].

Trauma epidemiology has also changed over time due to life changes. For example, the incidence of deaths due to motor vehicle accidents has been reduced due to legal regulations on mandatory seat belts [4].

There are many studies in the literature investigating the epidemiology of facial injuries in different countries of the world [3,5-8]. However, in developing countries such as Turkey, there are limited data regarding the epidemiology and treatment of facial injuries.

The aim of this study is to provide a perspective on the retrospective analysis of a series of maxillofacial trauma cases admitted to our faculty. We believe that the epidemiology of the jaw bone fractures for Erzincan can be determined and may lead to the development of treatment plans and prevention policies.

2. Material and Methods

The study was planned as a retrospective observational study. Erzincan Binali Yıldırım University Ethics Committee approval was obtained from Clinical Research Ethics Committee with a number 33216249-604.01.02-E.22015 and written consent was obtained from patients. The study was conducted in accordance with the Helsinki Declaration Principles.

Medical records of 50 patients operated for maxillofacial injuries between January 2016 and March 2019 were evaluated. Patients who were discharged from the hospital, who were treated as outpatients, and who had only soft tissue injuries without fractures were not included in the study. Age, gender, fracture types, causes, treatment plans and post-treatment complications of all patients were recorded. The diagnosis of maxillofacial trauma was based on clinical and radiographic examination. The results were presented for categorical variables as numbers. The categorical variables were compared between groups using Chi-square or Mann-Whitney U test. The statistical level of significance for all tests was considered to be 0.05. Statistical

analysis was performed using the IBM SPSS ver. 22 packaged software (IBM Software, New York, United States).

3. Results and Discussion

Demographic data:

The study included 39 males and 11 female patients. The mean age of the males was 32.09 ± 19.55 years and the women were 32.4 ± 13.72 years. The most frequent age range of fracture due to trauma was between 21-30 years (14 patients). This was followed by 31-40 years (10 patients) (Table 1).

Table 1. Demographic variables of patients

Age		Gender		Total
		Woman	Man	
0-10	Count	0	4	4
	% within age	0,0%	100,0%	100,0%
	% within gender	0,0%	10,3%	8,0%
11-20	Count	2	5	7
	% within age	28,6%	71,4%	100,0%
	% within gender	18,2%	12,8%	14,0%
21-30	Count	3	11	14
	% within age	21,4%	78,6%	100,0%
	% within gender	27,3%	28,2%	28,0%
31-40	Count	4	6	10
	% within age	40,0%	60,0%	100,0%
	% within gender	36,4%	15,4%	20,0%
41-50	Count	0	4	4
	% within age	0,0%	100,0%	100,0%
	% within gender	0,0%	10,3%	8,0%
51-60	Count	2	7	9
	% within age	22,2%	77,8%	100,0%
	% within gender	18,2%	17,9%	18,0%
61-70	Count	0	1	1
	% within age	0,0%	100,0%	100,0%
	% within gender	0,0%	2,6%	2,0%
71-80	Count	0	1	1
	% within age	0,0%	100,0%	100,0%
	% within gender	0,0%	2,6%	2,0%
Total	Count	11	39	50
	% within age	22,0%	78,0%	100,0%
	% within gender	100,0%	100,0%	100,0%

Etiology

The most common etiology causing jaw fracture was falling (40% n=20). The second was traffic accidents. The percentage of patients who had road accidents was 20% (n=10). Assault injuries were followed with 16% (n=8). The percentage of people who had a motorcycle accident was 12% (n=6). Other injuries were observed as car crash 4.2% (n=3), animal attack 2.8% (n=2) and occupational injuries 1.4% (n=1). The causes of falls and road accidents were more dominant in female cases. (Table 2)

Table 2. Etiology of fractures

Gender		**Etiology**							**Total**
		Assault	Fall	Road Accident	Car Crash	Motorcycle Accident	Occupational Injuries	Animal Attack	
Woman	**Count**	**0**	**5**	**6**	**0**	**0**	**0**	**0**	**11**
	%within gender	0.0	45.5	54.5	0.0	0.0	0.0	0.0	100
	%of total	0.0	10.0	12.0	0.0	0.0	0.0	0.0	22
Man	**Count**	**8**	**15**	**4**	**3**	**6**	**1**	**2**	**39**
	%within gender	20.5	38.5	10.3	7.7	15.4	2.6	5.1	100
	%of total	16.0	30.0	8.0	6.0	12.0	2.0	4.0	22

Fracture Pattern

Regarding the patterns of 72 fractures, 5.6% (n=4) of fractures were subcondylar, 4.2% (n=3) were belong to ramus, 16,7% (n=12) of angulus, 15.3%(n=11) corpus, 4.2% (n=3) symphyseal, 23.6%(n=17) midface, 26.4%(n=19) parasymphyseal and 4.2%(n=3) belong to condyle. In our study, the type of fracture observed with the highest percentage was parasymphyseal fracture. When comparing fracture patterns between genders, there was found no statistical difference. (Figure 1)

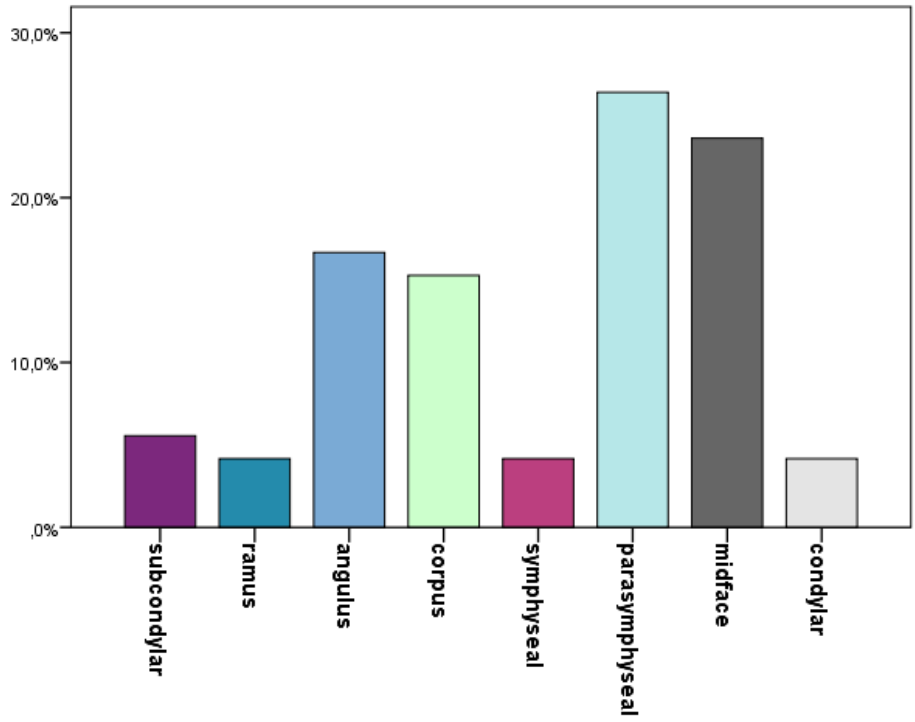

Figure 1. Fracture patterns

Treatment

25% (n=1) of the patients were treated with open reduction internal fixation (ORIF), 25% (n=1) with inte rmaxillary fixation (IMF), and 50% (n=2) with ORIF + IMF in subcondylar fracture. In ramus fractures, 33.3% (n=1) ORIF and 66.7% (n=2) combine technique was applied. 33.3% (n=4) IMF, 25% (n=3) ORIF and 41.7% (n=5) IMF+ORIF technique were applied in angulus fractures. Total 11 patients (100%) received IMF+ORIF technique in treatment of corpus fractures. 66.7% (n=2) patients treated with combine technique and 33.3% (n=1) patients treated close reduction and splinting in symphyseal fracture. Parasymphyseal fractures treated with ORIF in 52.6% (n=10) and combine 47.4% (n=9) patients. ORIF was applied 17.6% (n=3) of patients, combine was applied 58.8%(n=10), ear cartilage graft was applied 11.8% (n=2) and iliac graft was applied in 11.8% (n=2) in the treatment of midface fracture. 66.7 % (n=2) of condyle fractures were treated with IMF and one patient was received condylectomy. (Table 3)

Table 3. Treatment choice according to fracture patterns.

Pattern		Treatment							Total
		IMF	ORIF	IMF+ ORIF	Closed Reduction + Splinting	Condylectomy	Ear Cartilage Graft	Iliac Graft	
Subcondylar	Count	1	1	2	0	0	0	0	4
	%	14,3%	5,6%	4,9%	0,0%	0,0%	0,0%	0,0%	5,6%
Ramus	Count	0	1	2	0	0	0	0	3
	%	0,0%	5,6%	4,9%	0,0%	0,0%	0,0%	0,0%	4,2%
Angulus	Count	4	3	5	0	0	0	0	12
	%	57,1%	16,7%	12,2%	0,0%	0,0%	0,0%	0,0%	16,7%
Corpus	Count	0	0	11	0	0	0	0	11
	%	0,0%	0,0%	26,8%	0,0%	0,0%	0,0%	0,0%	15,3%
Symphyseal	Count	0	0	2	1	0	0	0	3
	%	0,0%	0,0%	4,9%	100,0%	0,0%	0,0%	0,0%	4,2%
Parasymphyseal	Count	0	10	9	0	0	0	0	19
	%	0,0%	55,6%	22,0%	0,0%	0,0%	0,0%	0,0%	26,4%
Midface	Count	0	3	10	0	0	2	2	17
	%	0,0%	16,7%	24,4%	0,0%	0,0%	100,0%	100,0%	23,6%
Condyle	Count	2	0	0	0	1	0	0	3
	%	28,6%	0,0%	0,0%	0,0%	100,0%	0,0%	0,0%	4,2%
Total	Count	7	18	41	1	1	2	2	72
	%	9,7%	25,0%	56,9%	1,4%	1,4%	2,8%	2,8%	100,0%

Complications

Hypoesthesia developed in two male patients after ORIF treatment in angulus fracture.

In this study, the etiology and treatment approaches of maxillofacial fractures in trauma patients admitted to our faculty in a certain period of time were evaluated. The most common causes of facial injuries were falls (40%) and all of traffic accidents (38%). The most common were motorcycle accidents. In the literature of jaw-face trauma, traffic accidents, assault, and falls are the leading causes of relative frequency depending on the socio-economic, cultural and environmental factors of the country. While traffic accidents have declined steadily in

developed countries, they continue to rise at a terrible rate in low- and middle-income countries in Africa and Asia [7].

In the EURMAT study [9]; the most common cause of injury was attacked (1309 patients), falls (1050 patients), sports accidents (385 patients), traffic accidents (375 patients), occupational accidents (117 cases) and other reasons (160 patients). Extremely low road traffic accidents and occupational accident percentages can be associated with recent strict road traffic and safety laws in most European countries. The application of safety norms such as mandatory seat belts, airbags, helmet wearing and speed limits for motorized bicycles, strict policies against alcohol and driving, as well as road traffic regulations appear to have caused a significant reduction in jaw trauma. Occupational accidents can also be reduced by more effective safety laws and regulations.

Similar to the findings of our study, in the studies of Obuekwe et al. [8], Kaura et al. [7], and Agarwal et al. [10], the most common age group of maxillofacial fractures was 21–30. The frequency between the ages of 21-30 may be due to increased participation in traveling to work and outdoor activities [11-13].

In this study, the male: female ratio was 4: 1. Other studies in India showed similar male dominance [3,7,11-13]. Again in the EURMAT study [9]; male: female ratio was 3.6: 1. This can be explained by the fact that men are more active in social activities and are therefore more susceptible to traffic accidents, interpersonal violence, work, and sports injuries. Other reasons for the increased rate of injury in this age group and gender may be due to lack of information or, in most cases, violation of traffic rules, as well as risk-taking behaviors [14]. The lower incidence of maxillofacial fractures in women may be due to less reporting of injuries due to gender-based neglect or domestic abuse, which is still prevalent in many rural areas.

The mandible fracture was the most common fracture in this study because it was the most prominent bone on the face. These findings are similar to our study in other countries, including Turkey [5,15]. The most common fracture was mandibular parasymphysis. Although there are conflicting data in the literature on the region [6,7,11,16], there are also studies supporting our findings [7,17].

The face consists of the vertical and horizontal buttresses where the bone is thicker to neutralize the forces applied to it. The reduction, stabilization of these key areas and providing intermaxillary dental occlusion is the basic principle of maxillofacial reconstruction [18]. Therefore, as in this study, ORIF + IMF (63%) is preferred as treatment. These findings are similar to the studies by Singh et al. [19],. ORIF remains the gold standard for the treatment of maxillofacial fractures [6].

Damage to the facial nerves, scarring, and occlusion disorders are limitations that can be observed with conventional open techniques. Prolonged maxillomandibular fixation and non-anatomical reduction of the fracture are associated with these complications [19]. Modern surgical techniques such as endoscope-assisted technology can be used to avoid at least some of these complications [20].

In such studies, there may be deficiencies in the initial assessment of patients or subsequent medical records. In this retrospective study, the results may be affected due to incomplete information. The details of alcohol use, driving style and helmet use that may affect the results in traffic accidents are not included in the study. Besides, the study population was obtained from a single trauma center and may not reflect experience in different centers.

4. Conclusion

This study provides important data to maintain plans for injury prevention. Unlike many developed countries, falls and traffic accidents are still the most common cause of maxillofacial fracture in our country. The largest population at risk are young men and motorcycle riders. Helmet use may provide a significant reduction in maxillofacial fracture rates. Preventive measures should be taken by raising awareness of safety guidelines and traffic rules. We believe that the epidemiological assessment of maxillofacial fractures will be valuable to health professionals involved in planning future prevention and treatment programs for government agencies.

Ethics in Publishing

The study was planned as a retrospective observational study. Erzincan Binali Yıldırım University Ethics Committee approval was obtained from Clinical Research Ethics Committee with a number 33216249-604.01.02-E.22015 and written consent was obtained from patients. The study was conducted in accordance with the Helsinki Declaration Principles. Preliminary data of this study was presented as an Oral Presentation at “Turkish Association of Oral and Maxillofacial Surgery 26th International Scientific Congress 28th April–02nd May 2019.

Author Contributions

Idea/concept: Yakup GÜLNAHAR, İlke KÜPELİ, Data collectıon and/or processıng: Tolga AKSAN, Fatih TAŞKESEN, Analysıs and/or comment: Fatih TAŞKESEN, İlke KÜPELİ, Article writing: Tolga AKSAN, İlke KÜPELİ, Materials: Yakup GÜLNAHAR, Tolga AKSAN, Fatih TAŞKESEN, M. Mustafa AYDINOL, Audit/consulting: Yakup GÜLNAHAR, İlke KÜPELİ

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