Trauma Mon. 2017 November; 22(6):e58204. doi: 10.5812/traumamon.58204.

Published online 2017 July 24. **Research Article**

Assessment of Maxillofacial Trauma in the Emergency Department

Hojat Sheikhmotahar Vahedi,[1] Elnaz Vahidi,[1] Roya Basirian,[1] and Morteza Saeedi[1,2,*]

[1]Emergency Medicine Research Center, Emergency Medicine Department, Shariati Hospital ,Tehran University of Medical Sciences, Tehran, Iran
[2]Prehospital Emergency Research Center, Shariati Hospital, Tehran University of Medical Sciences, Tehran, Iran

[*]*Corresponding author*: Morteza Saeedi, Prehospital Emergency Research Center, Shariati Hospital, Tehran University of Medical Sciences, Tehran, Iran. Tel: +98-2184902719, Fax: +98-2188633039, E-mail: m_saeedi@tums.ac.ir

Received 2016 September 12; **Revised** 2017 March 03; **Accepted** 2017 May 21.

Abstract

Background: Maxillofacial trauma is one of the most common traumas with many complications and disabilities. Recognition of the trauma-related mechanisms is the key to early diagnosis and treatment.
Objectives: The current study was aimed at assessing maxillofacial trauma in emergency department.
Methods: The current cross sectional study was performed on 406 patients with maxillofacial trauma recruited from the emergency department (ED) of Shariati and Imam Khomeini hospitals from January 2014 to March 2015. Demographic data, etiology and mechanism of trauma as well as the type of maxillofacial fractures were recorded by the emergency medicine (EM) residents. Maxillofacial fractures, diagnosed by the computed tomography (CT) scan, were reported by the ED attending radiologist.
Results: The current study evaluated 406 patients, 106 females (26.1%) and 300 males (73.9%), with maxillofacial trauma and the mean age of 29.95 $\pm$ 15.82 years. The leading causes of maxillofacial trauma were the road traffic accidents (RTA) (50.2%), followed by falling (20.0%) and assault (17.3%). Maxillofacial fractures were detected in 137 patients (33.7%) and mandibular fractures were the most common site (71.5%). The mean age of males was significantly higher than that of females. Some causes of maxillofacial trauma, such as assault and occupational accidents, were significantly common in males than females. The risk of maxillofacial fractures was significantly higher in the traumas caused by pedestrian-car accidents followed by falling and assault.
Conclusions: In the current study population, the patterns of underlying causes of maxillofacial traumas were similar to other types of traumas mainly affected by socioeconomic status of the society. RTA was the main cause of maxillofacial trauma and males were affected more than females. Most of the current study patients were in the 3rd and 4th decades of life. Mandible was the site mostly involved in MF fractures.

Keywords: Maxillofacial Trauma, Maxillofacial Fracture, Emergency Medicine

1. Background

The health and disease pattern in Iran recently showed the transition from the dominance of communicable diseases to that of non-communicable diseases and road traffic accidents (RTAs). In Iran, the highest disability-adjusted life year (DALY) rate is related to trauma and physical injuries. In addition, in Iran trauma is the 2nd leading cause of death after cardiovascular diseases (1). Different studies in Iran showed that about one-fourth of the patients with trauma had head and neck injuries and this comprised 33% to 46% of all such patients (2-4). Head and neck injuries have the highest mortality and morbidity rate among all patients with trauma (2, 3, 5).

Maxillofacial (MF) trauma refers to any injury to the face or jaw caused by external physical force (any trauma above clavicles). MF injuries are a serious clinical problem because important organs such as the digestive, respiratory, vascular, and central nervous systems (CNS) are located in this area. MF injuries can cause important cosmetic or functional complications such as visual, olfactory, and auditory sensory systems involvement or the problems in mastication and speaking (6-12). These injuries impose a great financial and psychological burden to the society. The 1st step to decrease the burden is injury prevention, followed by the early and proper treatment. Epidemiologic data collection and clinical pattern identification lead to plan a proper educational program for such injuries and could help to find out the best diagnostic and therapeutic approaches. The plan should lead to less complications and more desirable outcomes.

The patterns of MF trauma risk factors are similar to those of other traumatic injuries. These contributing factors differ significantly based on the demographic characteristics in rural and urban populations. The identification of such differences and risk factors is of great importance (13).

2. Objectives

The current study aimed at recognizing this pattern in 2 tertiary referral centers in Iran from January 2014 to

March 2015. These epidemiologic data and recognition of common etiologies can help the system to compile preventive strategies and decrease undesirable outcomes.

3. Methods

3.1. Study Design and Setting

The current cross sectional, prospective study reviewed 406 patients with sustained MF trauma referred to the emergency departments (ED) of Shariati and Imam Khomeini hospitals (2 tertiary referral centers of Tehran, Iran) from January 2014 to March 2015. The samples were collected consecutively.

3.2. Participants

Eligible patients had complaint of MF trauma (trauma above clavicles) within 24 hours of admission. All patients in different age ranges who met the inclusion criteria were enrolled in the current study. All patients signed the consent letter before enrollment. Patients unwilling to cooperate with the study or sign the consent forms, those with altered mental status, pregnant patients, and the ones with language barriers were excluded. The consecutive sampling method was used to select participants. All patients were diagnosed and examined by the emergency medicine (EM) residents, and then, specific imaging experiments were ordered. MF fractures were finally diagnosed by the computed tomography (CT) scan findings reported by ED attending radiologist.

3.3. Variables and Data Sources

Patients' number, age, gender, site of injury, type of injury, and the mechanism of MF fracture were recorded by the EM residents. The variables were found out simply by interviewing the patients or examining them. Final diagnosis was confirmed by the EM specialists. The current study mainly aimed at discovering the relationship between the type and mechanism of MF traumas.

3.4. Statistical Analysis and Sample Size Calculation

The current descriptive, prospective, cross sectional study enrolled all patients with MF trauma admitted to the ED from January 2014 to March 2015. All collected data were analyzed with SPSS version 22. Descriptive analyses, frequency, range, and percentage were performed for all study variables and distribution (percentage), demographic data such as gender (percentage), age (range and percentage), and trauma mechanism (percentage). To evaluate the normal distribution of quantitative data, the Kolmogorov-Smirnov (KS) test was conducted. The independent t test was used to compare the quantitative data with normal distribution, and nonparametric tests if the distribution was not normal. Quantitative data were reported as mean $\pm$ SD by 95% confidence interval (CI). Qualitative data were given as frequency and evaluated by the Chi-square test. The level of significance was 0.05.

3.5. Ethical Consideration

Ethical clearance was obtained from the research ethics committee of Tehran University of Medical Sciences. All patients' information and medical records were kept confidential. Only the total information was reported or published.

4. Results

The current study enrolled 406 patients with MF trauma. All the patients were eligible to the study. There were no missing data. Data of all patients were finally analyzed.

4.1. Demographic Pattern of the Patients

A total of 406 patients were presented to the ED of Shariati and Imam Khomeini hospitals from 2014 to 2015. In the current study, MF trauma involved males more than females: 300 (73.9%) males vs. 106 (26.1%) females. The total mean age was 29.95 $\pm$ 15.82 years; the mean age of males and females were 26.70 $\pm$ 16.44 and 31.11 $\pm$ 15.45 years respectively, ranged from 5 to 89. Half (50%) of the study patients were male within the age range of 19 to 39 years. The Kruskal-Wallis (KS) analysis showed normal distribution for age among the study population (P = 0.052). Independent samples t test showed a significant difference between the mean age of males and females (P = 0.017).

Among the 406 patients with MF trauma, 137 had MF fractures including 104 (75.9%) males and 33 (24.1%) females. The Chi-square test showed no significant difference between patients' gender and MF fracture (P = 0.050). Data are shown in Table 1.

Patients without MF fracture had soft tissue injuries related to MF trauma.

4.2. Trauma mechanism in patients

The most common mechanisms of MF trauma were RTA, accounting for 50.2% (n = 204) of the sample, followed by falls 20% (n = 81) and assaults 17.3% (n = 70). Most MF fractures were caused by auto-pedestrian accidents (46.8%). The Chi-square analytical test showed that the observed difference between trauma mechanism and MF fracture was significant (P = 0.009). Data are shown in Table 2.

Table 1. Demographic Pattern of the Studied Population

Age Range (Year)	Female, N (%)			Male, N (%)			Total
	With MF Fracture	Without MF Fracture	Total	With MF Fracture	Without MF Fracture	Total	
0 - 9	6 (5.7)	14 (13.2)	20 (18.9)	5 (1.7)	18 (6)	23 (7.7)	43 (10.6)
10 - 19	5 (4.7)	15 (14.2)	20 (18.9)	13 (4.3)	29 (9.7)	42 (14)	62 (15.3)
20 - 29	4 (3.8)	11 (10.4)	15 (14.2)	39 (13)	43 (14.3)	82 (27.3)	97 (23.9)
30 - 39	12 (11.3)	17 (16)	29 (27.3)	26 (8.7)	51 (17)	77 (25.7)	106 (26.1)
40 - 49	5 (4.7)	10 (9.4)	15 (14.2)	14 (4.7)	32 (10.7)	46 (15.4)	61 (15)
50 - 59	1 (0.9)	3 (2.8)	4 (3.7)	3 (1)	11 (3.7)	14 (4.7)	18 (4.4)
60 - 69	-	2 (1.9)	2 (1.9)	-	7 (2.3)	7 (2.3)	9 (2.2)
70 - 79	-	1 (0.9)	1 (0.9)	4 (1.3)	3 (1)	7 (2.3)	8 (2)
80 - 89	-	-	-	-	2 (0.7)	2 (0.7)	2 (0.5)
Total	33 (31.1)	73 (68.9)	106 (100)	104 (34.7)	196 (65.3)	300 (100)	406 (100)

Table 2. The Relationship Between Trauma Mechanism and MF Fractures in the Studied Population

Trauma Mechanism	With Fracture, N (%)	Without Fracture, (%)	Fracture, %	Total, N (%)
Road traffic accident	65 (16)	139 (34.2)	31.8	204 (50.2)
Pedestrian car/motor accident	22 (5.4)	25 (6.2)	46.8	47 (11.6)
Motor/car accident	30 (7.4)	80 (19.7)	22.7	110 (27.1)
Car accident	13 (3.2)	34 (8.4)	27.6	47 (11.6)
Falling	32 (7.9)	49 (12.1)	39.5	81 (20)
Assault	30 (7.4)	40 (9.9)	42.8	70 (17.3)
Occupational accident	6 (1.5)	26 (6.4)	7.1	32 (7.9)
Penetrating accident	-	9 (2.2)	-	9 (2.2)
Others	4 (1.9)	6 (1.4)	40	10 (2.4)
Total	137 (33.7)	269 (66.3)	33.7	406 (100)

MF trauma caused by occupational accidents and assaults was significantly more prevalent in males than females (P = 0.003). Data are shown in Table 3.

Different trauma mechanisms in all age ranges are shown in Table 4 and Figure 1.

4.3. Anatomical Site of MF Fractures in Patients

In the current study, 137 patients (33.7%) had MF fractures including 98 mandibular fractures (71.5%), 31 midface fractures (22.6%), and 8 mixed fractures (5.8%). The frequency of various sites of fracture had no significant difference between the genders or different age ranges (P = 0.557 and 0.298, respectively). The Chi-Square test showed no statistically significant difference between trauma mechanism and the anatomical sites of fracture (P = 0.588). Data are shown in Table 5.

4.4. Types of MF Fracture in Patients

Zygoma had the most frequency rate among all midface fractures. Single simple mandibular body fracture had the least frequency rate among all lower face fractures. Table 6 shows the distribution of different types of MF fractures in the current study population.

4.5. The Presence of Concomitant Fractures in Other Parts of the Body

Among 406 evaluated patients, 27 (6.6%) had fractures in other sites of the body and 379 (93.3%) did not. Based on the Chi-Square test, the association was statistically significant (P = 0.039). Data are shown in Table 7.

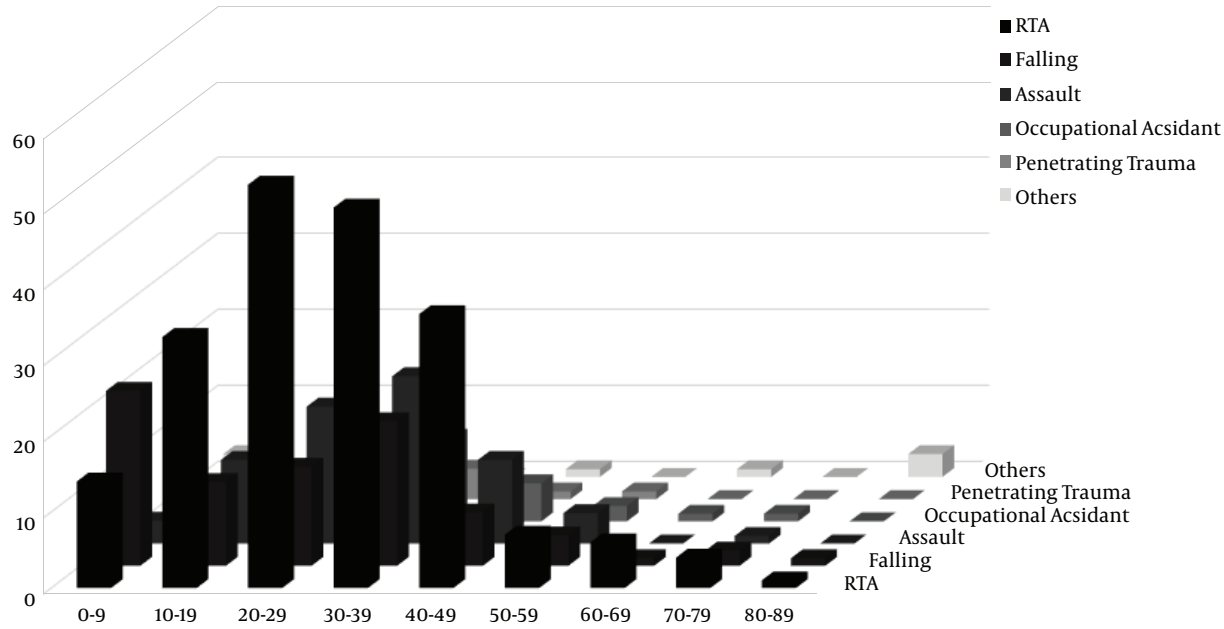

Figure 1. Trauma Mechanism in Different Age Ranges of the Studied Population

Table 3. Trauma Mechanism Based on the Gender in the Studied Population

Trauma Mechanism	Male, N (%)	Female, N (%)	Total, N (%)
Road traffic accident	148 (36.4)	56 (13.8)	204 (50.2)
Pedestrian car/motor accident	30 (7.4)	17 (4.2)	47 (11.6)
Motor/car accident	88 (21.7)	22 (5.4)	110 (27.1)
Car accident	30 (7.4)	17 (4.2)	47 (11.6)
Falling	51 (12.6)	30 (7.4)	81 (20)
Assault	58 (14.3)	12 (3)	70 (17.3)
Occupational accident	29 (7.2)	3 (0.7)	32 (7.9)
Penetrating accident	9 (2.2)	-	9 (2.2)
Others	5 (1.2)	5 (1.2)	10 (2.4)
Total	300 (73.9)	106 (26.1)	406 (100)

5. Discussion

There are many studies evaluating the causes and patterns of MF trauma in different populations. Van Den Bergh et al., found RTA and violence as the most prevalent mechanisms of MF trauma (14).

Engin D Arslan et al., evaluated the etiologies and patterns of MF trauma in a 3- year retrospective study. They found that etiologic factors, demographic properties, and fracture patterns yielded various results due to social, cultural, and governmental differences, and MF trauma was more prevalent in young males as a result of interpersonal violence (15).

Al-Khateeb and Abdullah evaluated patients with MF fractures and found RTA, violence, and falls as the most common etiologic factors involved in MF trauma mechanism. In their study, males were affected more than females and mandible fractures were the most common site (16).

Erol B et al., in a retrospective study of MF fractures found that such fractures were most frequent in males within the age range of 0 to 10 years. They also mentioned that RTA was the most etiologic factor (17).

Abdullah Pohchi et al., reported that RTA was the main cause of MF fractures and zygomatic bone was the most frequent site of fracture in Saints Malaysia hospital (18).

Ansari et al., compared the pattern and distribution of MF fractures from 1987 to 2001 in Hamadan, Iran. They reported RTA as the most common mechanism of trauma and lower jaw fractures as the most common site of injury (19).

Arabion et al., published a retrospective review of patients with MF trauma in Shiraz, Iran. In their study, males were affected more than females and they were mostly in their 3rd decade of life. Complex mandibular fractures were the most common reported fractures (20). Mesgarzadeh et al., showed the same result in West Azerbaijan province, Iran (21).

Table 4. Trauma Mechanism in Different Age Ranges in the Studied Population

Trauma Mechanism	Age Range (year)								
	0 - 9 (N)	10 - 19 (N)	20 - 29 (N)	30 - 39 (N)	40 - 49 (N)	50 - 59 (N)	60 - 69 (N)	> 70 (N)	Total, N (%)
RTA	14	33	53	50	36	7	6	5	204 (50.2)
Falling	23	11	13	19	7	4	1	3	81 (20)
Assault	3	11	18	22	11	4	-	1	70 (17.3)
Occupational accident	-	3	9	11	5	2	1	1	32 (7.9)
Penetrating trauma	-	1	2	4	1	1	-	-	9 (2.2)
Others	3	3	2	-	1	-	1	-	10 (2.4)
Total, n (%)	43 (10.6)	62 (15.3)	97 (23.9)	106 (26.1)	61 (15)	18 (4.4)	9 (2.2)	10 (2.5)	406 (100)

Table 5. Site of MF Fracture in the Studied Population

Site of Fracture	Number of Patients (%)		
	Female, N (%)	Male, N (%)	Total, N (%)
Mandible	24 (17.5)	74 (54)	98 (71.5)
Midface	6 (4.4)	25 (18.2)	31 (22.6)
Combined	3 (2.2)	5 (3.6)	8 (5.8)
Total	33 (24.1)	104 (75.9)	137 (100)

In the current study, among 406 patients with MF trauma, 137 had MF fracture and the male to female ratio was 3:1. This ratio was different from those of the previous similar studies conducted in Iran (19-21). This observation could be the result of different life styles, females' occupation, home environment, and intimate partner relationships. Age distribution in the current study showed that patients with MF trauma were mostly in the 3rd and 4th decades of life in contrast to previous similar studies in Iran, which reported that the patients were mostly in the 2nd or 3rd decades of life. This observation could be explained by the most prevalent mechanism of trauma in different studies. RTA was the cause of 50% of MF fractures in the current study, but it included 60% to 70% of all cases in other researches (19-21), and in the current study, assault and violence were more dominant. The current study found that occupational accidents and assault were significantly more prevalent in males than females. The most common site of fracture was mandible in the current study population. Most of the patients had no concomitant fracture in other sites of the body.

It seems that etiology, type, and site of fractures in MF trauma are related to a variety of factors such as geographical distribution and socioeconomic status of the studied population. Similar to most previous studies, RTA, falls, and violence were reported as the most frequent mechanism of MF fractures (22-25).

5.1. Limitations of the Study

One of the limitations of the current study was that the studied population was confined to patients referred to only 2 referral centers in Tehran, Iran. Due to possible differences in the etiologic pattern of trauma in different regions of Tehran and Iran, the observed results cannot be generalized to all other parts of the country. The current descriptive study can give only a superficial look to demographic features of maxillofacial trauma prevalence in Iran. The small sample size was another limitation of the current research. Further investigations with larger sample sizes of farthest parts of the country should be performed. The current study dataset was hospital-based and did not include patients with very severe injuries dying at the scene of trauma.

5.2. Conclusion

Underlying causes of maxillofacial trauma are similar to other types of trauma, and are affected by the socioeconomic status of the studied population.

Prevention of maxillofacial trauma could have a great impact on the burden of this type of trauma. In the current study, RTA was the main cause of maxillofacial trauma and males were affected more than females. Most of the current study patients were in the 3rd and 4th decades of life. The major site of fracture was mandible; this might be due to its structural prominence.

In Tehran, motor vehicle accident (MVA) was the major cause of the MF fractures. Many preventive measures are

Table 6. Types of MF Fracture in the Studied Population

Region	Anatomic Site	Number of Patients, (%)
Midface		
	Isolated Fracture	
	Zygomatic fracture	21 (14.48)
	Orbital fracture	1 (0.68)
	Combined Fracture	
	Alveolar and Zygoma	1 (0.68)
	Orbit and Zygoma	4 (2.73)
	Lefort I	3 (2.06)
	Lefort II	1 (0.68)
	Lefort III	0
Lower face		
	Isolated Mandibular Fracture	
	Condyle	13 (9.65)
	Ramus	5 (2.75)
	Angle	11 (7.59)
	Body	12 (8.27)
	Para-Symphysis	3 (2.06)
	Symphysis	3 (2.06)
	Multiple Mandibular Fracture	
	Symphysis and parasymphysis	3 (2.06)
	Condyle and Parasymphysis	12 (8.27)
	Symphysis and body	5 (2.75)
	Angle and parasymphysis	12 (8.27)
	Condyle and angle	5 (3.44)
	Angle and body	5 (3.44)
	Para-symphysis and body	1 (0.68)
	Condyle and symphysis	2 (1.37)
	Parasymphysis and ramus	1 (0.68)
	Angle and ramus	2 (1.37)
	Symphysis, parasymphysis, and condyle	1 (0.68)
	Condyle, parasymphysis, and body	1 (0.68)
	Angle, parasymphysis, and body	1 (0.68)
Mixed		
	Lefort III and mandible	2 (1.37)
	Maxilla and ramus	3 (2.06)
	Maxilla and body	3 (2.06)
Total		137 (100)

Table 7. Concomitant Fractures in Patients

Concomitant Fracture	Maxillofacial Fracture		
	Present, N (%)	Absent, N (%)	Total, N (%)
Present	14 (10.2)	13 (4.8)	27 (6.6)
Absent	123 (89.8)	256 (95.2)	379 (93.3)
Total	137 (100)	269 (100)	406 (100)

taken, but the MVA are not on the decline. Therefore, more preventive measures and law reinforcement on the traffic regulations are crucial (1).

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