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Evaluation of Oral and Maxillofacial Trauma in Tehran from 2008 to 2016

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Abstract

Background: The management of maxillofacial injuries is one of the most common challenges in the healthcare field as surgeons, who treat these patients have additional responsibilities in terms of esthetic reconstruction as well as restoration of the patient's appearance and function.
Objectives: The aim of the present study was to evaluate the epidemiology and etiology of trauma at Buali Hospital of Tehran during 2008 to 2016.
Methods: In this retrospective study, the files of all the trauma patients (n = 293) that had referred to Buali Hospital were investigated, and demographic data and etiologic factors were extracted. Radiographs were analyzed with regards to fracture patterns. The results were statistically analyzed using the SPSS 22 software.
Results: The mean age was 29.18 $\pm$ 14.74 years in males and 34.48 $\pm$ 19.81 years in females. Fractures were more frequent at ages between 21 and 30 years (39.9%) and less common among 71- to 84-year-olds (2.4%). Most patients were males (78.8%). Of all 474 fractures in 293 patients, zygomatic fractures were the most common fractures (18.6%), while Lefort III in the maxilla was the least common type (1.3%). The main cause of fracture was motor vehicle accidents (51.5%), whereas workplace injuries were uncommon (11.4%).
Conclusions: According to the results, fractures often occur in males in the third decade of life due to their roles in the community. In the current study, similar to other studies carried out in developing countries, the main cause of fractures was motor vehicle accidents. Most of the patients were treated by open reduction. The most frequent side effect was sensory disorders.

Keywords: Maxillofacial Injuries, Epidemiology, Etiology

1. Background

The management of maxillofacial injuries is one of the most common problems in the healthcare field (1). Trauma is one of the major causes of death in modern societies, and the craniofacial region is directly exposed to traumatic injuries. The management and treatment of maxillofacial trauma is very challenging, and surgeons, who treat these patients have additional responsibilities in terms of esthetic reconstruction and restoring the patient's appearance in addition to restoring the function (2).

About one-third of the patients injured in accidents sustain a trauma to the maxillofacial region (3). To overcome the complexity of maxillofacial trauma and to lower the costs of the management of these patients, especially in developing countries, it is needed to evaluate the etiology of these injuries. Epidemiological studies on these fractures and their causes allow for the development and implementation of new preventive and therapeutic methods (4). Despite a high rate of morbidity and mortality resulting from maxillofacial fractures in Iran, few studies have been conducted on this topic in some areas of the country, yet since Iran is a vast country with diverse ethnicities, cultures, and environmental conditions, the results of an epidemiological study in certain areas cannot be generalized to all geographic regions of the country.

Due to the rapid development of societies, the number of accidents and traumatic injuries has increased (5-14); the related information and data recorded in a specific time period can be useful for prospective planning (15). Considering inadequacies in previous studies, including incomplete parameters and ignoring damages to some

parts of the maxillofacial region such as the nasal bone (6, 7, 16, 17) and since most of the patients referring to Buali Hospital reside in the eastern region of Tehran, there was no comprehensive information about the epidemiology and etiology of maxillofacial injuries.

2. Objectives

The aim of the present study was to evaluate the epidemiology and etiology of trauma at Buali Hospital in Tehran during 2008 to 2016.

3. Methods

In this retrospective study, the files of all the traumatized patients (n = 293) referring to Buali Hospital were investigated. Demographic data and etiologic factors were extracted, and radiographs were analyzed with regards to fracture patterns.

The distribution of the fractures showed that all the patients had at least one fracture in the maxillofacial region (Table 1). In the 293 evaluated patients, 474 fractures had concurrent fracture patterns.

Table 1. Distribution of the Main Fracture Patterns[a]

Fracture Site	Isolated	Combination
Maxilla	5 (1.7)	27 (9.3)
Mandible	110 (37.5)	41 (14.0)
Midface	43 (14.7)	67 (22.8)
Total	158 (54.0)	135 (46.0)

[a]Values are expressed as No. (%).

4. Results

Among the 293 patients, the mean age of males was 29.18 ± 14.74 years, and the mean age of females was 34.48 ± 19.81 years. The age of the patients ranged from 1 to 84 years old. Fractures were more frequent at the ages between 21 and 30 years (39.9%) and less frequent at the ages from 71 to 84 years (2.4%). Most of the patients were males (78.8%) with a male to female ratio of 3.72. A significant difference was observed between males and females in terms of the frequency of fractures ($P < 0.005$).

Of all 474 fractures in 293 patients, the zygomatic region was the most common site of fracture (18.6%), whereas the least common fracture pattern was Lefort III in the maxilla detected in six patients (1.3%; Table 2). The main cause of fracture was motor vehicle accidents (160 patients, 51.5%), followed by assault (54 patients, 18.4%), falls (47 patients, 16%), sports injuries (11 patients, 3.7%), and other accidents (21 patients, 7.1%). The least common cause was workplace injuries (1.4%). Of the 293 patients, the fracture patterns in 191 patients (65.2%) was unilateral.

Most of the patients (80.8%) were treated by open reduction and rigid internal fixation, and the others (19.2%) were treated by closed reduction.

Table 2. Prevalence of Fractures at Different Sites[a]

Fracture Site	Prevalence
Lefort I	14 (2.9)
Lefort II	11 (2.3)
Lefort III	6 (1.3)
Symphysis	41 (8.6)
Parasymphysis	71 (15.0)
Mandibular ramus	18 (3.8)
Mandibular condyle	70 (14.8)
Mandibular body	72 (15.2)
Zygoma	88 (18.6)
Nasal bone	48 (10.1)
Other parts	35 (7.4)

[a]Values are expressed as No. (%).

The most frequent radiographic modalities used included plain radiography (64%), computed tomography (CT) in combination with plain radiography (27%), CT only (7%), and plain radiography in combination with cone-beam computed tomography (CBCT; 2%).

The most common side effect of treatments was sensory disorders (32.3%), followed by limited mouth opening (23.3%), malocclusion (18.2%), esthetic deformation (15.9%), vision impairment (9.04%), and hearing impairment (1.05%).

5. Discussion

In the present study, of 293 patients with maxillofacial injuries, 231 patients (78.8%) were males and 62 patients (21.2%) were females. A statistically significant difference was detected between males and females in terms of the frequency of fractures ($P < 0.05$). This result is consistent with the findings of all the studies that have been conducted so far, although the male to female ratio was different. In the current study, the male to female ratio was 3.72. According to Al Ahmed et al. (5), the overall male to female ratio ranges from 3:1 to 5.4:1. In a study by Rezaei et al. (2), the male to female ratio was 5:1, while in a study by Hogg et al. (18), this ratio was 3:1. Motamedi et al. (15) reported

a male to female ratio of 5.32, while Al-Dajani et al. (1) reported it to be 6.1. This ratio differs from one country to another and from one city to another, which may be related to differences in the social, cultural, and economic structures of different communities. This ratio also varies on a yearly basis. In general, maxillofacial fractures are more common in males, which seems logical because of the social nature of communities and given that, particularly in developing countries, most males are the head of the household, more engaged in outdoor activities, and have difficult jobs, thus they are at greater risk of motor vehicle accidents, assault, and occupational accidents (19-25).

The review of the records of the studied patients indicated that the mean age of males was 14.74 ± 29.18 years, and the mean age of females was 19.81 ± 34.48 years, ranging from 1 to 84 years. The highest incidence of fracture was detected in the age range of 21 to 30 years (39.9%), while the least frequency was observed in the age range of 71 to 84 years (2.4%). However, in a study by Cabalag et al. (11), the highest incidence of fractures was reported in the age range of 15 to 24 years (55.2% of the patients), and in a study by Pombo et al. (6), the highest incidence of fractures was in the age range of 16 to 30 years in males and 31 to 45 years in females. Also, Al-Dajani et al. (1) reported the highest incidence of fractures in the age range of 20 to 44 years (26.33%). The high prevalence of fractures in the third decade of life may be due to the fact that people in this period of life participate in sports and difficult jobs and drive high-speed vehicles more than other age groups. In general, the greater involvement of this age group can impose further damage and cost on the community.

The review of the distribution of the causes of fractures showed that the most common etiologic factor was motor vehicle accidents (151 patients, 51.5%) with an average age of 14.51 ± 27.95 years, and the second common cause was assault (54 patients, 18.4%) with an average age of 11.45 ± 29.30 years. The least frequent cause was workplace injuries (nine patients, 3%) with a mean age of 10.86 ± 30.33 years. In studies by Mohajerani and Ebrahimzadeh (4), Nosrati et al. (16), Rezaei et al. (21), and Pombo et al. (6), as well as the present study, motor vehicle accidents were the most common causes of fractures. However, in the current study, other common causes included falls and assault.

The results of the current study are inconsistent with the results achieved in developed countries reporting that the most frequent etiologic factor of injuries is assault. Etiologic differences can be attributed to economic and social factors, to the degree of the development of the national infrastructure (especially roads), and to the adoption and implementation of traffic rules and habits regarding alcohol consumption and other violent activities. In general, the main cause of maxillofacial fractures in developed countries is assault, while in developing countries, such as Iran, road traffic accidents are the main causes of these fractures.

The evaluation of the etiologic factors of traumatic dental injuries in the present study showed that the most common injuries were dentoalveolar fractures (153 cases, 61.4%). In a study by Gassner et al. (10), the most common dental injury was subluxation (2988 cases, 47.9%), followed by crown fractures (2356 cases, 37.8%), while the least common injury was intrusion (154 cases, 2.5%), which is inconsistent with the current results. The reason for different results is that in developed countries, the most common cause of fractures is assault and violence, leading to injuries, such as crown fractures and subluxation, yet in developing countries, such as Iran, the most common cause of injuries is motor vehicle accidents, which can cause dentoalveolar fractures.

In the current study, the most common types and sites of fractures were as follows: simple fractures of the mandible (110 cases, 37.5%), compound fractures of the midface with mandibular or maxillary involvement (67 cases, 22.8%), single fractures of the midface (43 cases, 14.7%), compound fractures of the mandible and maxilla (41 cases, 14%), compound fractures of the maxilla and the midface (26 cases, 9.3%), and single fractures of the maxilla (five cases, 1.7%).

The review of 474 fractures in 293 patients in the present study indicated that the most common type of involvement of the maxilla was Lefort I (14 cases, 2.9%), followed by Lefort II (11 cases, 2.3%), and Lefort III (6 cases, 1.3%). In the mandible, the most common sites of involvement were the body (72 cases, 15.2%), parasymphysis (71 cases, 15%), and the condyle (70 cases, 14.8%). In the midface, the most common sites of involvement were the zygomatic region (88 cases, 18.6%) and the nasal bone (48 cases, 10.1%).

In the study by Al Ahmed et al. (5), the mandible was the most common site of involvement, whereas the nasal bone was the least involved area. The incidence of fractures in the condyle, angle, and body of the mandible was 25.3%, 23.3%, and 20%, respectively. Lefort fractures in the maxilla occurred in one patient (29.4%) (5).

The differences in the fracture patterns reflect the mechanism of injury and the differences in anatomical locations. Of course variables, such as age, gender, and cultural characteristics influence the correlation between etiology and type of trauma.

The higher incidence of fractures in the mandible may be due to the fact that the mandible is the most prominent and the only movable bone in the maxillofacial region. Trauma to the mandibular region, especially to the mandibular body and then respectively to the mandibular condyle and the parasymphysis, can be considered as a de-

fense mechanism, preventing the transfer of energy of a severe blow to the superior sensitive regions, such as the brain and the skull. The anatomic location and position of the bone in the facial skeleton and muscle function as well as the severity of the impact, the speed, and track damage could be responsible for the type and location of the fracture.

In the current study, the fracture pattern was unilateral in 191 patients (65.2%). In the study by Mohajerani and Ebrahimzadeh (4), from 700 patients, 289 patients (41.28%) had unilateral fractures.

Of the 293 patients in the current study, 237 patients (80.8%) were treated by open reduction and rigid internal fixation, and 56 patients (19.2%) were treated by closed reduction. In the study by Mohajerani and Ebrahimzadeh (4), 281 patients (71.1%) were treated by open reduction, while 114 patients (28.9%) were treated by closed reduction similar to the current study. In a study by Motamedi (26), 65.9% of the patients were treated by open reduction, 25.4% were treated by closed reduction, and 8.7% were treated conservatively, which is similar to the current study.

In contrast, Carvalho et al. (14) treated 274 patients (77.2%) by closed reduction, while 81 patients (22.8%) were treated conservatively. Pacheco et al. (23) treated 1284 patients (58.6%) by open reduction, while 587 patients (26.7%) were treated conservatively, and 322 patients (14.7%) were treated by closed reduction.

Overall, most patients have been treated by open reduction and rigid internal fixation, and the rest, which are a small percentage, have been treated by closed reduction or conservatively. The reason for the selection of these treatments can be attributed to the nature of the fracture and to the fact that the treatment that leads to a faster recovery and restoration of normal function is more desirable.

In the current study, the side effects of the treatments were studied in 293 patients. Most complications were related to sensory disorders (32.3%), limited mouth opening (23.3%), malocclusion (18.2%), esthetic deformation (15.9%), and vision impairment (9.04%). The least common complication was hearing impairment (1.05%).

In the present study, most of the patients were treated by open reduction, and the main cause of fractures and maxillofacial injuries was road traffic accidents. Sensory disorders were the most common side effects since most fractures occurred in the mandible with a high density of sensory nerves.

In terms of the radiographic modalities used, the diagnoses were made in 186 patients (63.5%) according to plain radiography, in 80 patients (27.3%) according to plain radiography in combination with CT, in 21 patients (7.2%) according to CT, and in six patients (2%) according to plain radiography in combination with CBCT.

In a study by Yaghmaei et al. (3), plain radiography was used for the diagnoses in 97.6% of the patients, while 2.4% of the patients were diagnosed using CT. In a study by Mukherjee et al. (17), CT was used in 683 patients (96%) and plain radiography was used in 31 patients (4%).

In the current study, the most commonly used radiographic modality was plain radiography, which can be due to the nature of the traumatic injuries that eliminated the need for complex and detailed examinations of the craniofacial region; in most cases, the exact diagnosis and assessment of fractures were possible through plain radiographs.

According to the results of the present study, fractures often occur in males in the third decade of life due to their roles in the community. In the current study, similar to other studies carried out in developing countries, the main cause of fractures was motor vehicle accidents. Most of the patients were treated by open reduction. The most common side effect was sensory disorders.

Footnotes

Confloict of Interests: It is not declared by the authors.

Ethical Approval: The study protocol is consistent with the ethical guidelines of the 1975 Declaration of Helsinki as reflected in a prior approval by the institution's human research committee.

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