Epidemiological profile of maxillofacial traumatic injuries in southern Brazil

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Aim. **The objective of the present study was to describe the epidemiological characteristics of maxillofacial traumatic injuries in southern Brazil along a 5-year period.**
Methods. **The medical records of 173 patients with a total of 232 maxillofacial fractures were reviewed to collect information on patient age, sex, cause of fracture, anatomic location of fracture, duration of hospitalization, and treatment modality.**
Results. **Most fractures were caused by traffic accidents (31.2%), and patients belonging to age groups 21-30 and 31-40 years were most frequently affected. The male:female ratio was 6:1. The zygomatic-orbital complex was the anatomic region most frequently affected (47.8% of the 232 fractures), followed by the mandible (46.1%), maxilla (5.6%), and the naso-orbito-ethmoid complex (0.4%). Of the 173 patients, 55.5% were treated with open reduction with fixation, 23.1% with open reduction without fixation, and 20.2% with maxillomandibular fixation; in 1.2% of the cases, treatment modality was not informed. Most patients remained hospitalized for one to three days.**
Conclusion. **The findings of the present study revealed that, in southern Brazil, traffic accidents are the most frequent cause of severe maxillofacial injuries, affecting particularly the 21-40-year-old population. Prevention campaigns should be developed and implemented aimed at decreasing the number of trauma victims.**

KEY WORDS: Maxillofacial injuries - Epidemiology - Surgery, oral.

Throughout the years, traumatic injuries remain as one of the most important public health problems worldwide.[1, 2] The patterns of traumatic injuries affecting the face are constantly influenced by the geographic area where the traumatic events take place, by the social and economic conditions of the population affected, and by the period of investigation.[3]

Traffic accidents are a major cause of maxillofacial fractures.[4, 5] These fractures affect mostly youngsters [6, 7] and are responsible for a greater number of deaths when compared with cardiac diseases or cancer. In addition, the sequelae of maxillofacial fractures in traffic accident survivors include serious difficulties in their physical, psychological and social rehabilitation, not to mention the high treatment costs involved.[8, 9]

The main objectives of the treatment of maxillofacial fractures include accelerated bone repair, reestablishment of normal ocular, masticatory, respiratory, and phonatory functions, and acceptable levels of functional and esthetic dental health. During the phases of treatment and rehabilitation, two aspects acquire paramount importance: the minimization of adverse effects on the nutritional status of patients and the fulfillment of therapeutic objectives with the minimum possible patient discomfort.[10, 11]

In spite of the great impact of maxillofacial traumatic injuries on patient quality of life and on the healthcare system, little is known about the epidemiological characteristics of this problem in different

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TABLE I.—*Results of clinical trials with Nobori DES.*

Cause of fracture	Age group (years)					Total, N. (%)
	≤ 20	21-30	31-40	41-50	> 50	
Traffic accident	10	20	13	6	5	54 (31.2)
Workplace accidents	0	1	0	1	0	2 (1.2)
Physical aggression	8	11	12	9	3	43 (24.9)
Falls	3	4	3	8	2	20 (11.6)
Firearm injuries	1	4	0	2	0	7 (4)
Sports accidents	0	5	4	0	0	9 (5.2)
Other	3	1	0	0	0	4 (2.3)
Not informed	7	10	6	5	6	34 (16.6)
Total	32	56	38	31	16	173 (100)

countries. In Brazil, knowledge of the prevalence and epidemiological characteristics of maxillofacial fractures in different regions would be extremely useful to help healthcare professionals and resident students better manage this common problem in the clinical practice.

The objective of this retrospective, cross-sectional, epidemiological, descriptive, study was to describe the epidemiological characteristics of maxillofacial trauma victims treated at a reference center in the municipality of Porto Alegre, southern Brazil, during a five-year period, from 2005 to 2009.

Materials and methods

The present study reviewed the medical records of patients treated at the Oral and Maxillofacial Surgery and Traumatology Service at Hospital Cristo Redentor, Porto Alegre, Brazil, between 2005 and 2009. A total of 173 records of patients who had been hospitalized with a diagnosis of maxillofacial fractures were selected. Other oral and maxillofacial treatment procedures, such as orthognathic surgeries, retained tooth extraction, bone grafts, tooth extraction, and removal of cysts or tumors, were not taken into consideration.

The 173 records reviewed included a total of 232 maxillofacial fractures. The following data were collected from the charts: patient age, sex, cause of fracture, anatomic location of fracture, duration of hospitalization, and treatment modality adopted in each case.

Maxillofacial bone fractures were classified into the following categories: mandible, maxilla, zygomatic-orbital complex, and naso-orbito-ethmoid complex. The causes of fractures were categorized into traffic accidents, workplace accidents, physical aggression, falls, firearm injuries, sports accidents, and not informed. The following age groups were established: ≤20 years, 21-30, 31-40, 41-50, and >50 years. Finally, the following treatment modalities were considered: rigid internal fixation, maxillomandibular fixation, steel wire osteosynthesis, bonding with resin, open reduction without fixation, and fixation with miniplates and screws. Mean duration of hospitalization was also assessed.

Data collected from the patient charts were tabulated using Microsoft Excel®, version 10.0 (Microsoft Corporation, USA) and analyzed in the Statistical Package for the Social Sciences® (SPSS), version 11.5 (Microsoft Corporation, USA). Qualitative variables were presented as absolute and relative frequencies; quantitative variables were expressed as means and standard deviation. Statistical analysis was performed using the chi-square test complemented by analysis of adjusted residuals. Significance was set at 5%.

The present study protocol was approved by the Research Ethics Committee of Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, Brazil (protocol no. 0067/08).

Results

Table I shows the distribution of patients according to cause of fracture and age group.

TABLE II.—*Distribution of patients with facial fractures according to cause of fracture and age group.*

Location	Number of cases, N. (%)
Mandible	71 (41)
Maxilla	6 (3.5)
Zygomatic-orbital complex	81 (46.8)
Naso-orbito-ethmoid complex	1 (0.6)
Zygomatic-orbital complex + maxilla + mandible	3 (1.7)
Zygomatic-orbital complex + mandible	8 (4.6)
Zygomatic-orbital complex + maxilla	2 (1.2)
Maxilla + mandible	1 (0.6)
Total	173 (100)

TABLE III.—*Distribution of patients with mandible, maxilla, and zygomatic-orbital fractures according to treatment modality.*

Treatment modality	Patients with mandible fractures, N. (%)	Patients with maxilla fractures, N. (%)	Patients with zygomatic-orbital fractures, N. (%)
Rigid internal fixation	33 (39.7)	0 (0)	42 (44.6)
Maxillomandibular fixation	24 (28.9)	4 (33.3)	0 (0)
Steel wire osteosynthesis	13 (15.6)	1 (8.3)	5 (5.3)
Miniplates and screws + maxillomandibular fixation	11 (13.2)	0 (0)	0 (0)
Steel wire osteosynthesis + maxillomandibular fixation	1 (1.2)	1 (8.3)	0 (0)
Bonding with resin	1 (1.2)	0 (0)	0 (0)
Miniplates and screws	0 (0)	5 (41.6)	0 (0)
Miniplates and screws + maxillomandibular fixation	0 (0)	1 (8.3)	0 (0)
Rigid internal fixation + maxillomandibular fixation	0 (0)	0 (0)	1 (1)
Open reduction without fixation	0 (0)	0 (0)	45 (47.8)
Not informed	0 (0)	0 (0)	1 (1)
Total	83 (100)	12 (100)	94 (100)

TABLE IV.—*Hospitalization time of patients with facial fractures.*

Hospitalization time (days)	Patients, N. (%)
1-3	64 (37)
4-6	37 (21.7)
7-9	41 (23.7)
10-12	22 (12.7)
13-15	6 (3.5)
16-18	2 (1.2)
19-32	1 (0.6)
Total	173 (100)

TABLE V.—*Mean duration of hospitalization according to age group.*

Hospitalization time (days)	Patients, N. (%)
≤ 20	2.44±1.22
21-30	2.18±1.43
31-40	2.26±1.29
41-50	2.32±1.25
>50	2.5±1.15
Overall	2.3±1.29
19-32	1 (0.6)
Total	173 (100)

Men were more commonly hospitalized due to maxillofacial fractures when compared with women: 150 male patients (86.7%) *vs.* 23 females (13.3%) were affected, at a male:female ratio of 6:1.

The 232 fractures were distributed as follows: 111 (47.8%) affecting the zygomatic-orbital complex; 107 (46.1%) mandible fractures; 13 (5.6%) fractures affecting the maxilla; and one naso-orbito-ethmoid fracture (0.4%). Table II shows the number of patients in each fracture category.

Open reduction was the most frequent treatment modality employed. Of the 173 patients, 96 (55.5%) were treated with open reduction with fixation, 40 (23.1%) with open reduction without fixation, 35 (20.2%) with maxillomandibular fixation, and in two cases (1.2%) the treatment modality was not informed. Table III shows the treatment modalities adopted in patients with mandible, maxilla, and zygomatic-orbital fractures.

Most patients (37%) remained hospitalized from 1 to 3 days (Table IV). There was no statistically significant difference in mean duration of hospitalization (Table V).

Discussion

The present epidemiological study was carried out in city of Porto Alegre, capital of the Rio Grande do Sul state, southern Brazil, which has a population

of 1 436 123 inhabitants.[12] Our study reviewed the records of 173 patients treated by specialists in oral and maxillofacial surgery and traumatology at Hospital Cristo Redentor, a state reference center for the treatment of trauma, along a five-year period, from 2005 to 2009. The characteristics herein reported can contribute to improve the knowledge of healthcare professionals and resident students about the reality of maxillofacial fractures in southern Brazil. The findings may also assist in the creation of a database aimed at improving the care of these patients in terms of adequate medical and dental treatment approaches and the implementation of measures to prevent facial trauma.

Some studies have identified traffic accidents as the most common cause of maxillofacial fractures.[1-4, 8-10] Other authors, in turn, report physical aggression as the most frequent cause of fracture.[13] Our results show a high incidence of traumatic injuries caused by traffic accidents, especially car accidents in the 21-30-year age group. Nevertheless, the causes of traumatic injuries are known to vary according to geographic location and other variables; in the present study, all etiologic factors were directly related with patient age and sex, and were responsible for the different frequencies found for each facial bone affected.

Taken together, car, bicycle, motorcycle, and pedestrian run-over accidents (all categories included in the traffic accidents variable) accounted for 31.2% of our cases. In the retrospective analysis of 1 502 patients with facial fractures carried out by Iida *et al.*[2] traffic accidents were the cause of fracture in 52% of the patients; of these, 38.8% were unprotected road users, comprised of cyclists (13.5%), pedestrians (2.7%), and motorcycle riders (23.1%).

Our second most frequent cause of fracture was physical aggression (24.9%), which is in accordance with other studies that have also listed this variable as the second most common cause of facial fractures.[8, 10] Workplace accidents presented a frequency of 1.2%, compared to 3.1% found by Iida *et al.*[2] and 4.5% found by Brasileiro and Passeri;[14] the latter authors reported this to be the fifth most common cause of maxillofacial fracture. Falls, on the other hand, accounted for 11.6% of our cases, compared to 22.4% found by Simsek *et al.*[15]

With the significant increase lately observed in the use of motorcycles, the number of accidents involving these vehicles – and consequently the number of maxillofacial fractures – has also become extremely high.[16] According to Huelke and Compton,[9] car accidents are more common than motorcycle accidents, but the latter tend to be more severe. In Brazil, motorcycle accidents are characterized by two main problems: excessive speed and non-adherence to traffic laws. Not using a safety helmet, for example, is very frequent among Brazilian motorcycle riders because of the associated discomfort in hot weather, and can lead to severe, sometimes fatal, accidents. Subhashraj *et al.*[16] have reported that motorcycle accidents are more frequent in India due to several social and economic factors, including excessive speed, non-adherence to traffic laws, poor road conditions, and non-use of helmets and other safety equipment.

Maxillofacial fractures caused by firearm injuries accounted for 4% of the total of cases reviewed in our investigation. In an Iranian study, Taher [17] reported a frequency of 69.04% of traumatic injuries caused by firearms, whereas traffic accidents were responsible for 24.44% of the cases. Ugboko *et al.*[18] reported that 2.7% of the cases of fractures analyzed by those authors were caused by firearm injuries.

The zygomatic-orbital complex was the region most commonly affected in our study, accounting for 47.8% of the total of 232 fractures. Mandible fractures were the second most frequent ones, with 46.1% of the total, a finding that is in accordance with other published studies.[7]

The predominance of men and of 21-30 and 31-40-year-old patients in the frequency of maxillofacial fractures has already been documented. Our results revealed a male:female ratio of 6:1, compared to 3:1 in the study of Dingman and Natvig;[10] other studies have also corroborated this finding.[2, 4, 5, 14, 16] Moreover, the higher number of fractures in patients aged 21-30 and 31-40 years has been reported by several previous studies.[1, 4, 5, 10, 14, 16, 19] Iida *et al.*,[2] on the other hand, reported the age group of 11-20 years as the most affected one.

The development of scientific studies and the refinement of surgical procedures with the aim of optimizing the care provided to traumatic injury victims and improving treatment results is of paramount importance. Particularly, an increased worldwide knowledge of the open reduction and rigid internal fixation techniques for the treatment of maxillofacial fractures, in accordance with different healthcare protocols, would be especially useful.[20, 21]

The surgical treatment of maxillofacial fractures is based on the principles of reduction, fixation and immobilization of the involved segments, according to the characteristics of each case, maintaining the pretraumatic occlusal relationship of teeth. In spite of the significant advantages associated with open reduction and rigid internal fixation,[20, 22] these techniques are not the gold standard in every country, especially because of economic constraints.[4] In addition, satisfactory results have been obtained with the implementation of conservative treatment methods such as closed reduction and maxillomandibular fixation.[4, 21] At our service, rigid internal fixation with plates and screws is an available treatment approach, and therefore the great majority of our patients (78.6%) was treated and stabilized with open reduction (55.5% with fixation and 23.1% without fixation).

The epidemiological assessment of facial traumatic injuries allows to identify risk factors as well as population groups more susceptible to facial trauma. Moreover, an improved knowledge of the effectiveness of different treatment approaches and their complications allows for a more realistic and consistent interpretation of the best way to manage these patients. Trauma should not be considered only as a medical problem, but also as a social and economic issue. Factors such as the costs involved in the care of traumatic injury victims, damage to private properties during the traumatic event, wage losses, and permanent or temporary disability frequently lead to difficulties in the social reinsertion of these patients and in their return to work. All these aspects, plus the major effects on family members and the psychological distress involved in the care of these patients reveal a much greater impact of maxillofacial fractures on different scenarios, justifying the need for constant attention by healthcare institutions when dealing with these patients.[23]

Regular reassessments of the epidemiological profile of facial traumatic injury victims are extremely important for the confirmation of previously known patterns and/or for the identification of new characteristics so as to allow the development and maintenance of adequate preventive strategies and the qualification of treatment protocols.

In Brazil, traffic accidents are a serious public health problem, second only to homicides. There is no doubt that traffic education is of paramount importance to raise an awareness of safe traffic behavior in all citizens. However, the expected change in attitude could be more effective if a common cause was involved, in the sense of stimulating the commitment of Brazilian citizens to decrease the number of traffic accident victims.[24]

Conclusions

In our study, traffic accidents were the most frequent etiologic factor of severe maxillofacial injuries, particularly in the 21-40-year old population. These findings are in line with previous studies and therefore justify the development and implementation of prevention campaigns with the aim of decreasing the number of trauma victims in general and of patients with maxillofacial fractures in particular.

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