Maxillofacial Fractures in Bhopal, India: Analytic Study of 1268 Cases

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Abstract

Purpose To ascertain the pattern, incidence, causes, age and sex distribution, types, condition and treatment of maxillofacial fractures and their interwoven relationship being practiced in Bhopal.

Materials and Methods Retrospectively 3 year records of patients with maxillofacial fractures from 12 selected centres in Bhopal were reviewed. The following data were extracted from the medical records: age; gender; site of the fracture(s); other associated injury(ies); cause of the trauma and method of treatment(s).

Result In 1268 patients, a total of 2613 fractures were found of which 44.58 % patients had mandibular fractures. Parasymphysis was the most common site of fracture overall. Most patients were in the 21–30 year old age group, and the male: female ratio was 3.3:1. Road traffic accident accounted for 858 cases (67.67 %). Head injury was the highest occurring associated injury. Open surgical modalities was the most employed treatment modality in 52.60 % of cases.

Conclusion Preference for open surgical treatment along with increasing trend of supplemental intermaxillary

fixation was found, which prompts us to check for the underlying reason behind this, which could be the increasing number of displaced and comminuted fracture cases or the decreasing efficiency of open reduction treatment rendered. Latter reason prompts to re-evaluate the existing surgical techniques and expertise of the practicing surgeons.

Keywords Maxillofacial trauma · Incidence · Etiology

Introduction

Many standardized epidemiological studies about the pattern and management of maxillofacial fractures from different countries in different time periods have been published [1–3]. The incidence, etiology, pattern and variability in management of facial fractures have varied in most of the studies. These variations are mainly due to social, cultural and environmental factors [4, 5]. However, in spite of numerous studies the knowledge is limited to the pattern of maxillofacial fractures and their relation with the etiology and management in a developing countries, particularly in our country, India. The impact of social, cultural and economic factor in the management of facial fractures have varied among different demographical regions in our country itself [6].

India has a large population with ever increasing incidences of facial fractures causing direct or indirect influence upon the quality of life. There is insubstantial data about the etiology and pattern of facial fractures and its influence upon the management scheme. With this thought the aim of this research was established to ascertain the pattern, incidence, causes, age and sex distribution, types, condition and treatment of fractures of facial skeleton and

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Fig. 1 Distribution of cases according to age group and gender

their interwoven relationship being practiced in the capital of one of the largest states of India, Bhopal.

Materials and Methods

The present study involved a 3-year retrospective epidemiological study at maxillofacial units of five dental colleges and seven selected hospitals of Bhopal with major trauma centres. The time period was from January 2010–December 2012. Medical records of patients, who sustained maxillofacial fractures, from the department of Oral and Maxillofacial Surgery and other allied specialty departments of hospitals were analysed. The following data were extracted from the medical records: age; gender; site of the fracture(s); other associated injury(ies); cause of the trauma and method of treatment(s).

In all, records of 1268 patients were analyzed. The age of the patients was stratified decade wise. The site of fracture were categorized as upper third face; central and lateral middle third of face; and lower third of face. The individual fracture of all facial bones and site were also recorded. Those cases which were showing signs of malunion were considered as fresh cases, or the first treatment employed in those cases were recorded. The treatment was classified into broad categories of; open surgical method alone; close reduction method alone; open and close reduction; conservative treatment and no treatment. In case of open surgical method alone category, instances where direct open surgical exploration of the fractured site was done were included, irrespective of the fact that whether fixation method was employed or not. In the case of open and close reduction category, those multiple fracture instances were included, where some aspect of the fracture required surgical exploration of fracture for fixation and some aspect required closed manipulation for

reduction. Open and closed reduction category also included those fractures, which required both open reduction and internal fixation with supplemental intermaxillary fixation post operatively. Conservative treatment included, those cases where no active surgical intervention or reduction method was employed and only observation or palliative treatment was rendered which included drugs regime, soft diet therapy, protection devices, physiotherapy, and close follow-up. No treatment group included those patients who did not opt for treatment of fractures and also those patients who died before any active surgical treatment for fracture was given.

Quantitative Analysis

All the information from the records was fed into a computer for analysis of frequency and correlation of different parameters. The significances of the findings were evaluated using 'Pearson Chi Square test'. It was used to evaluate the association/significant difference between different variables/parameters.

Result

Age and Gender

Of the 1268 patients, 973 (76.74 %) were men and 295 (23.26 %) were women with a male to female ratio of 3.3:1. The highest numbers of patients affected were in the age group 21–30 years (33.52 %). Male patients were predominantly involved in all the age groups as shown in Fig. 1. The youngest patient was a 3-year-old male child and the oldest was a 90-year-old female patient.

Fig. 2 Distribution of cases as per etiology and gender

Causes

Road traffic accident (RTA) was found to be the paramount etiological factor for maxillofacial fracture (67.67 %), followed by fall and assault having almost equal contribution i.e. 13.33 and 13.09 % respectively as shown in Fig. 2.

Fractures

In 1268 patients, 2613 fracture of maxillofacial bones were found, in other words approximately two fractures per patient was found. 71.29 % of the cases had only one group of maxillofacial region involved with fracture i.e. either upper, central or lower third of face as shown in Fig. 3. Rest 28.71 % cases had fractures involving multiple facial regions as shown in Fig. 4. Lower face group (mandible) patients were the single highest group with maximum number of fractures i.e. 1165, which is 48.58 % of total fractures. Parasymphysis region was the most common site of fracture with a total of 388 instances. Next common bone site fractured were temporal bone with 307 fractures,

Fig. 3 Frequency of isolated groups of fractures as per gender

frontal bone with 292 fractures, followed by zygomatic complex with 288 fracture instances as shown in Fig. 5.

Associated Injuries

Overall 587 incidences of associated injury was found in the total cases, of which head injury was highest occurring associated injury (56.39 %), followed by orthopaedic injury (27.60 %). Vision loss was the least occurring incidence (3.24 %) as shown in Fig. 6.

Treatment

Open surgical procedures were the most employed treatment modalities (52.60 %), followed by close reduction methods (15.77 %), 11.04 % of cases were treated with combination modality. 10.33 % of the cases received conservative treatment, whereas, 10.25 % of the cases did not undergo any treatment as shown in Fig. 7. In the close treatment category the use of arch bars were the most employed means i.e. 72.84 %, followed by reduction alone category i.e. 20.90 % as depicted in Table 1. Use of cortical miniplates was the most employed internal fixation means, i.e. in 88.54 % of cases cortical miniplates were used as shown in Table 2. Next highest category were cases where debridement alone was done (Table 2).

Statistical Correlation

The correlation of etiology, age and gender was found statistically significant on application of Pearson's Chi square test. Statistically significant difference was found in relation of age and gender affected ($P < 0.05$). Similarly,

Fig. 4 Frequency of fracture cases in multiple fracture sites

Fig. 5 Distribution of fracture sites

Fig. 6 Incidence of associated injury

Table 1 Incidence of treatment by closed reduction

Closed method	Incidence N (%)
Reduction alone/closed manipulation	70 (20.90)
Eyelet wiring	6 (1.78)
Arch bars	244 (72.84)
MMF screws	7 (2.09)
Suspension wiring	4 (1.19)
Circum-mandibular wiring	4 (1.19)
Total	335 (100)

the relation of etiology, age group and gender was also found statistically significant ($P < 0.05$), in all the etiological categories.

Table 2 Incidence of treatment by open methods

Fixation method	Incidence N (%)
Cortical mini/micro plates	711 (88.54)
Reconstruction plates	10 (1.25)
Titanium mesh	14 (1.74)
Lag screw	10 (1.25)
Transosseous wiring	1 (0.12)
Debridement alone	57 (7.10)
Total	803 (100)

In the present study, on application of Pearson's Chi square statistical test, there was statistically significant difference ($P < 0.05$) found in relation of gender and major treatment methods employed. The same statistically significant test resulted in statistically non significant value ($P > 0.05$) when applied for relationship of age group and major treatment method employed. This explains the fact that irrespective of the age, open surgical methods for treatment is the preferred treatment modality.

Fig. 7 Major treatment distribution as per age group

Discussion

The incidence of maxillofacial fractures is one of the very common occurrences encountered in hospital setups, the most obvious and prominent reason being that ‘face is the most unprotected and exposed region of the human body’. Maxillofacial fractures affect the individual not only by limiting the functional aspect, but also hampering the aesthetics.

Many identical studies have been carried out in various time periods regarding maxillofacial injuries and maxillofacial skeletal injuries [7–14]. All these studies were carried out in different periods, in different countries and over different populations, and have shown differences in etiology. The etiological factors presented from these studies varies considerably from one study population to another depending on the country, socioeconomic status of population, and time factor. Sometimes even in the same geographical locality, etiological factor changes as the time progresses [15].

Most of the studies have attributed RTA as accounting for maximum maxillofacial injuries [6, 14, 16]. But some western studies have also recognized assault as the leading cause [17, 18]. In the present study RTA was the single highest contributing factor, similar to various studies conducted in various states of India [6, 8, 9, 16, 19]. In the studies from developed countries like Greece [20], New Zealand [21], United Kingdom [22] RTA as the causative factor was found to be low. Studies from developing countries like Nigeria [23], Jordan [24], and Libya [10] had similar contribution of RTA as in the present study. This vast difference of RTA association with cases in developing countries compared to more developed countries, might be attributed to the fact that there are, strict traffic laws, better law enforcement units, better sense of road safety among citizens and strictness in driving license distribution in developed countries.

Majority of the fractures occurred in mandible alone in our study. This correlates with the study by Mallet [25], Herman [26], Rowe and Killey [15], Gupta et al. [8], Sheikh et al. [10], Ugboko et al. [27], Fasalo et al. [23], Kadkhodaie [28], Matos et al. [29] and Wouter et al. [18]. Thus, depicting the trends of incidences of fracture site from late 90 s to recent years, where mandible has remained the most affected site of fracture.

The location of fracture site appears to be directly related to the cause of injury in some instances and probably reflects the direction from which force was applied to the mandible. Sports and altercations injuries most frequently resulted in angle fractures. Vehicular accidents and falls resulted in greater number of parasymphysis and condylar fractures. Studies by Beek and Merckx [30], Iida et al. [11] and Matos et al. [29] found that condylar fracture is the most common site of fracture, this is in contradiction to the present study where condyle was 3rd most common site in mandible fracture. Incidences of coronoid fracture were as low as only 8 instances of coronoid fracture were found.

Zygomatic complex fracture was found to be the most frequently affected region of middle third of face, which is in accordance with the earlier study of Afzelius and Rosen [1], Nair and Paul [31], Buchanan et al. [21], Brasileiro and Passeri [32], Kostakis et al. [20] and Bali et al. [6] where they also found ZMC as the most common fracture site of middle third of face. However, in our study the overall involvement of nasal complex fractures was found to be 6.93 %. This is comparatively low with respect to other studies by Kieser et al. [17] and van Hout et al. [18], where they found nasal complex or nasal bone fracture involvement of 12 and 12 % respectively. This might be associated to the reason that patients with nasal complex fracture often seek advice from Ear-Nose-Throat specialist rather than maxillofacial surgeons. In the present review, high association of head injury in the patients affected with maxillofacial fractures was found, prompting more

involvement of neurosurgeon during the management of patient.

In the present study, 52.6 % of the patients were treated by open surgical treatment modality alone, in which open reduction and internal fixation modality was by far the most common treatment method employed. The earlier studies conducted in developing nations like Brazil [32], Nigeria [27] and Jordan [22] have shown significant lower percentage of open surgical treatment method employment, when compared to developed countries like Netherlands [18], New Zealand [21] or UAE [12]. This difference again might be because of lower socio-economic living of people of developing countries to bear the financial burden involved in open surgical treatments, compared to better socio-economic status of developed countries.

In the study by Fasalo et al. [23], which involved subjects above 60 years of age, only 9.4 % of the patients, received open surgical treatment and most were treated with close treatment modalities. This is in contradiction to the present study where older patients i.e. patients above 50 or 60 years of age, also received the most opted treatment options i.e. open surgical treatment, similar to other age groups.

In the study from Brazil by Brasileiro and Passeri [32] an interesting finding which came out was the instances where supplemental intermaxillary fixation (IMF) was done after open surgical method employment, that was in 0.02 % of the subjects. Whereas, in the present study open and close treatment category included mostly such cases where supplemental intermaxillary fixation was given to patients after open surgery and it had 11.04 % of the total subjects, which can be attributed, to large number of high velocity fracture causing much of severely displaced fractures in our study, requiring supplemental IMF. Or it might also jazz up a possibility of low affectivity of open reduction treatment for rendering functional rigid fixation being employed in our region.

In the present study, most of the cases of condylar fracture were treated with intermaxillary fixation alone. Cases where condylar fracture was present in association with any other fracture, then other fractures were treated by open reduction and internal fixation method, and later condyle was addressed with intermaxillary fixation. This gives a logical explanation to the fact that most of the condyle fractures in the present study might not have fallen under the indications for open surgical reduction of condyle [33] or this might also highlight the fact that open reduction for condyle fracture is not popular among surgeons in the region.

Use of cortical miniplates as internal fixation implants was the highest treatment method employed. This explains the preferred usage of miniplates for maxillofacial fractures which corresponds to Maxime Champy [34] who opined that use of miniplates is sound enough to resist the strains

developed by the masticatory muscles for mandibular fracture. The second most common treatment modality under open surgical procedure was the procedure where debridement alone was done. This procedure was particularly seen in cases where there was fracture of upper face, or fracture of upper face in conjunction with other maxillofacial fracture.

Arch bar wiring technique was most frequently used for IMF found in our study. Second most common method under closed treatment category were instances where reduction of fracture fragments was done without fixation, that were mostly fractures of ZMC or nasal complex fractures.

The overall result from our study, has shown various drawbacks and benefits related to treatment and incidences of maxillofacial fractures. This would further help in improving the existing scenario of preventive measures and treatment modalities to be taken for maxillofacial fracture incidences.

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