Prevalence, pattern, etiology, and management of maxillofacial trauma in a developing country: a retrospective study

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Objectives: This retrospective study aims to evaluate the prevalence of maxillofacial trauma in a developing country, along with its pattern, etiology and management. Data for the present study were collected from the Department of Dentistry, ESIC Medical College and Post Graduate Institute of Medical Sciences and Research, Chennai in India.

Materials and Methods: The medical records of patients treated for maxillofacial injuries between May 2014 and November 2015 were retrospectively retrieved and analyzed for prevalence, pattern, etiology, and management of maxillofacial trauma. SPSS software version 16.0 was used for the data analysis.

Results: Maxillofacial fractures accounts for 93.3% of total injuries. The mean and standard deviation for the age of the patients were 35.0±11.8 years and with a minimum age of 5 years and maximum age of 75 years. Adults from 20 to 40 years age groups were more commonly involved, with a male to female ratio of 3:1. There was a statistically significantly higher proportion of males more commonly involved in accident and injuries (P <0.001).

Conclusion: The most common etiology of maxillofacial injury was road traffic accidents (RTA) followed by falls and assaults, the sports injuries seem to be very less. In RTA, motorized two-wheelers (MTW) were the most common cause of incidents. The majority of victims of RTA were young adult males between the ages of 20 to 40 years. The malar bone and maxilla were the most common sites of fracture, followed by the mandible. The right side of the zygomatic complex was the predominant side of MTW injury. The majority of the zygomatic complex fractures were treated by conservative management. Open reduction and internal fixation were performed for indicated fracture patients.

Key words: Fractures, Injuries, Mandible, Maxillofacial, Zygomatic

I. Introduction

Trauma is one of the leading causes of death among people under 40 years of age. Maxillofacial injuries are one of the most common injuries associated with other injuries and adult males are the most common victims. Road traffic accidents (RTA) are the major cause of maxillofacial injuries in developing countries. Our institution is a referral center, predominantly treating low-income insured employees. The Department of Dentistry routinely treats maxillofacial injury cases. The main aim of this retrospective study was to evaluate the prevalence of maxillofacial injury, etiology, type of injury, site of maxillofacial fractures, and their management.

II. Materials and Methods

The records of maxillofacial injury patients from May 2014 to November 2015 who reported to the Department of Dentistry, ESIC Medical College and Post Graduate Institute of Medical Sciences and Research (PGIMSR), Chennai in India were retrieved. Patients who reported with facial soft tissue injuries were also included. Head injury patients with brain involvement who required neural intervention and mortal cases were excluded. The records of 267 patients between the ages of five to seventy-five years were retrospectively analyzed. Data including age, gender, mode of injury, etiology, anatomical fracture site, consciousness status, alcohol...
abuse at the time of injury, and treatment rendered were extracted. The etiology of injury was categorized into four main categories: (1) RTA involving automobiles, motorcycles and bicycles, including drivers, pillon riders, passengers, and pedestrians; (2) Fall(s) from heights or while playing or due to systemic illness like epilepsy; (3) Assaults or interpersonal violence; and (4) Sports injuries and other injuries. Fractures were grouped and coded according to International Classification of Diseases (ICD)-10: S02.4, zygomatic complex (ZMC) fracture involving malar bone and maxilla; S02.3, orbital floor fracture; S02, fractures involving facial and skull bones; S02.6, mandible fractures (which includes condyle, ramus, angle, body of the mandible, parasympysis, symphysis); S02.5, tooth fracture; and S02.2, nasal bone fractures. Statistical analysis using SPSS version 16.0 (SPSS Inc., Chicago, IL, USA) was performed. Study outcomes were measured using percentages, the mean, standard deviation and tests of proportion as appropriate. The prevalence of injury in a particular age group and gender distribution, etiology, type of fracture, management and influence of alcohol were analyzed. For comparison, the existing literature related to maxillofacial injuries was reviewed.

The study was approved by the Institutional Review Board of ESIC Medical College and PGIMSR (No. 17-03/07/2015 ESIC MC PGIMSR -EC).

III. Results

Out of 267 case records in the age group between 5 to 75 years, maxillofacial fractures accounted for 93.3% of total injuries. The mean age and standard deviation of the patients was 35.0±11.8 years, with a minimum age of 5 years and a maximum age of 75 years. Adults between 20 to 40 years of age were more commonly involved. Gender distribution shows that 74.5% (199/267) of subjects were male and 25.5% (68/267) were female, with a male to female ratio of 3:1. (Fig. 1, Table 1) The test of proportion for males and females shows that there was a statistically significantly higher proportion of males involved in accident and injuries (P<0.001).

1. Etiology

(1) The report shows that the most common cause for maxillofacial injury was RTA, accounting for 73.8% of injuries (197/267), among which motorized two-wheelers (MTW) were the major cause of these injuries (90.9%, 179/197), including skids and falls, collision with other vehicles and pedestrians.

(2) Trauma due to fall accounted for 18.0% of injuries (48/267), mostly involving children who fell while playing, elderly people who fell down due to systemic illness, or men who fell down under the influence of alcohol.

(3) Assault by a known person constituted for 6.7% of injuries (18/267).

(4) Three cases of sports injury and one case of industrial injury were reported in our data.(Fig. 2, Table 1)

The test of proportion between RTA and other injuries showed that there was a statistically significantly higher proportion of RTA compared to other types of injuries (P<0.001). Overall results revealed that 41.6% of males (111/267) were

Fig. 1. A. Prevalence of maxillofacial injury. B. Gender distribution.
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under the influence of alcohol at the time of injury. Among MTW accidents, 48.6% (87/179) of injuries were on the right side, 31.3% (56/179) were on the left side and 19.6% (35/179) were bilateral. The test of proportion for the side of injury (right vs left) showed that there was a statistically significant difference in the side of injury, indicating that injury on the right side was more common compared to the left side (P<0.05).

2. Site or type of fracture

Analysis shows that 41.9% of fractures (112/267) involved the malar and maxillary bone, 33.0% (88/267) were mandibular fractures, 26.2% (70/267) were tooth (dentoalveolar) fractures, 8.6% (23/267) were orbital floor fractures, 7.9% (21/267) were facial bone fractures with skull bone fracture, 6.4% (17/267) were nasal bone fracture, and 6.7% (18/267) were soft tissue injuries. (Fig. 3, Table 1)

3. Management

The study found that 31.1% of fractures (83/267) were treated conservatively (65 cases of zygomatic maxillary complex, 14 condylar fractures, and 4 nasal bone fractures), close reduction was performed for 27.7% of fractures (74/267), 34.5% of fractures (92/267) were treated by open reduction,
and internal fixation was performed wherever indicated. Wound debridement was performed for 6.7% of soft tissue injuries (18/267). (Fig. 4, Table I)

IV. Discussion

The maxillofacial region is the most exposed part of the body and is more vulnerable to trauma. Trauma is one of the major causes of death among people under 40 years of age. Major causes for maxillofacial fracture as reported worldwide are interpersonal violence, traffic accidents, falls and sports injuries. RTA contribute significantly to mortality and morbidity throughout the world and in large numbers in developing countries. Reports reveal that 20% to 60% of all road traffic injuries involve some form of maxillofacial injury, and 62% involve motorcycles. The prevalence of maxillofacial injuries varies from 17% to 69%, and this large difference might be due to various environmental factors, socioeconomic conditions, cultural reasons, and traffic rules. In the present study, RTA accounted for 73.8% of injuries, and MTW were the major (90.9%) cause in injuries that involved skids and falls in collisions with other vehicles, including riders, pillion riders, and pedestrians. This might be due to differences in the proportion of vehicles registered in India and three highly motorized countries (HMC), the USA, China, and Brazil. The car population as a proportion of total motor vehicles is only 13% in India compared to HMCs (56%-80%). On the contrary, the proportion of MTW is much higher (70%) in India compared to HMCs. This high proportion of MTWs has a large effect on traffic and crash patterns. Pedestrians, bicyclists, and MTW riders are very vulnerable to injury and constitute 60% to 80% of all traffic injuries in India. The number of deaths or injuries caused by MTW is about 15 to 20 times greater than for enclosed vehicles. In our study, the major cause of maxillofacial injury was MTWs (90.9%). Our institution is a referral center, predominantly treating insured employees of low-income groups. Their main mode of transportation is MTW (bike, scooter) and bicycles. Nearly (41.6%) of males injured by MTW were under the influence of alcohol at the time of injury. These injuries usually involved a skid or fall from a vehicle or collision with another vehicle or loss of control due to an unexpected encounter with pedestrians or animals. The higher frequency of maxillofacial injuries among males compared to females is a universal finding of previous studies. In the present study, 74.5% (199/267) were males and 25.5% (68/267) were females, with a male to female ratio of 3:1.

Studies have reported zygomatic fractures as the most common subtype among midfacial fractures in both children and adults. The maxilla (22%), orbit (16%), and nasal (16%) bones were the most frequently fractured facial bones. In our study, 41.9% of fractures involved the malar bone and the maxillary bone, followed by mandible fractures (33.0%), tooth (dentoalveolar) fractures (26.2%), orbital floor fractures (8.6%), facial bone fracture with skull bone fracture (7.9%), nasal bone fractures (6.4%), and soft tissue injuries (6.7%). In other studies, alveolar ridge fracture occurred more frequently among children than among adolescents. The incidences of facial bone fractures were 39.3% and 51.8% among children aged 6 to 10 years and 11 to 14 years, respectively, and the most commonly involved age group was 11 to 14 years. In other study reports, the incidence of facial fractures in children in India was 5.5%, and this could be due to the fact that young children are less often involved in occupational or violence related incidents, which are the typical causes of adult facial fractures. Accidental fall is the leading cause of maxillofacial injuries in children, accounting for 43% to 71.42% of injuries. Among children below the age of 15 with injury due to falling while playing, the injury was mild, causing only soft tissue laceration or dentoalveolar or tooth fracture, rather than being a severe injury. The literature indicates that as the age of patients increases, the patterns of fractures progressively resemble that of adult patients. In our study, 2.2% (6/267) of reported injuries were in the 0 to 13 age group, and all were due to accidental fall while playing or fall from a bicycle. Out of 6 patients, there were 2 dentoalveolar (tooth) fractures, 3 mandible fractures, and 1 ZMC fracture. This low prevalence rate might
be because of mild, unnoticed injuries, or subjects may have received treatment in dental clinics outside the study area. In adults, fall was the second most common cause of injury, accounting for 18.0% (48/267) of maxillofacial injury, of which 52.1% (25/48) involved adult males, and 12 were under the influence of alcohol at the time of injury. Assault: Various reports reveal domestic violence as the cause of maxillofacial injuries among women, with a prevalence between 34% and 73%, representing a worldwide problem that crosses cultural, racial and socioeconomic lines. In our study, 3.0% (8/267) of females and 3.7% (10/267) of males between 20 to 50 years of age had reported an assault injury by known persons. This result was markedly lower compared to previous study results. Likewise, the proportion of sports injuries was much lower in the present study, at 1.5% (4/267), and the male-female ratio was 3:1.

Patten of injury: The peak incidence (47%) of mid-face fracture was in the age group of 21 to 30 years. The most common fracture was ZMC fracture, ranging from 36% to 62.5%. In our report, 41.9% of fractures (112/267) involved the malar bone and maxillary bone, 33.0% (88/267) were mandible fractures, 26.2% (70/267) were tooth (dentoalveolar) fractures, 8.6% (23/267) were orbital floor fractures, 7.9% (21/267) were facial bone fracture with skull bone fracture, 6.4% (17/267) were nasal bone fractures, which included 2 cases of isolated nasal bone fracture, and others were associated with LeFort II and III fractures. Dentoalveolar segment fracture accounted for 26.2% of injuries. In the present study, reported skull bone fractures (which were referred to our department but not requiring neurosurgical intervention) included depressed frontal bone fractures of the outer table, temporal bone fractures, and sphenoid bone fractures. In addition, 6.7% (18/267) of soft tissue injuries were treated by wound debridement.

In the present retrospective study, an interesting point to note was that 61.3% of malar and maxillary bone fractures were on the right side of the face. These injuries mainly resulted from skid falls from a MTW. A few patients were asked about the history of their injury, and they reported that they were right handed and had applied the right-hand
brakes at the time of the accident, indicating that the front wheel possibly caused the skid. In future studies, the type of vehicle (MTW) and the mechanism for the side of injury should be further evaluated. Management of maxillofacial injuries is a real challenge for oral and maxillofacial surgeons, and demands both skill and expertise. Open reduction and internal fixation (ORIF) were the major types of management performed for patients. (Fig. 5) Most ZMC (S02.6) fractures were treated conservatively, when fractures were nondisplaced and without any functional or esthetic or neurological deficits. Dento alveolar fractures, condyle fractures without displacement or dislocation or occlusal derangement were treated by close reduction and indirect fixation by intermaxillary fixation. ZMC fractures and zygomatic arch fractures not involving occlusion were elevated by the Gillies temporal approach if fractures were stable after elevation, and no direct fixation was done. All panfacial fractures, multiple fractures with occlusal derangement, and displaced fractures that were not reduced by close reduction and unstable ZMC fracture after elevation were treated by open reduction and direct fixation by miniplate osteosynthesis. (Fig. 6, 7)

A study conducted by Singh et al. reported that 3.88% of injured patients were intoxicated with alcohol at the time of their accidents and all were male. Agnihotri et al. reported that the rate of RTA was increased on weekends due to an increase in the number of drivers who were under the influence of alcohol. In our study, 41.6% (111/267) of males were under the influence of alcohol at the time of injury. When approaching a cross road, in order to turn to the right hand side, the driver needs to change gear, brake, indicate, scan for oncoming traffic, make a decision on when it is safe to turn, and steer and turn the vehicle in a coordinated sequence. Alcohol could affect psychomotor skills, ability to maintain balance and coordinate physical activities. Prabhu et al. reported that even as alcohol consumption is decreasing in some developed countries, it is on the rise in developing nations, particularly among those aged 21 to 35 years. This illustrates the urgent need for the implementation of measures to prevent RTA.

The monthly incidence of maxillofacial fractures was fairly constant along with seasonal variations, as reported in several previous studies. In India, August to November is the rainy season, and there is an increased incidence of accident-
V. Conclusion

Our reports revealed that the main cause of maxillofacial injury was RTA, and males aged 20 to 40 years more often sustained maxillofacial injury. Fractures of the malar bone and maxilla were the major prevalent fractures in the maxillofacial region, MTW were the major cause of injury, and the influence of alcohol was also one of the important factors responsible for injuries. Although the majority of malar and maxillary fractures were treated conservatively, ORIF was performed wherever indicated.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

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