Original Article

Prevalence of mandibular fractures reported at C.S.M.S.S Dental College, aurangabad from february 2008 to september 2009

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Abstract

Aim: The aim of this study is to determine the etiology, frequency of mandibular fractures among different age and sex, to determine the frequency of anatomic distribution, and to report the different modalities of treatment provided to the patients reported at our institution from February 2008 to September 2009. **Materials and Methods:** All patients fulfilling the selection criteria and having mandible fracture were selected for the study. Patient information was collected by means of a medical data form specifically designed for the present study. The values were subjected to Z and Chi-square tests. **Results:** Out of 35 patients, thirty one were males (88.57%) and four were females (11.43%) with a male:female ratio of 8:1. We found a peak occurrence in young adults, aged 21-30 years (n = 15, 42.86%). In case of etiology of fracture, road traffic accidents (RTAs) was the most common (n = 25, 71.43%) and condyle was most frequently involved site (n = 19, 38.78%). In most (n = 16, 45.71%) of the patients, an open reduction and rigid internal fixation using bone plate and screws was done. **Conclusion:** In the present study, the prevalence of mandible fractures was more prevalent in male patients, especially during the 3rd decade of life. The most common cause was road traffic accident and the more frequently affected region was condyle of the mandible. Open reduction and rigid internal fixation using miniplates and screws was the most commonly used treatment.

Key words: *Aurangabad, fracture, mandibular, prevalence India*

INTRODUCTION

Injuries of the maxillofacial complex represent one of the most important health problems worldwide.[1] Maxillofacial injuries, such as soft-tissue injuries, dental injuries, or maxillary, mandibular, and zygomatic fractures; are the most common injuries treated by oral and maxillofacial surgeons.[2]

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The mandible is a unique bone having a complex role in esthetics of the face and functional occlusion. Because of the prominent position of the lower jaw, mandibular fractures are the most common fractures of the facial skeleton. It has been reported that fractures of the mandible account for 36% to 59% of all maxillofacial fractures.[3] Despite the fact that it is the largest and strongest facial bone, it is the tenthth most often injured bone in the body[4] and second to nasal bone fractures[5] and it is fractured two or three times more often than other facial bones.[6]

The age distribution of persons sustaining craniomaxillofacial injuries differs from one country to another. Traditionally, there has been a high male-to-female ratio among craniomaxillofacial injury victims, ranging from 10:1 to 6.6:1. However, the recent literature shows a trend toward a more equal male-to-female ratio.

This can be attributed to a changing workforce and the fact that more women work outdoors in more high-risk occupations, thus becoming more exposed to RTA and other causes of craniomaxillofacial fractures.

Many causes of craniomaxillofacial fractures have been reported, including road traffic accidents (RTAs), assaults, sporting injuries, falls, and industrial accidents; and in some areas of the world, attacks by animals.[7] Many epidemiological studies have been published from different countries about the pattern of maxillofacial injuries, but demographic data are difficult to evaluate because of the many variables.[8] Studies around the world have shown that assaults are the predominant cause of maxillofacial fractures in developed countries, while motor vehicle accidents (MVAs) are the most common cause in developing countries.[9]

Also, in cases of multiple site fractures, association between specific anatomic sites is sought. The development of reliable predictors of injury patterns will be a useful guide to the prompt and accurate diagnosis and management of mandible fractures in the trauma patient population.[10]

For each patient, the combination of these factors determine the likelihood of a mandibular fracture.

Mandibular fractures have been studied extensively, and some controversy remains regarding the ideal treatment approach. The advent of AO/ASIF (Arbeietsgemeinschaft fur Osteosynthesefragen/Association for the Study of Internal Fixation) and microplating systems has further increased debate as to whether open reduction is a better treatment option for mandibular fracture treatment compared with closed reduction.[11]

A clearer understanding of the demographic patterns of mandibular fractures will assist providers of healthcare as they plan the treatment of maxillofacial injuries. Such epidemiological information can also be used to guide the future funding of public health programs geared towards prevention of such injuries.[12]

The aim of this study is to determine the etiology, frequency of mandibular fractures among different age and sex, to determine the frequency of anatomic distribution, and to report the different modalities of treatment provided to the patients of mandibular fractures reported at Department of Oral and Maxillofacial Surgery at our Institution from February 2008 to September 2009.

MATERIALS AND METHODS

This study was designed to establish the current demographic and treatment patterns of mandibular fractures at the Department of our institution.

This was an observational, descriptive, and epidemiological study that included all cases of mandibular fractures that were clinically and radiographically diagnosed and treated at our institution from february 2008 to september 2009.

Patients from 1 to 70 year age group and with either sex were included. Patients who had refused to participate in the research or medically compromised were excluded from the study.

Patient information was collected by means of a medical data form specifically designed for the present study. The data collected included age, sex, etiology of fracture, anatomic site of fracture, and the types of treatment provided.

RESULTS

Thirty-five patients included in the present study were divided into groups according to age (1-10 years; 11-20 years; 21-30 years; 31-40 years; 41-50 years; and 51-60 years) and according to sex into male and female. Mechanism of injury was recorded and classified as RTA, fall, interpersonal violence, assault, and other causes. Anatomically, the mandibular fractures were classified into seven regions: Symphysis, parasymphysis, body, angle, ramus, coronoid, and condylar.

After making final diagnosis, informed consent was obtained from each patient and appropriate management was done under suitable anesthesia.

Out of 35 patients, 31 were males (88.57%) and were females (11.43%) with a male:female ratio of approximately 8:1 [Table 1]. The difference between both groups was found to be statistically significant ($P < 0.05$).

The age of patients ranged from 1 to 57 years, with a mean age of 27.09 years. The mean age for

Table 1: Gender distribution of patients

Sex	No. of patients	(%)
Males	31	88.57
Females	4	11.43
Total	35	100

Z value=6.45, P<0.05: Significant

females was 32.5 ± 6.03 years and for males it was 26.39 ± 11.59 years.

We found a peak occurrence in young adults, aged 21-30 years (n = 15, 42.86%). This was followed by 31-40 years (n = 8, 22.86%), 11-20 years (n = 7, 20%), 1-10 years, and 41-50 years age group (n = 2, 5.71%). Patients belonging to 51-60 years were the least involved group (n = 1, 2.86%). Amongst males, 21-30 years group were the most frequently involved followed by 11-20 years (n = 7, 20%); whereas, in females 31-40 years age group was most common followed by 21-30 years (n = 1, 2.85%).

In case of etiology, RTAs were the most common (n = 25, 71.43%), whereas falls were the second most likely cause (n = 7, 20%). Interpersonal violence represented (n = 2) 5.71% and assault accounted for (n = 1) 2.86% of mandibular fractures almost 48% of RTAs were found in 21-30 age groups, 42.86% in 11-20 age groups, 50% of interpersonal violence were equally found in 11-20 and 21-30 age group; whereas, assault were found only in 31-40 age group. Statistically, no significant association existed between the age group involved and the etiology of fracture ($P > 0.05$).

The data for causes of fractures distributed by gender showed that, RTA was the most frequent etiological factor irrespective of gender (n = 23, 65.71% for males and n = 2, 5.71% for females). Whereas, the second most frequent cause of fracture for males was fall (n = 6, 17.14%) and in females was fall (n = 1, 2.86%) and assault (n = 1, 2.86%). But the interpersonal violence (n = 2, 5.71%) was the third cause of fracture which was found only in males. Statistically, significant association existed between the genders and the etiology of fracture ($P < 0.05$) [Table 2].

There were a total of 49 fracture sites in 35 patients. The condyle was most frequently involved site with (n = 19) 38.78% of the total mandibular fractures. This was followed by body (n = 11) in 22.45% and parasymphysis (n = 10) in 20.41%. Symphysis fractures accounted for (n = 5) 10.2%, angle for (n = 3) 6.12%, and the remaining 2.04% was involving the coronoid process (n = 1) of the mandible.

Out of the patients with RTA, the parasymphysis/condyle (12%) was the predominant combination of fracture site involvement, followed by the body/condyle (8%). In case of fall patients, the most common pattern was body/condyle (28.57%); whereas, in case of patients with interpersonal violence a combination of angle/parasymphysis (50%) and condyle/parasymphysis (50%) were the involved sites. Statistically, significant association existed between the etiology of fracture and the fracture site involved ($P < 0.05$) [Table 3].

Several different approaches were used for the reduction, fixation, and immobilization of mandibular fractures. In approximately half (n = 16, 45.71%) of the patients, an open reduction and rigid internal fixation using bone plate and screws were done. For the 11 patients (31.43%), treatment involved closed reduction of the fracture using arch bars or ivy loops and intermaxillary fixation, in three patients (8.57%) closed reduction using arch bars or ivy loops and short period of intermaxillary fixation followed by physiotherapy, two patients were treated using (5.71%) open reduction followed by physiotherapy. For the remaining three patients with high condylar fracture (8.57%), treatment involved only physiotherapy and soft diet .

Table 2: Etiologic distribution of mandibular fractures in males and females

Etiology	Males	Females	Total (%)
RTA	23	2	25 (71.43)
Fall	6	1	7 (20)
IPV	2	0	2 (5.71)
Assault	0	1	1 (2.86)
Total	31	4	35 (100)

X^2 Cal=8.35, df=3, P=0.039, P<0.05: Significant. RTA = Road traffic accident, IPV = Interpersonal violence, df = Degrees of freedom

Table 3: Etiologic distribution of patients according to the site of involvement

Causes	Anatomic site						
	S	P	B	A	CORO	C	Total (%)
RTA	4	7	10	2	0	13	36
Fall	1	1	1	0	0	5	8
IPV	0	2	0	1	0	1	4
Assault	0	0	0	0	1	0	1
Total	5 (10.20)	10 (20.41)	11 (22.45)	3 (6.12)	1 (2.04)	19 (38.78)	49 (100)

X^2 Cal=28.2, df=15, P=0.020, P<0.05: Significant. RTA = Road traffic accident, IPV = Interpersonal violence, df = Degrees of freedom, S = Symphysis, P = Parasymphysis, B = Body, A = Angle, CORO = Coronoid, C = Condylar

DISCUSSION

Regardless of geographical boundaries, injuries to the body are common.[5] The human face constitutes the first contact point in several human interactions; thus, injuries and/or mutilation of the facial structures may have a disastrous influence on the affected person.[13]

As with other diseases and injuries, epidemiological data provide an important basis for the evaluation of access to treatment, resource allocation and planning within the health services. It may also be used to develop preventive strategies and may provide information about the quality of care provided.[14]

Maxillofacial injury occurs in approximately 5-33% of patients experiencing severe trauma.[14] Moreover, maxillofacial fractures are often associated with severe morbidity, loss of function, disfigurement, and significant financial cost.[1]

Given that the mandible is the only facial bone that has mobility and the remaining portion is part of the fixed facial axis, the fracture is never left unnoticed because it is very painful, pain that worsens with mastication and phonation movements, and even respiratory movements; sometimes there are facial asymmetry complaints. Mandible fractures may lead to deformities caused by displacement or non-restored bone losses, with dental occlusion affection or temporomandibular joint disorder (TMJD). If not identified or inappropriately treated, these lesions may lead to severe sequelae, both cosmetic and functional.[15]

It has been reported that incidence of maxillofacial fractures varies widely between different countries.[16] The large variability in reported prevalence is due to a variety of contributing factors, such as the environment, sex, age, and socioeconomic status of the patient, as well as the mechanism of injury. For each patient, the combination of these factors determines the likelihood of a mandibular fracture.[4]

Mandibular fractures occur in people of all ages and races, in a wide range of social settings.[17] The results of the present study of patients with mandibular fractures, who were treated at our institution, are largely in agreement with those of previous reports, particularly with regard to age and gender of the patient.[3]

The finding that age group 21-30 years constituted the group with the highest frequency of jaw fractures is consistent with previously published studies.[6,17-20]

Trauma is now considered a problem of young people, which may be because of their aggressive nature and careless driving on roads.[21] It has also been consistently shown that the frequency of mandibular fractures among male (88.57%) is far greater than that of female (11.43%). This was found to be statistically significant (Z value = 6.45, $P < 0.05$) in the present study. Reported overall ratios of male to female have ranged from 4:1 to 12:1 in other studies; similar to the ratios observed here (8:1).[6,15,16,22-24]

The predominance of male gender is due to the fact that this group make up the most active group in society,[4] is more prone to traffic accidents since they drive motor vehicles carelessly and is most likely to be involved in interpersonal violence[25] and is normally associated with use of alcoholic beverage.[15] The higher frequency of mandibular fractures among males compared to females may also be attributed to the fact that the females, most often, are confined to housework and they drive vehicles less frequently and carefully, and are less exposed to accidents, fights, industrial works, and sports and more participate in trading or farming.[21]

The causes of fracture have extremely variable incidence depending on social, geographical, and economic characteristics.[15] In the present study, RTAs was the most frequent cause of fracture which was found to be statistically significant in males and females ($P = 0.039$). These results were found to be in agreement with the studies conducted by different authors,[4,6,18,20,23,26,27] which were most common in males than females in the age group of 21-30 years. This might be because a large proportion of the population uses a motorcycle on a daily basis.[4] The increasing number of RTAs in developing countries like India may be attributed to many factors like sharing of roadways by pedestrians and animals with fast-moving vehicles, with almost no segregation of pedestrians from wheeled traffic; the large numbers of old and poorly maintained vehicles on road; large numbers of motorcycles, scooters, and mopeds; low driving standards; large numbers of overloaded buses; widespread disregard for traffic rules; defective roads; poor street lighting; and defective layout of cross roads and speed breakers. In addition, the increasing volume of traffic as a result of economic expansion and rapid increase in the density of urban population may also be the factors responsible for increasing RTAs in recent times.[21]

Perhaps, the lack of experience in traffic, imprudent driving, and the type of service for which the motorcycle is generally used (fast delivery) might

explain the higher incidence in young drivers. High speed, imprudence, use of open helmets, or no use of helmets can explain the high number of fractures secondary to motorcycle accidents. Olson *et al*., reported that wearing helmet decreases the mortality but does not reduce significantly the number of fractures and point to speed as a determinant factor for fracture occurrence. Other studies have reported an association between wearing a helmet and the decrease of maxillofacial lesions and the severity of skull injuries. A previous study showed that facial trauma incidence was lower when the victims wore helmets, especially if closed. Although the Traffic National Code imposes the compulsory use of helmets and seat belt and apply severe penalties for high speed and/or drunk driving, there are still people that do not follow the law.[24]

These were followed by falls in the age group of 1-30 years, interpersonal violence in the age group of 11-30 years, and assault in the age group of 31-40 years. In a retrospective study, Fridrick *et al*., demonstrated that altercations accounted for 47% of fractures and automobile accidents for 27%.[28] Thorn *et al*.,[29] in Greenland (90%) and Lee in New Zealand (49%)[30] reported that the major cause of mandibular fractures were due to interpersonal violence. In a study conducted by Czerwinski *et al*.,[31] Alexander *et al*.,[17] King *et al*.,[8] and Dongas and Hall[9] assault was the most common cause of fracture. There are countries whose main cause of mandibular fracture is related with sport activities, such as in Austria.[32] With regards to the patient characteristics, there existed no significant association between certain age groups and etiology of fracture ($P = 0.222$) in the present study.

Whenever the maxillofacial region is injured, the mandible is more vulnerable than the midface fractures. This could be because the mandible is mobile and has less bony support than midfacial bones. These fractures are, however, more common in certain sites of the mandible than others.[3]

In the present study, the condylar region of the mandible was the most commonly involved site which is similar to the results found in other studies in men aged 21-30 years.[33-35] This might be because the force of a blow is transferred from the chin along the mandible to the condyle often causing fractures in the neck, which is one of the weak anatomical locations within the mandible.[21] But certain studies found other sites of mandible to be most commonly involved.[3,8,9,15,24,36] It is difficult to cite a reason for this difference; perhaps further study on the causes of the regional mandibular fractures would be useful. One can speculate that interpopulation difference in the sites of mandibular fractures partly related to the diverse etiologic factors involved.[3] This allows the conclusion that the pattern of presentation is a multifactorial variable.[4] These were followed by body, parasymphysis, symphysis, and angle. The least affected site was the coronoid process of the mandible. With regards to patient characteristics, there existed no statistically significant association ($P = 0.79$) of any patient age group with any specific mandibular fracture site. This suggests that fracture site is dependent primarily on the physics of the specific injury mechanism and not on any inherent characteristics of the mandible itself such as the absence of dentition or presence of unerupted third molars.[8] No statistically significant association ($P = 0.097$) was found between males and females with a particular anatomic site involved, between the anatomic site and the side of involvement ($P = 0.193$), and between males and females involving either the right side ($P = 0.086$) or left side ($P = 0.166$).

The involvement of mandible fracture site is variable, depending on the many different causes of the fracture. Therefore, the literature differs a lot concerning the affected sites.[15] The mechanism of patient injury correlates significantly ($P = 0.020$) with the anatomic location of fracture, and knowledge of these associations should guide treating physicians in their diagnostic workup of all head and neck trauma patients.[10] Automobile accident victims will more commonly have condylar and body fractures. Patients involved in accidents involving posterosuperiorly directed energy such as being struck by vehicles where the underside of the anterior mandible receives the primary force of impact should be suspected of having condylar and subcondylar injuries. Victims of falls are significantly more likely to suffer from symphysis, parasymphysis, and body fractures. Victims involved in interpersonal violence will more commonly receive a blow to lateral portions of the jaw, predisposing these patients to fractures at lateral locations such as the parasymphysis, angle, and condyle. Victims of violent crimes such as assault are statistically more likely to suffer from coronoid fractures.

In the present study, the percentage of single mandible fracture site (62.85%) coincides with other mandible fracture indiceses reported in large centers.[15,37] 34.28% patients presented with two fracture sites and 2.85% with three fracture sites in the mandible.[4] These were found to be statistically insignificant ($P = 0.402$).

The most common mandibular fracture combination in this study was condyle/parasymphysis followed by body/condyle. These often occurred as a result of RTAs, with the mandible presumably fracturing in areas deficient in strength.

Regarding the severity of mandibular fractures, displaced and undisplaced fractures were most commonly seen in males than females which were not found to be statistically significant ($P = 0.76$).

Treatment of mandibular fractures has changed over the last 20 years.[3] In 1989, Arthur and Berardo introduced a simplified technique of maxillomandibular fixation (MMF) by the use of cortical bone screws and stainless steel wire. This technique offers several advantages over traditional closed reduction techniques; including ease of technique, reduced operative time, and diminished chance of glove penetration and transmission of human immunodeficiency virus (HIV) and hepatitis B virus.[38]

There has been a decrease in the use of wire osteosynthesis and intermaxillary fixation and an increase in preference for open reduction and internal fixation with bone plates and screws. This has helped to reduce malocclusion, nonunion, improved mouth opening, speech and oral hygiene, decreased weight loss, and increased the ability for patients to return to work earlier.[3]

Treatment of mandibular fractures continues to be a challenging problem for the facial trauma surgeon.[38] There are many different therapeutic possibilities, but many authors disagree about the best treatment approach.[3]

The treatment of mandible fractures requires adequate fracture reduction and stabilization through a closed or open technique. Success relies on the restoration of normal dental occlusion and bony union.[38] The treatment chosen may differ as there are many factors like cost of treatment, affordability by the patient, feasibility in the hospital, doctor's decision and skill, and patient's willingness to avail the treatment advised; all of which may vary from one country to another.[21]

In the present study, 11 patients (31.43%) were submitted to closed reduction and MMF (using arch bars or ivy loops), three patients (8.57%) were submitted to closed reduction and MMF (using arch bars or ivy loops) followed by physiotherapy, two patients (5.71%) were treated with open reduction and rigid internal fixation using bone plates and screws followed by physiotherapy, and 16 patients (45.71%) were treated with open reduction and rigid internal fixation (ORIF) using bone plates and screws; which is in agreement with other literature studies.[6,8,39,40] And remaining three patients (8.57%) were treated with soft diet and physiotherapy alone.

Closed reduction and MMF treatment was preferred in cases of single, simple, or bilateral fractures; with little deviation or when the number of teeth and dental support provide conditions for the stability of the occlusion. ORIF was advised in patients with partial dentition, multiple, displaced, or severely comminuted fractures. Subcondylar fractures were mostly treated by CR and MMF or ORIF followed by physiotherapy to avoid TMJ stiffness whereas high condylar fractures were treated by soft diet and physiotherapy.

The current preference for the use of miniplates systems in the treatment of mandibular fracture is evident. Increasing cost of equipment and operating time have frequently been considered a disadvantage of miniplate fixation of mandibular fractures. The major advantage of osteosynthesis is the avoidance, or reduction of IMF duration.[4]

In the light of the present study, we speculate that socioeconomic reasons such as poor roads, inadequate enforcement of road safety regulations and speed limits, reluctance to use helmets, decreasing tolerance, and increasing personal competitiveness among young men, could be the possible explanations, in particular in this part of the country.

Hence it is strongly recommended that improving the condition of the roads and driving skills, raising the traffic sense of the general public through campaigns, strict legislation about the use of helmets by motorcyclists and seat belts by front seat occupants, and restriction of use of mobile phones while driving may help to reduce the number of the injuries. In addition, the need to encourage massive investments in safer alternative transport system needs to be emphasized.

Epidemiological reviews of these injuries are needed to identify the risk factors leading to such trauma and help to train medical and dental practitioners to diagnose facial trauma and to provide immediate and long-term treatment.[41] These reviews are useful for reaffirming previously established trends and identifying new patterns of disease frequency. Additionally, the success of treatment and the implementation of preventive measures are more dependent on the epidemiological assessments.[42]

Mandibular fractures occur in people of all ages and races, in a wide range of social settings.[17] It is hoped that such assessments as the one presented here will be valuable to government agencies and healthcare professionals involved in planning future programs of prevention and quantifying demands or services[3] and treatment.[17]

Future scope for the present study includes data collection from all the trauma centers of a particular location with the study conducted for longer duration to confirm the present trend/pattern of variables associated with mandibular fractures of a particular region.

CONCLUSION

In the present study, the incidence of mandible fractures was more prevalent in male patients, especially during the 3rd decade of life. The most common cause was traffic accident and the more frequently affected region was condyle of the mandible. Open reduction and rigid internal fixation using miniplates and screws was the most commonly used treatment.

The coordinated and sequential collection of information concerning demographic patterns of maxillofacial injuries may assist healthcare providers to record detailed and regular data of facial trauma. An understanding of the cause, severity, and temporal distribution of maxillofacial trauma will permit the clinical and research priorities to be established for effective treatment and prevention of those injuries.

Since, the main cause of these fractures proved to be MVAs, any efforts made to enforce traffic and safety rules in the roads and improve traffic culture can be an effective measure to promote the present situation. In addition, the need to encourage massive investments in safer alternative transport system needs to be emphasized.

Since, significant association was found between cause of fracture and the fracture site involved in the present study, more studies are needed to confirm these associations which will help the attending healthcare professional in making quicker and correct diagnosis in all head and neck trauma patients.

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