Original Article - Retrospective Study

Retrospective Analysis of 162 Mandibular Fractures: An Institutional Experience

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Abstract

Objectives: The objective was to evaluate the age, gender distribution, side and site distribution, etiology, and common patterns of the mandibular fractures. **Materials and Methods:** This was a systematic retrospective review of records of 94 patients with 162 mandibular fractures treated in a single institution. **Results:** Of 94 patients, 72 male and 22 female patients belong to the age group of 4–62 years (average 31.57 years). Among the various etiologies, i.e., assault, road traffic accident (RTA), self-fall, workplace injury, and sports-related injury, RTA accounts for 62.76% and self-fall for 18.08% of cases. Of the 100 fractures analyzed, 46% are unilateral fractures and 54% are bilateral. Sides affected among these are left (58%), right (39%), and symphysis or midline (3%). The site distribution is as follows: symphysis – 5; parasymphysis – 64; body – 13; angle – 43; and subcondylar – 37. The most common fracture pattern is the ipsilateral parasymphysis with contralateral angle (21 cases). Open reduction and internal fixation was the predominant modality of treatment. Complications were observed in 27.65% of patients. **Conclusion:** Surveys play a vital role in better understanding the biomechanics of the mandible fractures. Furthermore, analysis of the treatment modalities used and their respective outcomes are of paramount importance in guiding surgeons to evaluate their efficacy.

Keywords: Mandibular fixation, mandibular fractures, retrospective analysis

Introduction

The mandible is immaculate in design with varying strength of bone in different regions, in correlation with stress distribution on function. It is a tubular V-shaped bone that articulates with the skull via paired temporomandibular joints. It is the second most common maxillofacial bone prone to trauma second to nasal bones.[1] Maxillofacial trauma disrupts efficient form, function, and esthetics. The first description of mandibular fractures dates to the 17th century BC in the "Edwin Smith papyrus" brought by Smith in Luxor in 1862 and later translated by Breasted.[2] Management of the mandibular fractures has evolved with time. It has come a long way from the initial use of horse hair as interdental wiring tool, to the present-day use of resorbable hardware and custom-made titanium hardware.[3]

The basis of this evolution in management strategies is largely attributable to a better understanding of the biomechanics of the mandible, its behavior in response to traumatic forces, fracture patterns, etiology, epidemiology, mode of healing, and functional rehabilitation. Hence, it is of paramount importance that the aforementioned variables are further researched to improve our understanding of the mandibular fractures. The objective of this study was to perform a retrospective analysis of patients with mandibular fractures reporting to our institution and to evaluate the (i) age distribution, (ii) gender predilection, (iii) etiology, (iv) site and side distribution of the fractures, (v) common concomitant fractures of the mandible, (vi) treatment protocol, and (vii) postoperative complications.

Materials and Methods

A systematic retrospective analysis of all patients who reported to K.L.E Society's Institute of Dental Sciences, Bengaluru, with maxillofacial injuries between June 2010 and July 2017 was conducted. The study was approved by the Institutional Ethics Committee. Only those patients with either isolated or

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concomitant mandibular injuries operated by a single operating surgeon were included in this study. Out of 103 records, 94 records were selected and nine were excluded for incomplete records because of patient's noncompliance with follow-up of those patients.

All records were reviewed by a single reviewer. Details of patient demographics, etiology of trauma, clinical findings, radiographic findings, treatment performed, and postoperative complications were noted. Radiographs were evaluated for the site and side of fractures, which were correlated with the clinical findings. Orthopantomograms (screening radiograph), posteroanterior skull view, and cone-beam computed tomography were included as radiographic evidence.

Results

Among the 94 records, 72 (76.59%) were male patients and 22 (23.40%) female patients. Male-to-female predilection is 3:1 [Figure 1].

The age range of the patients included in the study is 4–62 years with an average of 31.57 years. The most commonly affected age group is between 21 and 30 years in male patients. Among the various etiologies assessed among the trauma victims, the following are the commonly implicated etiologies: Road traffic accident (RTA) was the most common etiology accounting for 62.76% of cases followed by self-fall (18.08%), assault (13.83%), occupational injury (4.25%), and sports-related injury (1.06%) in the decreasing order [Figure 2]. The presenting chief complaint reported by the mandibular trauma patients was pain (44.68%) and deranged occlusion by 18.08% of patients [Figure 3].

Evaluation of the case history and the radiographic records of the patients selected for the study revealed a total of 162 fractures with 46% of cases with unilateral mandibular fractures and 54% of cases with bilateral mandibular fractures. Left side (58%) of the mandible was affected more than the right side (39%) of the mandible. Mandibular symphyseal fracture accounted to only 3% of the cases [Figure 4].

Parasymphysis fracture (40%) was the most common site followed by mandibular angle (26%), subcondylar fracture (23%), body fracture (7%), and symphysis (4%) [Figure 5]. Concomitant fractures of the mandible were seen in 43 cases (45.74%). Ipsilateral parasymphysis and contralateral angle (21 patients) is the most common fracture pattern observed in patients with bilateral fractures [Figure 6]. In our study, we found one female patient with double unilateral fractures who reported with ipsilateral body and ipsilateral subcondylar fracture secondary to assault.

Treatment strategies employed either open or closed reduction based on clinical findings and situations; 92 patients were treated by Erich arch bar placement along with open reduction and internal fixation (ORIF), cap splint fabrication, and circummandibular wiring as closed reduction technique used in two pediatric mandibular fracture patients.

One hundred and eleven mandibular fractures were accessed via an intraoral approach among which 67 were parasymphysis, 28 angle, 10 body, three symphysis, and three subcondylar fractures. Of the 34 mandibular fractures approached via an

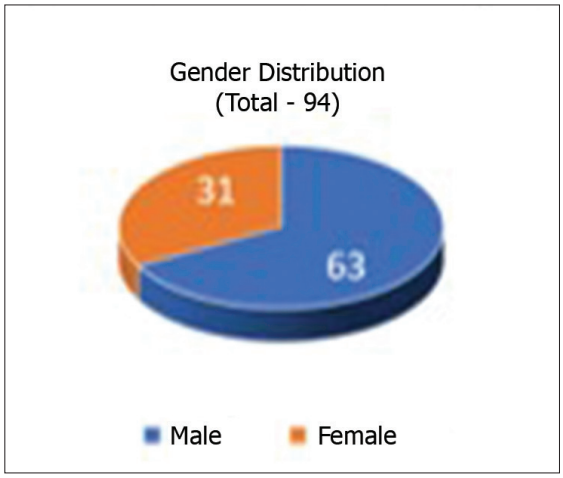

Figure 1: Gender distribution of patients

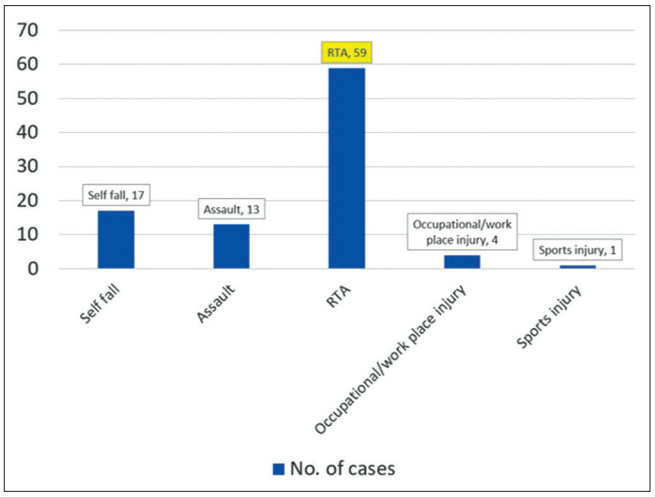

Figure 2: Distribution of cases based on etiology

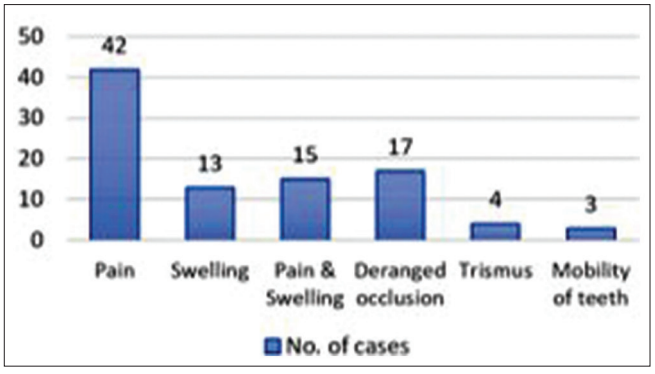

Figure 3: Distribution of patients based on chief complaints

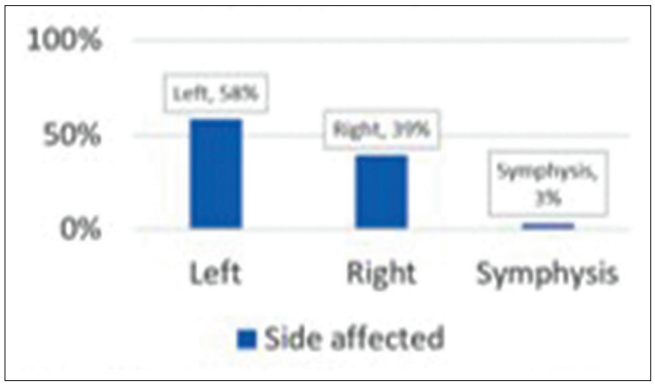

Figure 4: Side distribution of mandibular fractures

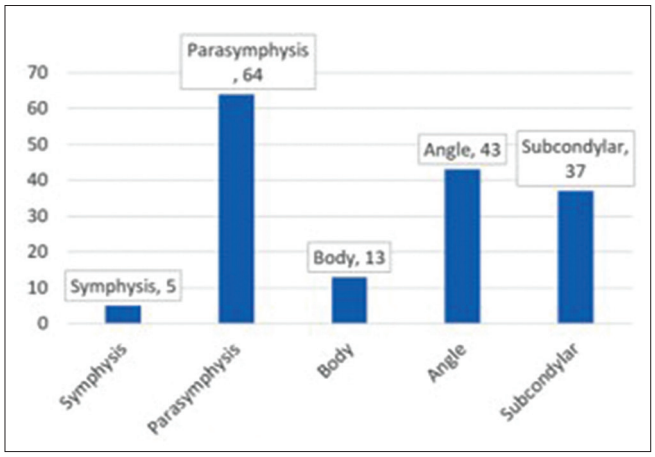

Figure 5: Site distribution of mandibular fractures

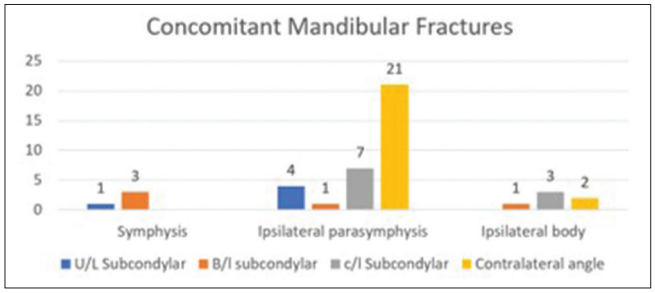

Figure 6: Number of cases with concomitant fractures of the mandible

extraoral incision, 17 were angle fractures, 13 subcondylar fractures, two parasymphysis fractures, and one fracture each of symphysis and body. The latter three were approached through pre-existing lacerations.

Twenty-six patients reported back to the institution with postoperative complication earliest at about 6 months post surgery. Fifteen patients complained of deranged occlusion, seven patients with paresthesia of the lower lip, and four patients with extraoral sinus secondary to infection of the hardware used for ORIF. Patients with deranged occlusion were treated with selective occlusal grinding and functional elastics for a minimum of 2 weeks, which at a later follow-up developed satisfactory occlusion. Patients with paresthesia were prescribed with multi-vitamin tablets, whereas patients who were evaluated with infected hardware underwent surgical removal of the infected mini-plates and screws under general anesthesia.

Discussion

One of the earliest extensive reviews was performed on the incidence and pattern of mandibular fractures by Ellis *et al.*; they analyzed over 3400 mandibular fractures within 10 years between 1974 and 1983.[4] They found a high male preponderance of mandibular fractures between the age group of 21 and 30 years consequent of RTA, i.e., 42.85%. Predominant attributions include reckless and impatient driving, driving under the influence of alcohol, failure to wear protective helmets, and poor road maintenance.[5-7] Similar incidences are found in other studies performed in Central Karnataka, Chennai, and Rohilkand Region, Uttar Pradesh.[5,8,9] The increasing incidence of trauma victims due to RTAs in India is attributed to the increasing incidence of alcohol dependence and drunken driving. Giri *et al*. in their study explain that the high prevalence of intoxication among the affected population points to the growing necessity of a reliably documented and scientifically backed evidence that could hasten the strict enforcement of road traffic legislation with decongestion of roads and formulation of strict drink-and-drive policies, and also, the use of seat belts and safety helmet regulations should be made compulsory.[8]

Assaults and falls contribute to about 35.71% of the patients among the same age group. A common factor in both etiologies is the involvement of alcohol. Mandibular parasymphysis fracture is the predominantly affected site of the mandible in all maxillofacial trauma victims, accounting to 42% of the cases, followed by mandibular angle 26%. Reviewing the side distribution, the left side has a marginally higher predilection as compared to right. Symphyseal fractures have the least incidence.

Contradictory to our study, Morris *et al*., in their retrospective analytical study of 4143 fractures in 2128 patients, found that the highest number of fractures occurred at the mandibular angle (1123), followed by the mandibular symphysis (882), condyle/subcondylar complex (761), body (695), and ramus (225). It is the opinion of these authors that a specific association between different locations of fractures is an important consideration when performing clinical assessment of a patient with a mandible fracture. Knowledge that one particular type of fracture may be more likely with a fracture at another location can aid in diagnosis.[10]

Morris *et al*. in their study found that the mandibular body is most often associated with concomitant angle fractures (52.5%) followed by condyle fractures (27.7%).[10] However, in our study, we found that the most common concomitant fracture was an ipsilateral parasymphysis with contralateral angle fracture in 22.34% of the patients, while the next common pattern occurring together was with contralateral subcondylar

fracture (16.27%). A similar finding was also found in a study performed by Patel *et al*., who analyzed the mandibular angle fractures in detail; they reported 100% involvement of contralateral angle fracture with a parasymphysis fracture in their evaluation of patients with multiple mandible fractures.[11] Dongas and Hall also found similar incidence in their study similar to the present study.[12]

It was noticed that many of the assault victims suffered from mandibular fractures of the left side of the mandible; the reason behind this occurrence is that most of the Indian population are right-handed individuals. According to McManus, Professor of Psychology at University College London, approximately 90% of humans are right-handed, explaining why the left side of the face is the most common location of the injury.[13] Only three out of the 11 assault victims filed a medico-legal complaint before their treatment in our institution. It is possible that the other eight victims failed to seek medico-legal aid because the offender is a family member/friend, a prolonged period to be served justice, fear of legal officers, financial limitations, commitment of time, or even guilty of being the co-offender.

In our study, only one female patient reported with double unilateral fractures involving ipsilateral parasymphysis and ipsilateral subcondylar region caused by physical assault. In general, the unique shape of the mandible tends to make double unilateral fractures rare. The incidence of multiple unilateral mandibular fractures has been rarely reported.[14] Cillo and Ellis described the management of double unilateral fractures in their study involving 31 cases. The common pattern observed was mandibular angle and body in 58% of cases, while the least common was mandibular condyle and angle.[15]

All patients who underwent ORIF were treated following the Champy's principles and Meyer's lines of osteosynthesis. Various osteosynthesis materials are available in the market, each having their own indications, contraindications, advantages, and disadvantages. Few of these modalities include lag screws, mini-plates – locking/nonlocking (titanium or stainless steel), dynamic compression plates, eccentric dynamic compression plates, three-dimensional strut plates, and reconstruction plates. We, at our institution, used titanium nonlocking mini-plates for ORIF in 89 patients, locking mini-plates in nine cases, and four patients were treated with three-dimensional strut plates, particularly in mandibular symphysis fracture (2 patients) and parasymphysis fracture (2 patients).

Myall mentioned that the aims of treatment in the management of pediatric mandibular fractures are to obtain bony union, to normalize the occlusion, to restore normal form and function, and to avoid impediments to normal growth. Conventional wisdom tells us that to best fulfill these aims, the bony fragments must be accurately aligned. However, perfect alignment is not always necessary for complete success. Children differ from adults in that the final result is determined not merely by the initial treatment but also by the effect that the growth has on form and function over time. Minor malocclusions left during the deciduous or mixed dentition stages will be corrected by eruption of teeth or growth of the alveolus. Minor bony irregularities will likewise be remodeled by growth if normal function is maintained.[16]

Two pediatric patients included in this review were treated conservatively with the use of open cap splint and Circum-mandibular wiring for 2 weeks. One year follow-up of both the patients revealed no postoperative complications or growth disturbances.

Many practitioners use intraoral approach for access to the fracture site citing ease of access, absence of extraoral scar, and patient or surgeon preference as their reason. One hundred and eleven fractures were accessed via an intraoral approach and 34 via extraoral approach. Of the 34 fractures accessed extraorally, two parasymphysis, one symphysis, one body, and five angle fractures were included because of the presence of preexisting laceration. The rest of the 12 angle and 13 subcondylar fractures were accessed either via submandibular incision or retromandibular incision for better esthetic result.

Intermaxillary fixation (IMF) has long been used as a primary as well as an adjunctive treatment modality for mandibular fractures along with internal fixation. While Champy *et al*. was among the first to find that the use of a single plate without postoperative IMF resulted in minimal complications,[17] other authors believe that placing all patients in postoperative IMF is beneficial because IMF might help to form an oral mucosal seal thus allowing undisturbed healing of intraoral incisions, helps in initial stabilization of occlusion particularly in cases with nonrigid fixation and trains the patient to become accustomed to a liquid diet.[18] However, we have limited use of functional elastics to manage the post-operative mild-to-moderate derangement of occlusion. Postoperative IMF was employed in only three of the patients who were treated by closed reduction of mandibular subcondylar fractures.

Complications involving mandibular fractures are a consequence of myriad of factors. They may be secondary to original injury, a result of the subsequent treatment, or, in some cases, a result of failure to render treatment. Complications of the mandibular fractures have an increased relevance because of the important role that the mandible plays in the establishment of occlusion, function, and facial esthetics.[19]

Postoperative complications of the mandibular fractures include malunion, nonunion, neurosensory deficit, infection, and temporomandibular joint problems such as ankylosis. We experienced a total of 27.65% complication rate in the form of deranged occlusion (15.95%), neurosensory disturbance of the inferior alveolar nerve (7.04%), and infected hardware (4.25%). Deranged postsurgical occlusion among these patients was successfully managed with functional elastics and soft diet for 2 weeks. While treating mandibular fractures, the inferior alveolar nerve, mental nerve, and marginal mandibular nerve are more prone to injuries. Evaluation of neurosensory deficit was done both pre- and post-operatively by performing the

two-point discrimination test. Overzealous exposure and retraction of segments, improper drilling, and inappropriate placement of plates and screws have been implicated in postsurgical nerve dysfunction.[19] Patients with postoperative neurosensory deficit were prescribed multi-vitamin tablets for 1 month and were kept under follow-up. All patients showed signs of improvement with resolution of symptoms over postoperative follow-up of 6 months. According to the literature, the incidence of posttrauma nerve deficit of inferior alveolar nerve ranges from 5.7% to 58.5%. The prevalence of inferior alveolar nerve deficit after fracture treatment ranges from 0.4% to 91.3%.[20,21]

Four of the patients reporting with extraoral draining sinus were managed surgically, all of whom underwent removal of infected hardware under general anesthesia. The curettage and excision of the extraoral sinus tract were done with achievement of primary closure. These patients were also prescribed with 5 days course of antibiotics, i.e., cefotaxime 1 g, two times daily intravenous, and metronidazole 500 mg, thrice daily intravenous.

Conclusion

Stratification of data obtained from various epidemiological studies and retrospective analysis of maxillofacial trauma victims will help increase the trauma database, helping practitioners in understanding the variables and outcome of maxillofacial fractures.

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Conflicts of interest

There are no conflicts of interest.

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