MANAGEMENT PROTOCOL OF MANDIBULAR FRACTURES AT PAKISTAN INSTITUTE OF MEDICAL SCIENCES, ISLAMABAD, PAKISTAN.

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Background: Maxillofacial trauma is very frequent and associated with a high incidence of mandibular fractures. Although there is universal agreement as to the treatment goals and basic therapeutic principles of reduction and stabilization, a variety of currently accepted treatment modalities indicate a lack of consensus. The authors evaluate the incidence, etiology, management and complications of 344 mandibular fractures in 228 patients treated in the Department of Plastic and Reconstructive Surgery at Pakistan Institute of Medical Sciences (PIMS), Islamabad, Pakistan, during a three year period. Indications and techniques for closed and open treatment of mandibular fractures are reviewed along with any complications of these fractures or their management. **Methods:** A total of 344 mandibular fractures in 228 patients were included in this study. The sex, age, etiology, presentation, fracture characteristics, associated injuries, various methods of management and any pre or postoperative complications were evaluated. **Results:** Although various devices and techniques have been used to treat these fractures, modern plate and screw fixation systems have proved to provide the best rigid stabilization, early mobility and associated with least complications. There was a satisfactory bone healing in all the patients and a minimal complication rate associated with open reduction and internal fixation (ORIF). **Conclusion:** Mandibular fractures occur with high frequency in road traffic accidents and interpersonal violence. They are among the most common types of facial fractures treated by the plastic surgeons. They must be managed carefully to maintain the function of the mandible, re-establish proper occlusion, and minimize secondary complications. Open reduction and internal fixation has proven to be the most effective method for treatment of mandibular fractures.

Key Words: Maxillofacial; Trauma; Fracture; Mandible; Management

INTRODUCTION

Maxillofacial trauma is a major cause of mortality and morbidity worldwide. It is a frequent occurrence in Pakistan and is associated with high incidence of facial fractures in different combinations. Mandibular fractures are one of the most common facial fractures.[1-6]

Some of the most severe injuries are caused by automobile accidents but many others result from interpersonal violence, industrial accidents, sports, home accidents and missiles or gun shots.[7] Road traffic accidents (RTA) have been reported as a leading cause of mandible fractures in many third world countries while interpersonal altercations are mainly responsible in the developed countries.[8-10] The differences reflect a lack of traffic regulations including seat belt and helmet enforcements, absence of air bags in the vehicles and poor road infrastructure in the underdeveloped and alcohol abuse in the developed countries.[11-13] Countries where the use of seat belt and safety helmet regulations have been made compulsory showed a decrease trend of mandibular fractures associated with RTA as compared to the past.[14,15] Mandible fractures overwhelmingly occur in young males.[3,16-18]

Although there is a universal agreement as to the treatment goals and basic therapeutic principles of reduction and stabilization, a variety of currently accepted treatment modalities indicate a lack of consensus.

Pakistan Institute of Medical Sciences (PIMS) is a tertiary care hospital located in Islamabad, Pakistan and caters for a vast population of patients from neighbouring areas as well as Azad Jammu and Kashmir regions. There are two hospitals in the area that take care of maxillofacial injuries, one for military patients and the other (PIMS) for civilian population.

During a three years period from September 1997 to October 2000, 270 patients with maxillofacial injuries, out of which 228 had mandibular fractures, were treated at the Department of Plastic and Reconstructive Surgery, PIMS. A total of 344 mandibular fractures were found in these 228 patients through clinical evaluation, plain radiographs and computerized tomography (CT) scans.

This prospective study was designed to determine the various aspects of mandibular fractures in our society. The incidence, sites of involvement, etiology, management protocol followed, indications

for closed reduction or open reduction, and any pre or postoperative complications was evaluated in these 228 patients presenting to PIMS.

MATERIALS AND METHODS

A prospective study of 270 patients with maxillofacial injuries presenting at PIMS during a three years period from Dec 1997 to Oct 2000 was carried out. Accurate record of the history, etiology, investigations, fracture characteristics, type of treatment, complications, and results was maintained.

The management started with immediate resuscitation following the principles of advanced trauma life support (ATLS). Plain anteroposterior (AP) and lateral facial radiographs, Orthopantomogram (OPG) and occipitomental (OM) or Water's view was done in all the cases. An axial, coronal and 3-D CT scan was obtained in patients with multiple facial factures, mandibular condyle or subcondylar fractures. An accurate assessment of the fractures was made including the site and type of fracture, the amount of displacement, amount of pain or discomfort, anaesthesia in the distribution of inferior alveolar nerve, marginal mandibular nerve paresis, the status of dental occlusion, any associated temporomandibular joint (TMJ) dislocation, or any other functional deficits.

All cases were operated upon within 48 hours of initial presentation on elective operation schedule. Seven patients were operated in emergency for panfacial fractures. Antibiotic prophylaxis was given in all cases. In cases of treatment delay, we used a Barton bandage to obtain dental occlusion and decrease pain.

Two forms of treatment modalities were used. Closed reduction (CR) along with mandibulo-maxillary fixation (MMF) was performed in isolated body and angle fractures, with no displacement, good occlusion and minimal pain, or in edentulous, atrophic mandible. MMF was achieved using arch bars, ivy loops or suspension screws. ORIF was used for symphyseal, parasymphyseal, displaced body and angle, or multiple fractures. An intraoral buccal sulcus incision was used for parasymphyseal and body fractures with care taken to avoid injury to the mental nerve and its branches. Either an external or intraoral approach was used for access to angle or ramus fractures. Reduction was achieved by putting the patient into normal dental occlusion and MMF. Once this was established, ORIF was done. Rigid fixation was carried out with the help of lag screws, mini plates, and direct compression plate (DCP) or reconstruction plates. MMF was either removed at the end of the procedure when two plates were used, or continued for 2 to 3 weeks when a single plate was used or when the stability of the internal fixation was suspicious, such as in comminuted fractures or with concomitant subcondylar fracture.

Condylar fractures were mostly treated by CR and MMF. Indications for ORIF in condylar fractures were displacement into the middle cranial fossa or failure of closed reduction to reestablish pre injury dental occlusion.

The post treatment care of closed or open reduction included nutrition consultation of jaw-wire diet, stress upon oral hygiene, and physical therapy. Patients were assessed weekly for two weeks, then fortnightly for one month, to observe any pain at the fracture site, wound infection, paresis in the distribution of mandibular or inferior alveolar nerves, paresthesias, malocclusion and maintenance of MMF. OPG was repeated 6 weeks post operatively to determine evidence of bony healing. MMF was then removed (when done with CR), and physiotherapy advised to avoid TMJ stiffness. Mobility of TMJ and the time of return to work were noted. They were followed on monthly basis thereafter observing any nerve paresis, paresthesias, malocclusion or pain at the fracture site which would signify bone infection or nonunion. OPG was repeated after 3 months to determine the progress of bony healing. They were discharged from outpatient care, once satisfactory bone healing was observed on OPG, no pain at the fracture site or any residual TMJ stiffness was present and the paresthesias had settled down.

RESULTS

Out of the 270 patients with maxillofacial injuries, 228 were proven to have a single or multiple mandibular fractures. These 228 patients had a total of 344 mandibular fractures, with an average of 1.5 fractures per person.

85% patients were male, mean age being 26 years. 80% of cases had history of RTA followed by gunshot wounds, interpersonal violence and falls as etiological factors in the remaining patients.

Mandible was fractured in isolation in 58% and in combination with other facial fractures in 42% cases. Solitary mandibular fracture was found in 54% while multiple mandibular fractures were seen in 46% of patients (Figure1). The most commonly fractured site was parasymphyseal region followed by body, angle, condyle and ramus (Figure 2).

Regarding treatment modalities, 210 fractures (61%) were treated by ORIF alone, 80 fractures (23%) with ORIF plus short duration MMF and 54 fractures (15%) with CR plus MMF (Figure 3).

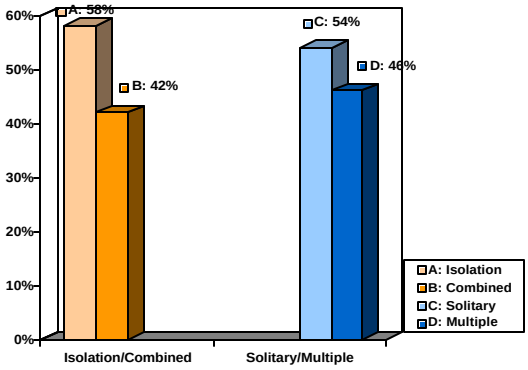

Figure 1. Mandible fracture statistics

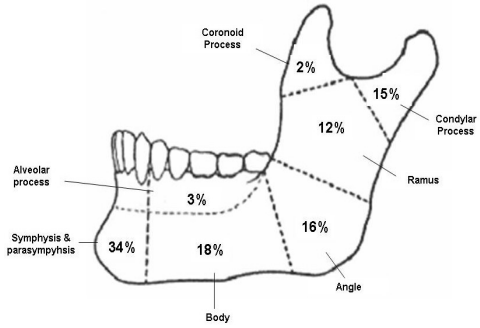

Figure 2. Percentage of fractures occurring in different regions of the mandible.

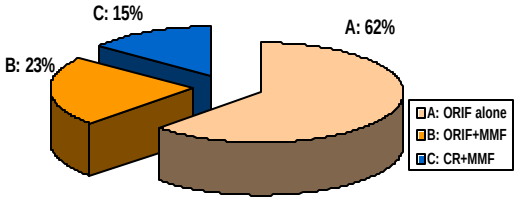

Figure 3. Different treatment modalities used for management of mandibular fracture.

There was good bone healing noted in all the patients in the follow up OPG. No residual TMJ stiffness was noted in the patients treated with ORIF alone. After CR and MMF, patients had some stiffness, which improved with TMJ exercises and completely resolved in six months time. The average time of return to work in case of CR and MMF was 3 months while in ORIF it was one and a half month post injury.

A complication rate of 4 % with CR and MMF vs. 3.2% in the ORIF patients was noted. The difference was mainly due to late return to work and residual stiffness of TMJ in patients with MMF alone. Other complications included minor wound infection (04 patients) and paresthesias that subsided within 6 months. There was no case of bone infection, malunion, non-union or any iatrogenic nerve (V3) injury.

DISCUSSION

Maxillofacial injuries are not uncommon in Pakistan.[3,6] The frequency of facial injuries is high because the face is exposed and has a little protective covering. A unique aspect of facial injuries is that the restoration of appearance may be the chief indication for treatment.[19]

Mandible is the most commonly affected bone in a number of series.[3,5,6,12,20] Bilateral body or angle fractures can result in airway distress.[18] Concomitant injuries must be ruled out, and the principles of ATLS should be followed. In cases of mandible fractures secondary to interpersonal conflict, loss of consciousness occurs in about 20%, and the possibility of closed head injury should be considered.[21]

The parasymphyseal and body region were the most affected sites in our study, and same has been reported in some western studies.[22] Plain radiology, such as a Panorex, is very helpful and has been proved to diagnose 92% percent of mandible fractures.[23] It is also useful as a post reduction radiograph. A maxillofacial CT scan may be useful if the patient has multiple midface injuries, is in a cervical collar, or cannot otherwise undergo panoramic radiography. The three-dimensional reconstructions may be useful in planning treatment or if the axial cuts appear confusing.[18]

Mandibular fractures are mostly described by anatomic location in the mandible and whether they are displaced, comminuted, or "greenstick." They may also be classified as either favorable or unfavorable, based on the location and configuration. Favorable fractures are those that are nondisplaced and include most ramus fractures. Angle fractures that extend posteriorly and downward are horizontally unfavorable and tend to be displaced by the muscles of mastication. Symphyseal and parasymphyseal fractures tend to be vertically unfavorable and are displaced by the downward pull of the suprahyoid musculature. High condylar fractures are considered unfavorable and are often displaced medially by the lateral pterygoid muscle.[18]

Definitive repair of a mandibular fracture is not a surgical emergency, and treatment is often delayed in a patient with multiple injuries. A recent study shows attempts to manage these patients within 24 to 36 hours of injury, to minimize patient discomfort and expedite hospital discharge, as well as to avoid maximal soft-tissue edema and fibrinous deposition within the fracture.[18] In cases of treatment delay, a Barton bandage is frequently used to obtain dental occlusion and decrease pain.[24] Special

consideration should be given to teeth in the line of fracture. A loose tooth is not necessarily an indication for extraction. A tooth extraction is recommended if a comminuted or displaced fracture contains a tooth, if the tooth root is fractured, if there is periodontal disease or an abscess near the fracture line, or if the tooth is functionless because of lack of opposing teeth. [25]

Indications for closed reduction of mandibular fractures remain controversial but may include nondisplaced or grossly comminuted fractures, fractures in the presence of mixed dentition or in an atrophic mandible, and fractures of the coronoid or condyle.[18] Closed reduction is commonly achieved by MMF using arch bars, ivy loops, or suspension screws and wiring.

Indications for open reduction and internal fixation of mandible fractures include most symphyseal and parasymphyseal fractures, displaced body and angle fractures, and certain condylar fractures. Reduction can often be achieved with application of MMF. Additional reduction may be achieved with the use of plate and screws. Indications for use of MMF after open reduction and internal fixation include the presence of a concomitant subcondylar fracture, if a single plate is used without a tension band or when the stability of the internal fixation is in question, such as in comminuted fractures.[18] Lazow showed good results with a 2- to 3-week period of MMF after performing open reduction and internal fixation, with a complication rate of only 3.4%. [26]

A recent review provided by Alpert et al, describes the three basic types of rigid fixation: stabilization by compression, stabilization by splinting, and semi rigid fixation.[27]

The indications for the use of compression plates remain controversial, as the plates are technically difficult to use and may cause malocclusion and there are no studies showing their superiority versus other fixation methods. Compression plating of mandibular fractures may result in higher rates of complications, especially infections.[27]

Lag screws may be used for compression if the fracture line is favorable and if the fracture is noncomminuted. Usually, two lag screws, at least 20 mm in length, are sufficient for stabilization. When treating a parasymphyseal fracture, two long lag screws can be criss-crossed across the vertical fracture line.[28,29]

A locking reconstructing plate can be used when the fragments are small and comminuted and compression is not needed. Internal fixation is achieved by locking the screw to the plate rather than compressing each fragment of bone to the plate. Semi rigid fixation can be performed using a small plate with 1.5- to 2.0-mm unicortical screws. The advantages are the limited periosteal stripping of the fracture site.

There are a few absolute indications for open reduction and internal fixation on condylar fractures: displacement into the middle cranial fossa, impossibility of obtaining dental occlusion by closed reduction, lateral extra capsular displacement of the condyle, presence of a foreign body, or open fracture with potential for fibrosis.[30] Relative indications include bilateral or unilateral condylar fractures along with mid face fractures, comminuted symphysis and condyle fracture with tooth loss, displaced fracture resulting in open bite or retrusion in mentally retarded or medically compromised adults who would not tolerate intermaxillary fixation, and displaced condylar fractures in an edentulous or partially dentate mandible with posterior bite collapse.[18] The absolute contraindications to open reduction and internal fixation of condylar fractures are fractures at or above the ligamentous attachment (single fragment, comminuted, or medial pole) or when other injury or illness precludes extended general anesthetic risk.[31]

Recently there have reports on the use of absorbable plates and screws.[32] The role of absorbable plates in the treatment of mandible fractures continues to evolve and has implications in the treatment of the child's growing mandible.

In various studies, complication rate ranges from 7 to 29%,[33,34] and has been correlated to the severity of the fracture. In our study, the complication rate was found to be 3.2% with no significant difference between the CR and ORIF. Lois et al, found no difference in the complication rate of fractures treated by MMF (4.3%) versus open reduction and internal fixation (5.4%).[35]

Wound infection is the most common complication in all types of mandibular fractures.[15] Other complications that occur less often, include malocclusion, nonunion, malunion, tooth loss, trismus, ankylosis, deviation, unsightly scars and paresthesias.

Normal bony union of mandible takes place over 4-8 weeks, depending on the age of the patient. A nonunion occurs when bony union has not occurred within this time period.[36] The radiographic appearance is one of sclerotic bony margins and a gap where bone has not bridged the fracture site. Many of these fibrous nonunions will eventually convert to a bony union. Inadequate mobilization, incomplete reduction, infection, poor blood supply, and nutritional/metabolic alterations are the most frequent causes of nonunion in mandibular fractures.[37]

CONCLUSION

Fractures of the facial skeleton are frequently encountered by the plastic surgeon. They must be managed carefully to maintain the function of the mandible, re-establish proper occlusion, and minimize secondary complications. Open reduction and internal fixation with plate and screws has

proven to be the most effective method of rigid fixation, associated with minimal morbidity and early mobilization and return to work.

Countries, where the use of seat belt and safety helmet regulations have been made compulsory, showed a decreased incidence of mandibular fractures associated with road traffic accidents as compared to the past. Hence it is strongly recommended that the existing infrastructure be improved upon, Highways be decongested and traffic laws be enforced amongst road users. In addition, the need to encourage massive investments in safer alternative transport system needs to be emphasized.

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