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Mandibular Ramus Fracture and Treatment Planning: A Review

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Abstract

The Mandibular bone is an important anatomical and functional, v-shaped component of the facial bone, which has a dynamic role in, speech, and facial esthetics. Considering this important functions of Mandibular bone, it is utmost important for the surgeons should not only treat function but also consider the esthetics together. The purpose of this article is to study the fracture pattern of Mandibular ramus, which is rare and to devise a classification proposed by different authors and to facilitate management.

Keywords: Mandibular ramus, temporomandibular joint, mandibular fractures.

Introduction

The mandibular bone, is an important anatomical and functional structure, constitutes the lower height and width of the facial skeleton. It is a complex bony structure and has a vital anatomical articulation with other cranio-maxillofacial components. It functional integrity deals with digestive system in speech and facial expression. The mandible is a v shaped bone articulating with the temporal bone at the temporomandibular joint (TMJ). Mandibular bone has a horizontal and vertical portion[1]. The mandible is the largest and strongest bone of the face but it is very frequently fractured (second to the nasal bone) because of its position. Mandibular fractures account for twice the number of midface fractures which

comprise the majority of injuries treated by an oral and maxillofacial surgeon. The incidence of ramus fractures is quite low among mandibular fractures and rank just above the least encountered fractures of the coronoid and alveolar processes [3].

Etiology (epidemiology)- The sole reason for fracture are due to different etiologies such as interpersonal violence, traffic accidents, gunshot wounds, sport accidents, work accidents, and falls. The etiology of mandibular fractures varies from time to time, culture to culture. In developed countries, vehicle and sport accidents are main causes of mandibular fractures, while in developing countries and rural areas, inter personal violence, gunshot wounds, and falls in foregrounds[1].

Biomechanics- The mandibular bone is exposes to many kinds of linear and angular forces such as compression and tension, shear, torsion, and bending. External forces cause mandibular bone to undergo plastic and elastic deformation. Contrarily, muscles have some vertical and horizontal forces on fragments. These forces causes displacement of fragments or may stable the fracgment. The temporalis, masseter, and medial pterygoid muscle pull are responsible for vertical displacements of fragments. Horizontal displacements are mainly caused by lateral and medial pterygoid muscle pull. Some muscles have complex force on fragments such as mylohyoid, digastric, and geniohyoid which have a torsion effect on fragments. Champy and co-workers described a zone of tension in the alveolar part of the mandible and a zone of compression on the lower border. This information allowed ideal lines for mandibular internal fixation to be identified along the physiological tension lines[1].

Figure1: Tension zone marked in red (−) and compression zones marked in blue (+)[1]

Figure 2: Champy's principle of osteosynthesis lines[1]

Classification of Mandibular ramus fracture- Anatomically the ramus is located between the subcondyle and angle of mandible. Fractures in this area have been observed to run obliquely or horizontally. No classification exists for such fractures, as a result of which there is a dearth of understanding about their management and, generally, are either left untreated or treated[3]. A proposed classification was given by Dr. Padmini agarwal, and Dr. Divya Mehrotra, in their respective article[3]. They have classified the Mandibular ramus fracture as Classification of Mandibular Ramus Fractures. Type I: Vertical/oblique fracture line extending from the sigmoid notch to either the inferior border or angle of mandible. Type II: Vertical/ oblique fracture line extending from coronoid process to either the inferior border or angle of mandible. Type III: Horizontal fracture line extending from anterior border to posterior border of ramus of mandible. Type IV: Oblique fracture line extending from posterior border of ramus to inferior border of mandible (separating the angle segment). Type V: Comminuted fracture of ramus of mandible (may cause isolated fractures of the coronoid, condyle, and the angle of mandible)[3].

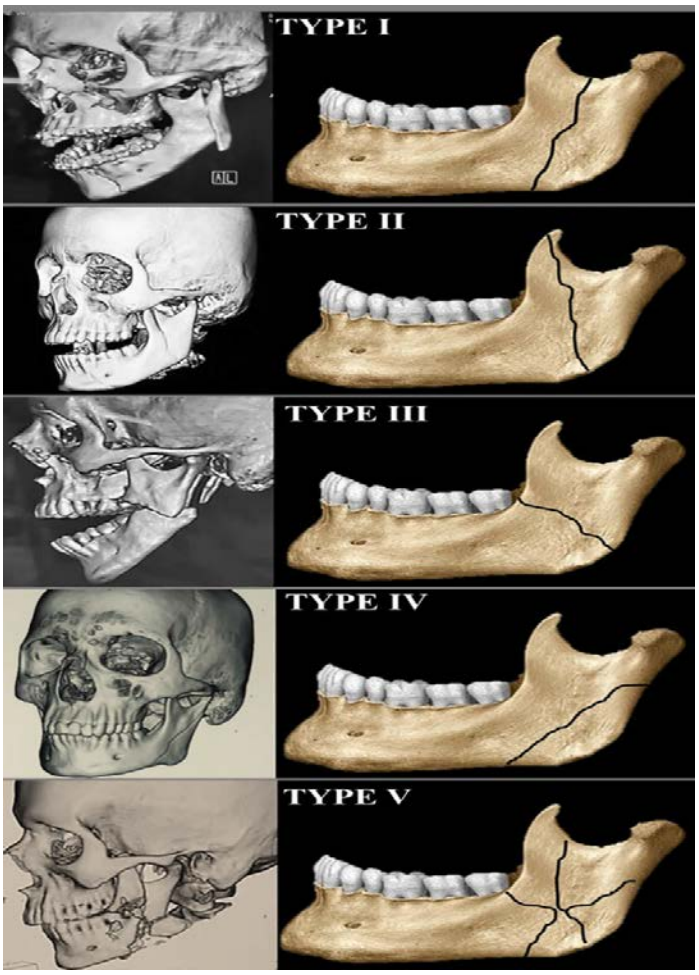

Figure 3: classification of mandibular ramus fracture[3].

Evaluation

Initial Assessment Patients should be assessed in accordance with the Advanced Trauma Life Support protocol. Life-threatening injuries should be recognized and treated accordingly[2].

Radiographs

CT is the current diagnostic tool of choice for the radiographic evaluation and diagnosis of mandible fractures. Most patients with mandible fractures, particularly in the setting of polytrauma, present to an emergency room and undergo initial computed tomographic (CT) imaging to evaluate for cervical spine (C-spine) and other concomitant injuries[2]. Although panoramic tomography used to be the gold standard, is cost-effective, and useful in the assessment of dental trauma, certain fracture patterns may be missed, particularly in the posterior mandible[2].

Examination

On exam, the physician should bimanually palpate the fracture site to check for fragmentmobility. A lackofmobility indicates a stable fracture that may be amenable to conservative management, provided the occlusion has not been altered. Intraoral lacerations, injuries of the soft tissues, and hematomas at the fracture site are also important to note as these may lead to an increased risk of infection. Ecchymosis of the floor of the mouth is classically pathognomonic for mandibular fractures. The dental status of the patient should also be evaluated. Loose teeth are extremely common following facial trauma and should be noted during the initial assessment. Exceedingly carious or damaged teeth, particularly at the fracture site, should prompt consideration of extraction. Tooth extraction is recommended if the tooth is (1) luxated from its socket and/or interfering with fracture reduction, (2) fractured, (3) has advanced dental caries carrying a significant risk of abscess, (4) has advanced periodontal disease with mobility that would not contribute to establishing stable occlusion, or (5) has existing pathology such as cyst formation and pericoronitis. There are certain situations in which teeth in the fracture line can be left in place as they can provide a larger repositioning surface. They can also be used for the application of tension bands in certain cases and do not cause delayed healing when treatedwith a closed reduction[2].

Clinical sign and symptoms of mandibular ramus fracture-

Clinical symptoms of ramus fractures include pain and swelling over the region with trismus. Step deformity is relatively uncommon owing to the overlapping muscular sling although angle deformities are present in type III

fractures. Anterior open bite was wide and most common in type III fractures, and mild anterior open bite combined with occasional occlusal discrepancies is present in types I, II, and V fractures. Type IV fractures were mostly asymptomatic with tenderness around the angle. Bony overlap/ crepitus along the fracture line was present in types I, II, and V. The absence of segmental mobility and overlapping symptoms due to contiguous fractures (as ramus fractures seldom occur isolated) make radiographs indispensable for a final diagnosis and for differentiating from adjacent fractures of the mandible. Diagnosis can be easily confirmed by orthopantomograms and computerized tomography scans[3].

Management

Ramus fractures are generally associated with other facial fractures and seldom occur isolated, similar to our patients. In cases where closed reduction of ramal fractures is performed, the concomitant fractures should be subjected to ORIF. When opting for ORIF of the fractured ramus, Risdon's submandibular, retromandibular, transmasseteric, or transparotid incisions were used for surgical exposure. Intraoral or transbuccal approaches only give limited access in this region. ORIF provides advantages of early functional and anatomical rehabilitation with easier maintenance of a patent airway and oral hygiene with improved nutrition. For ORIF, we fixed the ramus at 2 points because of the large rectangular surface area of the mandible as plating at the superior or inferior border only can result in torquing forces that may lead to opening up of the fracture on the opposite side[3]. Fixation can be done by load sharing fixation using 2 non-compression mini-plates or 3-D plates. Few authors have also advocated the use of three 2-hole non-compression mini-plates along the fracture site for 3-point stabilization owing to the length of the fracture line in such cases.16 However, 2 such plates at both ends of the fracture line were also found to be sufficient, conferring adequate anatomical and functional reduction. Type III fractures were efficiently managed by 3-D plates/rectangular/trapezoidal/ strut plates. Type IV fractures did not require any form of intervention due to their anatomical advantage, but in cases of gross displacement, aesthetic compromise, load sharing fixation could be acceptable. Type V fractures needed mini-plates for orientation and load bearing fixation in the form of reconstruction plates.

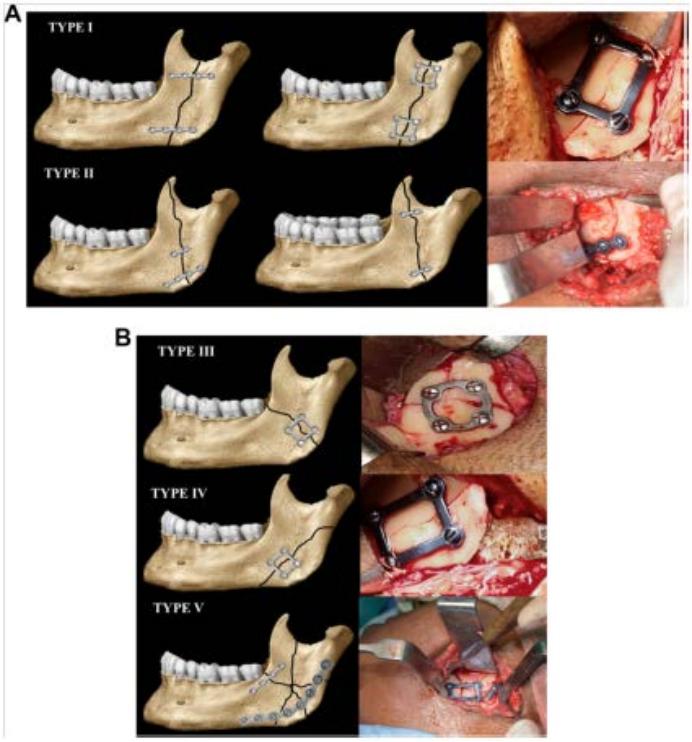

Figure 4: Open Reduction and Internal Fixation (ORIF) performed: A, Two-point ORIF done with one plate near the lower border for types I and II. B, Choices for fixation for types III, IV and V[3].

Discussion

The purpose of this article was to review and study ramus fractures and to re-introduce a classification that was previously described by different author. The aim of mandibular fracture treatment is the restoration of anatomic form, function with particular care to reestablishment of occlusion, and facial aesthetics, which

is often contingent on a precise bony reduction and immobilisation. A less precise bony reduction may be acceptable if there are no opposing teeth or in an edentulous smandible. This can be achieved with MMF alone or in combination with surgical exposure and internal fixation. The controversy of treating ramus fractures by either ORIF or closed treatment can be debated and discussed at length as there is lack of evidence based literature for its management till date[5].

Conclusion

Within the limitations of the current study, we conclude that ramus fracture is a relatively rare subsite to get fractured amongst mandible fractures. Mandible is one of the the main skeletal component of the face and their fractures are among the most common traumatic injuries of the maxillofacial region which jeopardize both esthetic and function patients. The occlusion, form, and function should be all considered in the managements of mandibular fractures.

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