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Review Article

Favorable and unfavorable maxillofacial comminuted fractures

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ABSTRACT

Many maxillofacial injuries were reported with the most common ones being nasal bone injuries. In another context, injuries occurring to the mandible followed by the malar bone and axilla are the most common injuries that require surgical interventions. However, favorable outcomes regarding the management of these injuries are associated with many factors. Such factors include the severity of the fracture and the presence of associated morbidities and other fractures, which might lead to unwanted complications and complex management plans. In this study, we aim to discuss the most reported maxillofacial fractures, elaborating when favorable and unfavorable events can be detected. Moreover, this literature review discusses some challenges that might be present in some cases, requiring the integration of certain management skills and techniques. Providing adequate examination is essential to conduct better management. Caring for the associated fractures with the main event is also important, and should be considered to intervene against the development of any adverse events.

Keywords: Communited fracture, Maxillofacial fractures, Favorable, Unfavorable, Management

INTRODUCTION

Maxillofacial trauama cases can attribute to many emergency room admissions. Examination and management of these types of injuries might be challenging due to the presence of facial trauma, reduced patient cooperation, and inadequate examination.1 Maxillofacial injuries can be variable with those occurring to the nasal bones are considered the most common types of traumas.[1-4] In another context, injuries occurring to the mandible followed by the malar bone and axilla are the most common injuries that require surgical interventions.[1-3] Favorable outcomes regarding the management of these injuries are associated with many factors. Such factors include the severity of the fracture and the presence of associated morbidities as well as other fractures, which might lead to unwanted complications and complex

management plans.[5-7] Accordingly, the aim of this literature review is to discuss the most reported maxillofacial fractures, elaborating when favorable and unfavorable events can be detected.

METHODS

This literature review is based on an extensive literature search in Medline, Cochrane, and EMBASE databases which was performed on 19th June 2021 using the medical subject headings (MeSH), and a combination of all possible related terms. This was followed by the manual search for papers in Google Scholar while the reference lists are included at the end of this research.[8,9] Papers discussing maxillofacial fractures were screened for relevant information, with no limitation placed on date, language, age of participants, or publication type.

DISUCSSION

Many fractures can occur in the different parts of the maxillofacial region. Accordingly, the management modalities for each type of fracture differ greatly according to the site and severity of the fracture. In the following section, we discuss the different types of maxillofacial fractures, and whether the management requires the integration of certain techniques to obtain better outcomes and avoid the development of adverse events.

Mandibular and palatal fractures

The development of these types of fractures usually requires the integration of certain efforts. They are usually associated with the development of malocclusion which might have significant morbidity and adverse events on the affected patients. Regarding types of maxillofacial fractures, the mandibular comminuted fractures were estimated to be the second most common types of fractures following nasal bone fractures. Morphologically, the bone of the mandible has a U shape as it connects to the calvaria, it can appear as a ring-like shape. Due to its anatomical structure, the occurrence of at least two separated fractures is common. However, when a single fracture of the mandible is observed, checking the temporomandibular joints should be conducted, as they are usually dislocated.[10] The management of mandibular fractures usually requires open reduction procedures followed by computed tomography (CT). CT has been marked as the first choice for examination of such events, being widely available and easy to use within the different clinical settings, replacing plain-film panoramic radiographs. There are different types of mandibular fractures, which are usually classified based on the severity of comminution. The definition of mandibular comminuted fractures is based on the number of fragments that could be observed within one anatomical plane where the injury occurred. When there is three or more bone fragments at the local injury, the condition is considered comminuted. Meanwhile, when there is more than five fragments, a diagnosis of severe communication is established.[11] It has been demonstrated that the occurrence of severe comminution can affect the periosteal ligaments of the affected regions, leading to the revitalization of the affected regions, which is a significant indication for removing it. Basal triangle is a term that has been used to describe the mandibular fractures that are usually triangular and basal in shape that are usually observed inferiorly to the mandible.[11,12] Significant damage to the inferior alveolar nerve may occur leading to the loss of sensation if the alveolar canal is involved in the displacement trauma.[12-14]

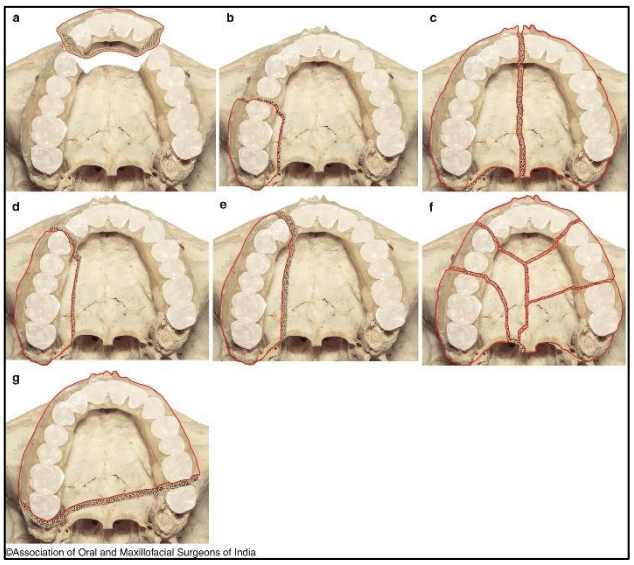

Figure 1: Hendrickson's classification of palatal fractures from type Ia-b to VI, respectively.[31]

Palatal fractures have been classified into six anatomical patterns according to Hendrickson et al (Figure 1).[15] Performing diagnostic CTs helps achieve adequate and proper detection of these fractures for better management plans. Moreover, two other subcategories were furtherly reported when the alveolar bone is found to be involved in such fractures, leading to posterolateral and anterior fractures. Anterior alveolar or type I palatal fractures happen when the incisor teeth are found impacted while posterolateral of type Ib palatal fractures is used to describe posterior teeth affection. Furthermore, it was estimated that the development of type III and IV fractures to this region is the most common among other types, and studies show that type II fractures are uncommon in adults where it occurs as sagittal fractures. Moreover, type III occurs in a parasagittal pattern away from vomer bone movement to the axillary bone, particularly in the area where the palate is thinnest. Additionally, the fracture is usually limited anteriorly by the pyriform aperture and canine teeth. On the other hand, the posterior limit of type III fractures has been marked as the track or tuberosity near the midline. Type IV fractures might present as extensions of type III fractures, with an observed fracture line that is neer to the maxillary alveolar bone. Communication fragments are usually observed with type V of palatal fracture, which leads to significant management difficulties. Lastly, type VI are the least common palatal fractures usually occurring

in a horizontal pattern. Open reduction and internal fixation procedures might be indicated for severely affected cases while maxillo-mandibular fixation procedures are routinely recommended for the usual non-severe types by using palatal splints and gunning approaches.

Le fort fractures

These types of fractures represent a huge portion from the maxillofacial fractures. In addition, it has a variety of complications requiring certain management techniques. Nonetheless, the term for these types of fractures was based on the first investigation that was published in 1991 by Rene Le Fort which found that by applying significant blunt force to the midface, these fractures can develop in three different patterns, which include damage to the pterygoid plates.[16] On the other hand, a previous study has shown that around 37% of patients with fractured pterygoid plates developed craniofacial injuries not related to the Le Fort fractures because the such fractures are usually associated with various forms of fragments leading to significant damages.[17] In another study, it was previously reported that classifying these lesions is difficult. However, a previous investigation by Rhea et al showed that Le Fort fractures can be classified into three main types by observing the main pattern of the fracture to differentiates it from other types of fractures.[18] In type I, the anterolateral boundary of the nasal fossa is involved. In type II, the rim of the inferior orbit is involved while in type III, involvement of the zygomatic arch is the main hallmark. Le Fort fractures can also be furtherly subclassified by their levels, according to the method by which the damaging force has been applied to the face, which might result in significant differences between the two traumatized sides. Management of incomplete fractures, with intact or impacted periosteal attachments, requires the integration of serious events. Therefore, an adequate examination is favored for appropriately managing these types of fractures. Complications that might make the management procedure of the Le Fort fractures challenging that it can include adjacent or other maxillofacial fractures, which has been reported as a common event.[18,19] Furthermore, it was previously demonstrated that the classification and definition of the Le Fort fractures were based on slow force traumas, while more rapid and forceful events might occur to the same region of the face leading to different observations and findings with the Le Fort fractures.[20] Additionally, the recent application of favorable osteosynthesis hardware in the management of Le Fort fractures has significantly led to favorable outcomes. Nonetheless, recent advances have shown that it is now easy to depend on the upper margin of these fractures in the management procedures, which has been a hallmark in the past that would intervene against the development of management-related adverse events such as flattened or elongated faces due to the loss of the anteroposterior projections. On the other hand, detecting the lower level is still of significant management perspective, which might be used for the early detection and management of associated occlusions.

Zygomaticomaxillary and aso-orbito-ethmoid fractures

Disruption to the naso-orbito-ethmoid complex has been reportedly associated with various types of injuries impacting the medial wall of the orbit, the nasal bone, and the frontal maxillary process.[19] Although the trauma is usually caused by applying severe force anteriorly to the nasal bones, the force is transmitted posteriorly, inducing severe damage bilaterally to the maxillary buttresses.[17] Many complications have been associated with these types of fractures including telecanthus, exophthalmos, and cerebrospinal fluid leakage through a damaged cribriform plate.[17] Other injuries such as ocular and nasofrontal duct injuries were also reported to frequently occur with these types of injuries.10 The classification of these types of injuries is mainly dependant on the extent of involvement of the medial canthal tendon, according to the Markowitz and Manson system. In type I, the tendon can be found attached to a single large fractured bone while in type II, it is attached to a single comminuted bone. In type III, avulsion of the tendon is probably present because the comminution trauma now involves the location where the tendon is inserted, being at the level of the lacrimal fossa on the anterior medial wall of the orbit.[10,21] The boundaries of the complex involve the zygomatic process and the inferior part of the maxilla, which can be used to construct the management procedure of the whole complex. Detecting the displacement of the central fractures of the medial orbital wall that might occur in these types of fractures is important because CT cannot detect tendon injuries leading to inadequate identification of the injury.16 Besides, the management plan can also change based on the presence or absence of other fractures occurring to the maxillary frontal process, the nasal bones, and the frontal nasal processes.[19,22]

Zygomaticomaxillary fractures occur as a result of the direct effect of the trauma to the malar eminence leading to immediate separation of the maxillary bone from the calvaria. Fractures occurring to the complex have been reportedly impacting all four bones and sutures of the maxilla that connect it with other facial bones. Quadripod or tetrapod fractures are also other terms for these complex fractures. The term tetrapod was adopted because radiographically we can only detect three impacted dimensions. However, it was previously noticed that the fractures might extend to the spheno-zygomatic bone sutures, and therefore, the trauma can be quadripod. Radiological examination is an important factor in the management procedure, which can be impacted by the severity of comminution.[23,16] Developing a proper management plan is important to intervene against the development of adverse events, which are usually associated with significant facial deformities.[24] Orbital fractures can also be associated and should be evaluated to intervene against enophthalmos.[19] Performing open reconstruction procedures is usually recommended when

more than 50% of the orbital bone has been affected.[23,25] Moreover, the orbital apex might also be involved when the medial orbital wall is impacted, which might significantly affect the carotid arteries and the cranial nerves. Therefore, caring for these events is important while conducting the intended management modality.[26] Chewing difficulties might also be present in the affected patients suffering from rotated zygomaticomaxillary complexes, impacting the masseter muscle.[10]

Blow-out or orbital fractures are also reported among the maxillofacial traumas and are linked with more severe adverse events than the corresponding similar events that might happen in the zygomaticomaxillary and other aforementioned fractures.[10,19] Injuries occurring to the roof of the orbit are uncommon. However, when they occur, they might lead to brain herniation or cerebrospinal fluid leakage leading to significant adverse events. Trapped extraocular muscles are also frequent in children requiring emergency referral and faster inervention.[27-29] Injuries to the eye globe, intraorbital hemorrhage, and infraorbital nerve are also potential complications. As a result, proper evaluation of orbital bone fractures is essential to achieve better outcomes.[10] Among the reported maxillar fractures, fractures of the alveolar process are estimated to be the most common pattern such fractures. Surgical debridement and administration of antibiotics are crucial in management to prevent infections and further complications.[10] Many complications related to the underlying tooth might be associated, the management of which should be considered for better prevention.[30]

CONCLUSION

Providing adequate examination is essential to conduct better management. Caring for the associated fractures with the main event is also important and should be considered to intervene against the development of any adverse events. Maxillofacial fractures require timely management to reduce unwanted injuries and complications to the patient.

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