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Sequencing in Pan Facial Trauma – A Case Report

DR.VIGNESWARAN T[1], DR. PRIYADHARSANA PS[2] , DR. EFFIE EDSOR[3]
[1](HOD and Professor, Department of oral and maxillofacial surgery ,RVS Dental college and hospital, Coimbatore, Tamilnadu, India)
[2](Reader, Department of oral and maxillofacial surgery ,RVS Dental college and hospital, Coimbatore, Tamilnadu, India)
[3](Reader, Department of oral and maxillofacial surgery ,RVS Dental college and hospital, Coimbatore, Tamilnadu, India)

Abstract:
Background*: Pan-facial fractures, involving the upper, middle, and lower thirds of the face, present a significant challenge due to the complex anatomy and the functional and aesthetic considerations involved in treatment. This case report describes the management of a 25-year-old male who sustained pan-facial fractures following a high-impact motor vehicle accident. The patient presented with multiple fractures, including the Frontal bone fracture, Right zygomatico-maxillary complex fracture, Left maxilla fracture, Right parasymphysis fracture of mandible and Dentoalveolar fracture in relation to 11,21,31,32,33,41,42 & 43 region. The multidisciplinary approach included initial stabilization, comprehensive radiological assessment, and a staged surgical intervention prioritizing airway management, skeletal realignment, and restoration of facial symmetry.*

KEYWORD*: Pan facial, Bottom up; outside in, Submental intubation, Intermaxillary fixation, Midface fracture, Open reduction and internal fixation, Frontal fracture*

I. Introduction

Panfacial fractures are typically defined as fractures that affect the upper, mid, and lower regions of the face simultaneously. However, there is no universally accepted definition or classification for panfacial fractures in the literature. According to Follmar et al., panfacial fractures are characterized by fracture patterns that involve at least three of the four axial segments of the facial skeleton: the frontal bone, upper midface, lower midface, and mandible.[1-3]

Panfacial fractures can result from road traffic accidents, interpersonal violence, sports-related injuries, industrial accidents, or gunshot wounds. Understanding the mechanism of injury is crucial, as it helps determine the energy of impact and the likely extent of the injury. Panfacial trauma is often associated with multisystem injuries, requiring a multidisciplinary approach to treatment. Once the patient is stabilized, the primary objective should be the early and complete restoration of facial form and function. The management of panfacial trauma has evolved from a conservative, delayed, multi-stage approach to an early, aggressive, single-stage process. Achieving optimal results relies on high-resolution computed tomography (CT), adequate surgical exposure, precise anatomic reduction, rigid fixation, primary bone grafting, and soft tissue suspension.[4,5]

The primary goal in managing panfacial fractures is to restore functional and aesthetically pleasing three-dimensional facial contours as early as possible while minimizing patient pain and reducing costs for both the patient and society. However, determining the optimal sequence for treating complex panfacial trauma remains one of the most significant challenges for every maxillofacial surgeon.[6]

The selection of surgical procedures is primarily determined by the level of fracture displacement and the severity of comminution.[7]

n the published literature, two classic approaches for managing panfacial trauma are described: the "bottom-up and inside-out" approach and the "top-down and outside-in" approach. The preferred sequence typically begins with the reconstruction of the mandible, including fractures of the temporomandibular joints. the next step involves reconstructing the frontofacial and zygomatico-orbital regions, which are essential for the successful restoration of the midface.[8,9]

II. Case Report

A 25-year-old male patient reported to the Dental hospital with history of road traffic accident [Figure-1]. Patient had no history of Loss of consciousness, positive Oral & Nasal bleed, history of vomiting was present, No history of seizure and Patient was conscious but drowsy & disoriented. On Extraoral examination, Deep laceration was seen in lower lip, No subconjunctival ecchymosis / periorbital edema was seen, Active nasal bleed was seen, Step defects were palpated at mandibular parasymphysis region, Diplopia/ eye ball movements could not be elicited [Figure-1]. On Intraoral examination, Restricted mouth opening, Segmental mobility in relation to right maxilla, positive Coleman sign, Segmental mobility noted in mandible between 42 & 43 region, Avulsion in relation to 11,21,31,32,33,41&42 [Figure-2]. Radiographic examination of 3D CT facial revealed multiple facial fractures involving Frontal bone Right zygomatico-maxillary complex, Left maxilla, Right parasymphysis, Dentoalveolar in relation to 11,21,31,32,33,41,42 & 43 region [Figure-3].

Patient was advised for surgery and informed written consent was obtained. All routine blood investigations were done which were required for surgery under General Anaesthesia. Oral and Nasal intubation was unfavourable as the patient had Parasymphysis fracture along with nasal bone fracture so submental intubation was done which is an indication for these types of panfacial fractures. Patient underwent open reduction and internal fixation of the panfacial fractures with "BOTTOM UP, OUTSIDE IN" approach. Various incisions were made

- transconjunctival incision - infraorbital rim and orbital floor
- lateral brow or upper blepharoplasty incisions -frontozygomatic suture and lateral wall of orbit
- High intraoral vestibular incision - maxilla and zygomatic buttress
- coronal incision - frontal, fronto-naso-ethmoid complex, zygomatic arches and roof of orbit
- Mandible symphysis, parasymphysis - intraoral vestibular or crevicular incisions.
- Mandibular angle - extended 3rd molar incision alone or in combination with a transbuccal approach using a trochar and cannula.
- The condylar head - preauricular or bicoronal incision. Mandibular subcondyle and ramus - retromandibular or peri-angular incision

First, mandibular Parasymphysis fracture was reduced and stabilised using titanium miniplates and screws [Figure-5]. Rowe's disimpaction forceps were used to disimpact the maxilla and attain proper occlusion using Maxillo mandibular fixation [Figure-4] . Then, intra oral vestibular sulcus incision was placed in Right maxillary region and stabilisation of maxilla was done using titanium miniplates and screws [Figure-6]. Followed by right infraorbital and lateral wall of orbit fixation using titanium miniplates and screws [Figure-7 and Figure-8]. After placing miniplates incisions were closed in layers using 3-0 vicryl and 4-0 vicryl. Deep cut laceration in lower lip was also sutured using 3-0 vicryl.

Postoperative medications were advised. Postoperative instructions was given. Patient was advised soft diet for one month. Patient was advised to use chlorhexidine mouthwash to maintain oral hygiene and hydroheal ointment for extraoral application. Extra oral sutures were removed after a week. Patient recovered and healing was uneventful. Postoperative stability and functions were satisfactory [Figure-9].

FIGURE -1: Preop Extraoral

FIGURE-2: Preop Intraoral

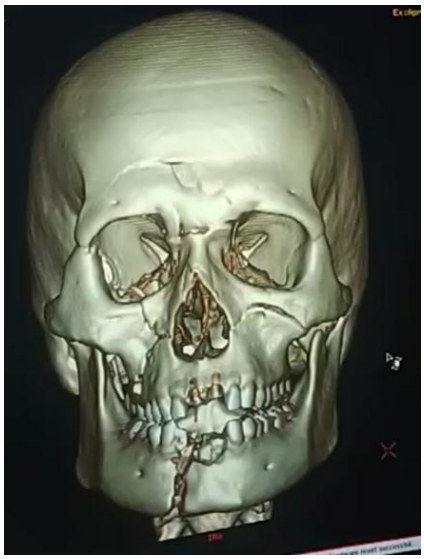

FIGURE-3: 3D CT FACIAL SCAN

FIGURE-4: INTERMAXILLARY FIXATION

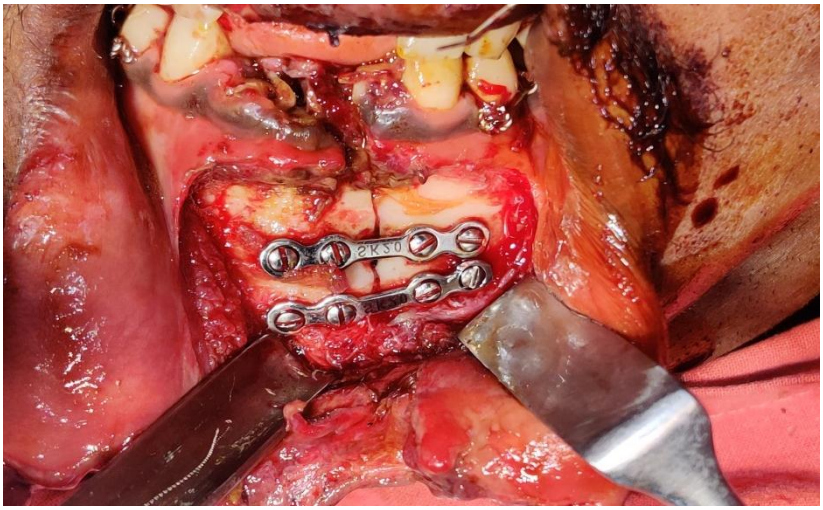

FIGURE-5: LEFT PARASYMPHYSIS FIXATION

FIGURE 6- RIGHT MAXILLA FIXATION

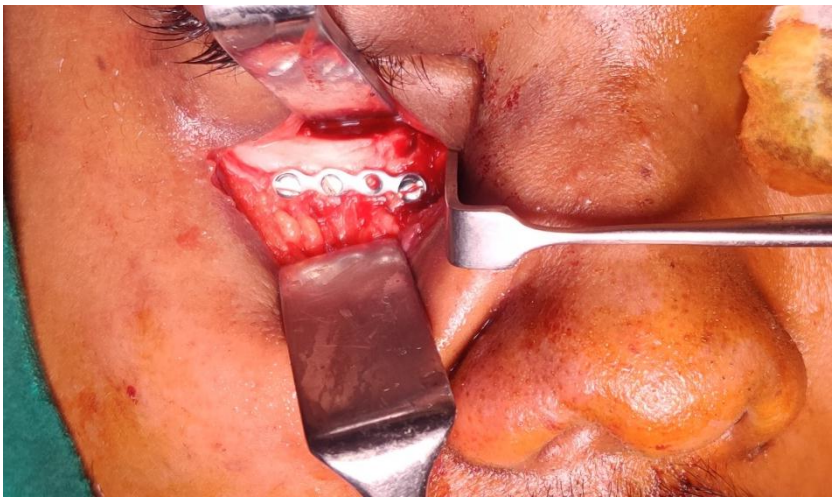

FIGURE 7- RIGHT INFRAORBITAL FIXATION

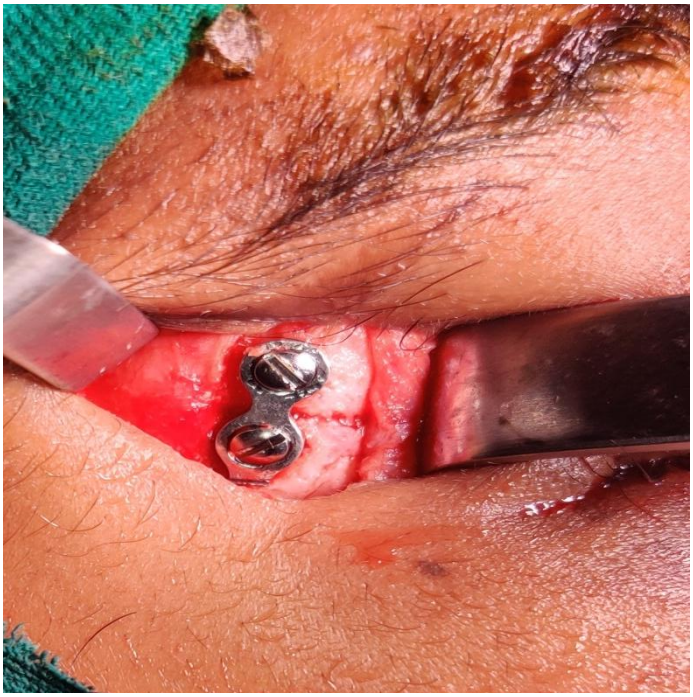

FIGURE- 8: RIGHT LATERAL WALL OF ORBIT

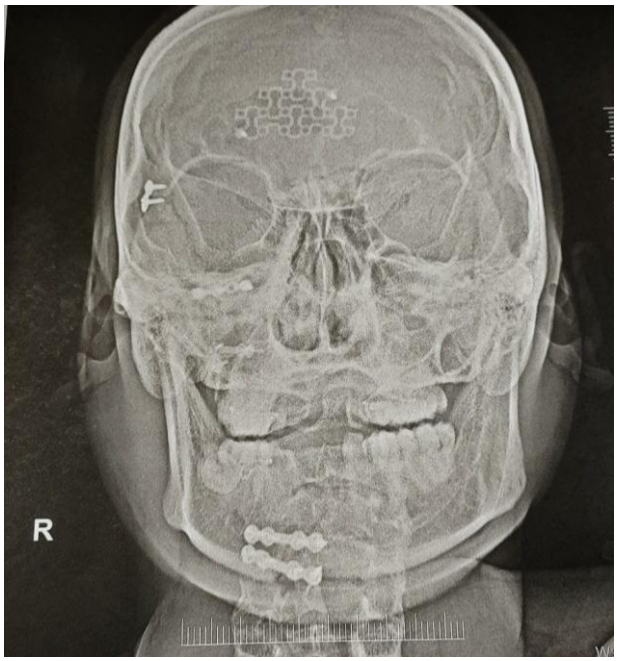

FIGURE-9: POST-OP PA VIEW

III. Discussion

Panfacial fractures (PFFs) involve complex fractures across the upper, middle, and lower thirds of the face, including structures such as the mandible, maxilla,zygomaticomaxillary complex (ZMC), frontal bones, and naso-orbito-ethmoid(NOE) regions. Historically, these fractures were managed conservatively, often leading to significant posttraumatic complications. Such complications included crippling malocclusion, a condition where the teeth do not align properly, along with an increase in facial width and a decrease in facial projection[10] both of which contribute to severe aesthetic and functional deficits . The treatment of PFFs is challenging due to the disruption of critical facial landmarks, especially when fractures interrupt the maxillary and mandibular arches, which are essential for maintaining recognizable occlusion and bone continuity[11]. A detailed surgical plan is necessary, identifying the key facial buttresses to be reduced and the sequence of reduction to ensure successful outcomes in the management of PFFs.

Surgical management of PFFs emphasizes the bottom-top and outside-in sequence as a common approach. This method typically begins with the stabilization of the mandible, a pivotal structure in the facial skeleton due to its role in determining the width, height, and projection of the lower face[1,7,12].The mandible's body, condyle/ramus, and symphysis areas serve as reference points for this stabilization. The mandible also provides continuity between the lower third of the face and the entire facial skeleton by connecting with the maxilla and anchoring to the skull base via the temporomandibular joint[13] Once the mandible is fixed, the midface is addressed using the outside-in principle, starting from the ZMC and progressing towards the NOE region[14]. The ZMC offers more definitive landmarks for reconstruction and is crucial in controlling the transverse and anteroposterior dimensions of the face, providing stability to the lateral pillar[15] of the facial skeleton . The NOE region, being more complex and offering fewer reliable landmarks, is typically addressed after ZMC fixation.

However, not all cases follow this sequence. For example, in situations where nasal bone dislocation occurs into the anterior skull, Pau et al.[16] suggested an inside-out approach . Additionally, the top-bottom; sequence has been advocated in specific cases, particularly those involving frontal bone fractures near the nasofrontal junction. This sequence is sometimes preferred in cases with open wounds near the frontal bone, allowing surgeons to start the reduction from the frontal bone and proceed downward, as demonstrated by Kim et al. [17]. The choice of sequence might also depend on the surgeon& specialty, reflecting differences in the frequency and type of fractures encountered in their practice. For instance, oral and maxillofacial surgeons

(OMS) who frequently manage mandibular fractures may prefer beginning with the mandible, whereas plastic and reconstructive surgeons (PRS) might opt to start with the upper facial bones

In clinical practice, most cases requiring surgery involve fractures in two of the three facial regions (upper, middle, and lower) rather than severe fractures in all three regions. This situation often necessitates a decision on whether to prioritize upper or lower fractures during surgical reduction. To address this, PFFs can be classified into mid-lower (maxillomandibular) or upper-middle (fronto-orbital, fronto-zygomatic, or fronto-maxillary) fractures. This classification helps guide the choice between the bottom-top or top-bottom sequence. For example, maxillo-mandibular fractures should be reduced using the & bottom-top sequence to restore the occlusal surface by first stabilizing the mandibular buttress. Conversely, fractures primarily involving the frontal bone and midface should be treated using the top-bottom sequence, which first restores the transverse frontal buttress .

However, achieving a straightforward operation in PFF cases is not always possible, even when considering these methods. Thus, a flexible approach that prioritizes aligning the most stable and reliable buttresses first, tailored to the individual patient's specific fractures, often yields the best outcomes .This approach is analogous to assembling a puzzle: rather than following aunidirectional sequence, it's often more effective to first set the puzzle & borders, then position the most reliable pieces, and finally place the larger, more stable pieces before the smaller ones.

This strategy reflects the real-world complexity of managing PFFs, where a rigid adherence to a single sequence may not always be practical or yield the best results. Instead, the surgeon must adapt the approach to the unique characteristics of each patient & fractures, ensuring that the most critical structural components of the face are addressed in a manner that restores both function and aesthetics.

IV. Conclusion

Out of the two classical approaches, an approach which goes from known to unknown is more accurate in managing panfacial injuries. Thorough anatomical knowledge and expertise of the maxillofacial surgeon is important for managing a case of pan facial trauma using either of the approaches. To conclude; a minimally invasive approach should be used to treat the panfacial fractures. Early surgical intervention to reduce and fix the fractures using miniplate osteosynthesis after stabilising the trauma patient yields good postoperative results. Patients with complex facial injuries should be informed pre operatively regarding the need for a secondary correction surgery at a later stage. The surgical approach to facial fracture management should focus on attaining proper occlusal, vertical and horizontal relationships of the facial frame along with restoration of orbital, oral and nasal cavities.

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