ACTA SCIENTIFIC DENTAL SCIENCES (ISSN: 2581-4893)

Volume 4 Issue 8 August 2020

Review Article

Extra Corporeal Fixation of Cranial Bone Fracture

Sundaram Rajaram*, Manjunath NM, J Joseph Arnold and Gauthami Sundar

Department of Oral and Maxillofacial Surgery, Rajaram's Dental Surgery, India

***Corresponding Author:** Sundaram Rajaram, Department of Oral and Maxillofacial Surgery, Rajaram's Dental Surgery, India.

DOI: 10.31080/ASDS.2020.04.0883

Received: June 24, 2020

Published: July 21, 2020

Abstract

Fracture of the frontal bone, although form a low percentage of Maxillofacial cases, carries significant risk for the patient, regardless of the type of injury. Usual methods of stabilizing fragments in cranial bone fracture include the use of threads, wires, plates, titanium clamps. This article presents and discusses a case of cranial bone fracture and subsequent management of the same. The uniqueness of this article lies in the new approach to facilitate the fixation of the fractured bone fragments extra corporeally. Thus, this article aims in describing a technique that is safe and simple for the operator and patient. The fixation was very rigid and aesthetic results were attained.

Keywords: Cranial Fracture Fixation; Frontal Sinus Fracture; Extracorporeal Fixation

Introduction

Frontal bone injuries typically involve the supraorbital rim and frontal sinus. Many times it may involve injury to the brain parenchyma leading to further neurological problems. Frontal bone fractures occur in a relatively low frequency and they make up to about 5% to 15% of the facial fractures in the adult patient. However frontal bone fracture can lead to a lot of potential complications ranging from short term to long term [1-3]. The association of high morbidity and mortality make this type of injury a cause of great deal of concern and prompt action in managing them bearing in mind about the potential complications. Fractures with multiple fragments may become a challenging feat to be fixed. Such fixation involves a great deal of precision and efforts. This article describes a unique approach of fixing the fracture fragments extracorporeally making the procedure lot simpler and achieving aesthetic results.

Case Report

The 25 years old patient sustained a head injury while working in a construction site, after which he was immediately admitted in the Emergency department where an emergency surgical decompression of the brain was done. Once stabilised, the patient was referred to the maxillofacial team for management of the cranial bone fracture.

Clinical examination

Clinical examination reveals stapled Bicoronal incision and a stapled laceration on forehead. Ptosis of the left upper eyelid, flattening of the bridge of the nose were noticed on inspection. On palpation, tenderness and step deformity and mobility of bony segments felt on frontal bone and right supraorbital rim. Tenderness and flattening of the bridge of the root of the nose noticed. Lower third of the face was normal (Figure 1).

Radiological examination

CT reveals Fractured and inwardly displaced left supraorbital rim, fractured right outer table of frontal sinus (Figure 2). Axial sections at the level of the supraorbital rims, reveal fractures of the outer table of the left frontal sinus (Figure 3).

Figure 1: Preoperative profile picture.

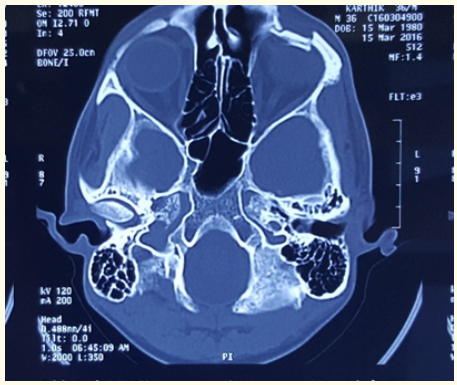

Figure 2: Axial CT showing left supra orbital rim displacement.

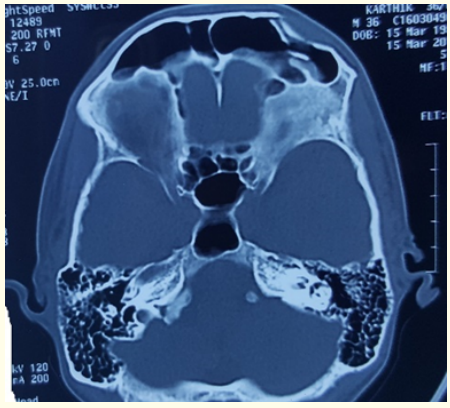

Figure 3: Axial CT showing left frontal sinus fracture.

3D CT reveals grossly fractured, comminuted and depressed frontal bone fracture on left side involving the glabella, fracture of the left Zygomatico frontal suture with displaced left Supraorbital rim. Ipsilateral nasal bone fracture with minimal displacement is also seen. undisplaced Right Zygomatic complex fracture and displaced Left Zygomatic complex fracture with a fracture line noticed at both zygomatic buttress (Figure 4).

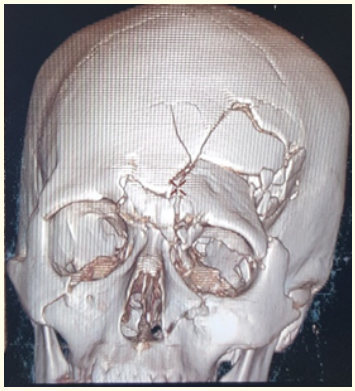

Figure 4: 3D CT showing the fracture details.

Surgical procedure

Under oral endotracheal intubation, General anesthesia was administered. Standard draping and Betadine painting done. Bicoronal incision was placed and anterior flap raised to expose the fracture site. It displayed a heavily comminuted frontal bone extending upto the supraorbital rim. Some of the fractured bone pieces were stuck to the flap that was reflected. Grossly shattered skull contributed more to the difficulty in assembling the bone pieces to form the total architecture. Sinked in pieces of the fractured skull made the reduction very risky. The individual pieces of the fractured skull bones were retrieved with great care without any damage to the duramater. The bone pieces were transferred to a sterile zone where the bone pieces were assembled and plated using 1.5 mm stainless steel plates (Figure 5). Then the assembled bone chunk was placed back to cover the skull to cover the defect and fixed in situ with 1.5 mm stainless steel plates (Figure 6).

The assembly of the framework of the cranium with the frontozygomatic suture on the left side, placed the left zygomatic complex in alignment. Closed reduction of the nasal bone was performed.

Figure 5: Assembled and fixed fractured skull pieces extracorporeally.

Figure 6: Completed fixation of skull fracture.

Closure of the flap done in layers using 3-0 vicryl and skin staples with placement of a suction drain. Patient was extubated and shifted to postoperative ICU. Recovery of the patient was uneventful (Figure 7). The patient was reviewed 3 months post operatively. Well healed surgical wounds with no continuity defect of the skull was seen.

Discussion

Exposure of and access to the fractured fragments of the frontal bone can be gained either through an existing laceration or local incisions such as the "brow" or a "Gullwing" or "Open Sky" incisions; however, the scar is unesthetic. Bicoronal incisions are

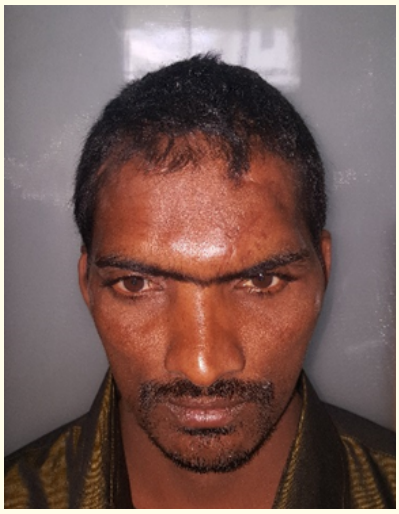

Figure 7: 3 months postoperative picture of the patient.

preferable as they provide good access and exposure and also are subsequently well camouflaged by hair [4].

Considering the limitations of incisions like Gullwing or Opensky, Bitemporal incision would suit the scenario better for want of good exposure.

The gold standard method of evaluation for frontal sinus fractures is computed tomography (CT) [5,6].

Isolated fractures of the anterior table of the Frontal Sinus range from linear undisplaced or minimally/moderately displaced fractures to severely displaced and comminuted fractures, depending on the nature and degree of trauma sustained, and the size and degree of pneumatization of the sinus. Linear, undisplaced, or minimally displaced fractures carry little or no risk of cosmetic deformity, CSF leak, and functional deficit of the Frontal sinus or development of a mucocele and hence can be managed conservatively by periodic observation [7].

If the degree of displacement, as visualized on axial or sagittal sections of CT scans, is > 1 - 2 mm, that is, more than a table's width, it warrants an open reduction and fixation within 7 - 10 days, not only to correct the contour irregularity, but also to release any mucosal entrapment at the edges of the fracture, which could other-

wise lead to late mucocele formation or chronic frontal sinusitis [8].

More severe injuries resulting in comminution of the outer table require meticulous repositioning, stabilization, and fixation of the fragments in order to prevent a cosmetic contour deformity later. Mucosal injury of the Frontal sinus would require complete extirpation of the sinus lining and Frontal sinus obliteration.

Presence of a bone defect would entail bone grafting, ideally, split-thickness corticocancellous, or symphyseal bone grafting. Alloplasts such as 3D dynamic titanium mesh or Medpore implants can also be used to bridge small bony defects [5,9].

The current case scenario exhibits a situation where there is a breach and displacement of only the outer table of the frontal sinus not necessitating any further intervention other than architectural reconstruction.

The continuity defects between the frontal bones after fixation were minimal and needed no bone grafting or titanium mesh reconstruction.

There are several techniques to reduce displaced fragments of the fractured frontal bone. A Periosteal elevator or a Bone hook can be insinuated within a fracture line and the fragment mobilized and elevated [10].

A hole can be drilled through a depressed fragment and a screw inserted, which can be grasped using a wire twister to exert an outward traction thereby reducing a depressed fracture segment [11].

Jeyaraj P has described an Alternative technique, in which the individual fragments can be removed, shifted to a sterile zone on the side table, where they can be assembled, and then replaced back over the defect [11].

Similarly, in this case scenario also, the fracture fragments were removed and shifted to a sterile zone and fixed with great precision.

Although the practice of using an elevator or bone hook or a screw to manipulate and assemble the fractured fragments still prove efficient, they always carry a potential risk of iatrogenic damage to the surrounding structures and the contents of cranium. Extra corporeal fixation of the skull bones obviously does not carry the aforementioned risk and makes the operator convenient to fix the fractured fragments at a greater precision and accuracy.

Conclusion

The cranial fracture management involves a prompt multidisciplinary approach in managing the same. Fixing the fractures of skull with simpler and safer techniques make the procedure easier, keeping in mind to protect intracranial structures from iatrogenic injury, to restore frontal sinus function and to minimize the possibility of development of complications in the future.

Bibliography

1. Sataloff RT., *et al*. "Surgical management of the frontal sinus". *Neurosurgery* 15.4 (1984): 593-596.

2. Fattahi T., *et al*. "Comparison of 2 preferred methods used for frontal sinus obliteration". *Journal of Oral and Maxillofacial Surgery* 63.4 (2005): 487-491.

3. Luce E. "Frontal sinus fractures: guidelines to management". *Plastic and Reconstructive Surgery* 80.4 (1987): 500-510.

4. Donath A and Sindwani R. "Frontal sinus cranialization using the pericranial flap: an added layer of protection". *Laryngoscope* 116.9 (2006): 1585-1588.

5. Zavattero E., *et al*. "The use of titanium mesh for the reconstruction of defects of the anterior wall of the frontal sinus". *Journal of Cranio-Maxillofacial Surgery* 24.2 (2013): 690-691.

6. Ravindra VM., *et al*. "Surgical management of traumatic frontal sinus fractures: Case series from a single institution and literature review". *Surgical Neurology International* 6 (2015): 141.

7. Rice DH. "Management of frontal sinus fractures". *Current Opinion in Otolaryngology and Head and Neck Surgery* 12.1 (2004): 46-48.

8. Hwang K and Song YB. "Closed reduction of fractured anterior wall of the frontal bone". *Journal of Cranio-Maxillofacial Surgery* 16.1 (2005): 120-122.

9. Chen KT., *et al*. "Frontal sinus fractures: a treatment algorithm and assessment of outcomes based on 78 clinical cases". *Plastic and Reconstructive Surgery* 118.2 (2006): 457-468.

10. Echo A., *et al*. "Frontal sinus fractures". *Seminars in Plastic Surgery* 24 (2010): 375-382.

11. Jeyaraj P. "Frontal Bone Fractures and Frontal Sinus Injuries: Treatment Paradigms". *Annals of Maxillofacial Surgery* 9.2 (2019): 261-282.