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Cranioplasty: evidenced based evaluation of consequences and management of frontal bone fracture – A Case Report

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Abstract

Frontal sinus (FS) injuries remain infrequent then, reliant on the impact's severity might injure anterior, posterior, or frontal sinus outflow tract (FSOT).Significant causes include falls from high places, boxing, extreme sports, interpersonal viciousness, & penetrating trauma from workplace incidents. The main goals of treatment are to correct anti-aesthetic transformation, prevent complications, preserve cerebral frameworks, and control cerebrospinal fluid (CSF) leakage. A 21-year-old male patient with pan facial fracture managed with reduction of broken bone segments and fixation with titanium plates. Over the site of the left frontal bone fracture, titanium mesh was adapted. Complications are common after a cranioplasty, happening between 10% and 43% of the time. In our case, better results were determined by considering various factors, such as complications, timeliness, quality of life, and cosmesis.

Keywords: Cranioplasty, Titanium Mesh, Frontal bone fracture

Introduction

Frontal bone fractures involving the frontal sinuses (FSs) make up about five percent of all maxillofacial injuries, making them relatively uncommon occurrences in maxillofacial trauma.[1] Open or compound frontal sinus fractures are more likely to develop potentially fatal infections.[2]

High-velocity, powerful strikes that impact the superior portion of face, as perceived in vehicle crashes, remain the most frequent root of FS fractures. Significant causes include falls from high places, boxing, extreme sports, interpersonal viciousness, & penetrating trauma from workplace incidents.[3]

The frontal bone needs 800 to 1600 pounds of force to break. That is five times more than the energy desirable to break the maxilla and twice as much as breaking the mandible.[5]Regarding frontal bone fractures and FS injuries, the following are the immediate or acute concerns: safeguarding the internal organs (brain, meninges), control of rhinorrhoea and the leakage of cerebrospinal fluid (CSF), Restoring the attractive shape of the forehead.

Long-term issues or late problems include the following, which can appear or last from six months to decades: Persistent frontal headache brought on by a supraorbital nerve injury, Constant frontal sinusitis, persistent CSF leak, and persistent brain abscess.

Case Report

The Oral and Maxillofacial Surgery department received a 21-year-old male patient who claimed they had a fracture in the faciomaxillary region and a depressed left side of the frontal region. Following emergency neurosurgery and a general anesthetic-assisted left-side decompressive craniectomy was done, the patient spent 20 days in the intensive care unit under monitoring before being transferred to the oral and maxillofacial surgery department. Step deformity over left supraorbital and infraorbital area; pain over the left side of the frontal region; leftzygomaticomaxillary buttress; and symphysis region with bilateral occlusion disturbed were observed upon examination. (Fig.1) A 3D CT scan of the face reveals a comminuted displacement fracture in the left half of frontal bone that extends into the ventral and dorsal walls of both frontal sinuses, left zygomaticomaxillary complex region.(Fig.2)

Patient was taken up for open reduction & internal fixation of fracture fragments. A zigzag incision (Fig.3)was made with crosshatch lines in between, 4 cm behind the hairline bilaterally and latero-inferiorly up to the preauricular region. A no. 10 blade was used to make an incision through the skin, subcutaneous tissue, and galea. Continuing the preauricular incision, revealed the subgaleal plane of loose connective tissue covering the pericranium and extending toward the wisdom of the shimmering temporoparietal fascia. Using finger separation to elevate flap atop the periosteum and electrocautery to cut the back, Raney clips were placed over the flap. After the left half of the broken frontal and supraorbital bones were exposed (Fig.4) , a continuous 1.5 mm plate with 12 holes that was 4 mm in size was reduced using six screws. The left half of the frontal bone was covered with a 2 mm titanium mesh (Fig.5) , which was plated with 10 screws of a 4 mm size.

A transconjunctival incision with lateral extension was made using three frost sutures. The infraorbital fracture site was then exposed through blunt dissection, and a 2 mm by three-hole continuous plate was plated by using a 6 mm diameter of two screws. An intraoral left maxillary vestibular incision from canine to 2nd molar was given and dissection was carried till the piriform fracture line

was exposed and reduced with 1.5mm – 2hole with gap plate by 2 screws and fracture line running through zygomaticomaxillary buttress region was reduced and plated by 1.5mm L-plate 4 hole with the gap by 4 screws.

Closure of vestibular incision was done by 3-0 vicryl in horizontal mattress fashion and transconjunctival incision with 5-0 vicryl in interrupted suture technique. Coronal flap closure (Fig.6) was done in 2 layers with 3-0 vicryl and 4-0 prolene. A postoperative 3DCT face was done to evaluate the adaptation of titanium mesh & reduction of fracture segments. (Fig.7) A Follow-up of the Patient was carried out for evaluation of any postoperative infection or titanium mesh exposure or any neurological deficit (Fig.8).

Discussion

The five anatomic characteristics that can be used to make treatment decisions for frontal sinus fractures are (1) anterior table injury; (2) posterior table injury; (3) Recessus frontalis rupture; (4) dural rupture; (5) displacement of fracture fragment. Treatment options include monitoring, endoscopic repair, sinus cranialization, sinus obliteration, then, in rare instances, sinus eradication (Reidel surgery) & open reduction and internal fixation of broken bone fragments.

Fractures either linear, undisplaced, or mildly displaced have little to no chance of developing a mucocele, a functional deficiency in the Frontal Sinus, or a cosmetic deformity. As a result, they can be conservatively handled with routine observation.[7] By reconstructing the skull, cranioplasty seeks to enhance cosmesis and safeguard the brain. It has been demonstrated that cranioplasty reduces the incidence of epilepsy. Brain Edema, hydrocephalus, and infection are contraindications for cranioplasty.

Reconstructive materials applied for frontal bone deformities including autogenous tissue (calvarium, rib, iliac crest), allogenic implants (autolyzed antigen-extracted allogenic AAA-bone), alloplastic material (methyl methacrylate, hydroxyapatite cement, acrylic resin, hydroxyapatite porous polyethylene implant and polyether ether ketone -PEEK.[11]

Following a cranioplasty, complications occur between 10% and 43% of the time. A higher frequency of bone resorption was linked to cranial autograft implantation, while higher incidences of infection and skin erosion were linked to Polymethylmethacrylate and titanium mesh, respectively. After a titanium mesh cranioplasty, the infection rate is around 20%. Early (8 months) cranioplasty and senior age are risk factors. A 6% implant extrusion following Titanium mesh cranioplasty was described by Lee et al.

Conclusion

The focus of modern treatment paradigms for frontal bone fractures and FS injuries is early, aggressive, and definitive management to preserve intracranial structures from additional damage, restore FS function, and reduce the likelihood of complications developing later. The extent of anterior table displacement, frontonasal duct patency, and posterior table involvement are the three main findings that guide current frontal sinus fracture management. Improved results in our case were determined by considering various criteria, including cosmesis, quality of life, timeliness, and complications.

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Legend Figures

Figure 1: Preoperative profile

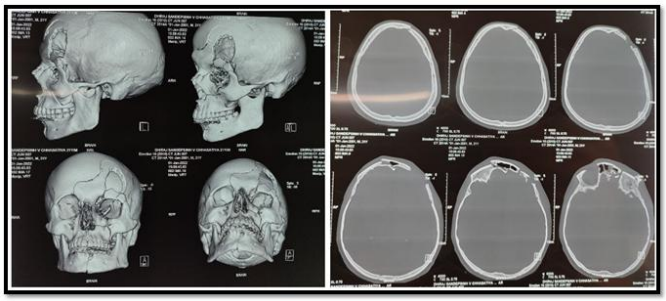

Figure 2: Preoperative 3DCT Face reconstruction

Figure 3: Intraoperative marking of incision line

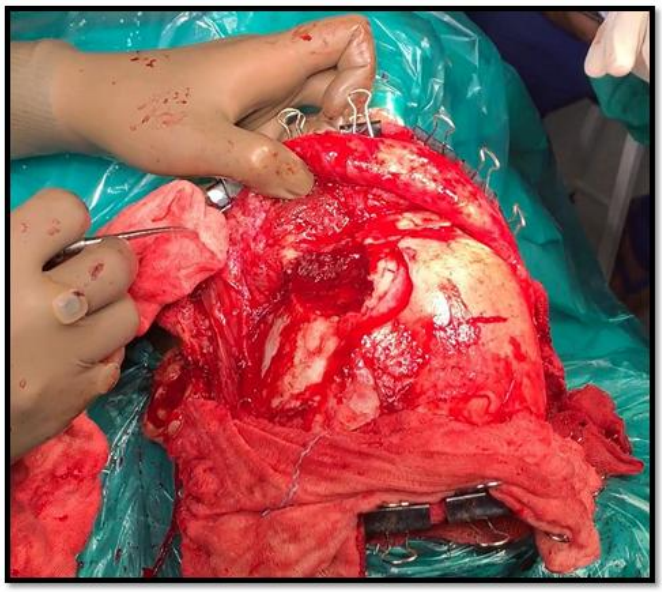

Figure 4: Fracture site exposed

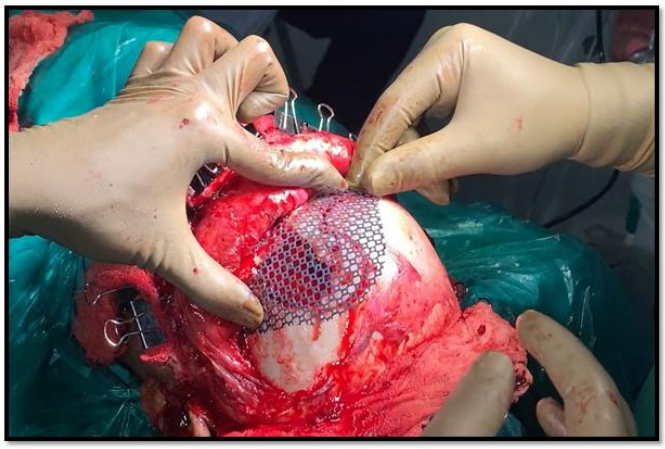

Figure 5: Titanium mesh adaptation

Figure 6: Closure of the operative site

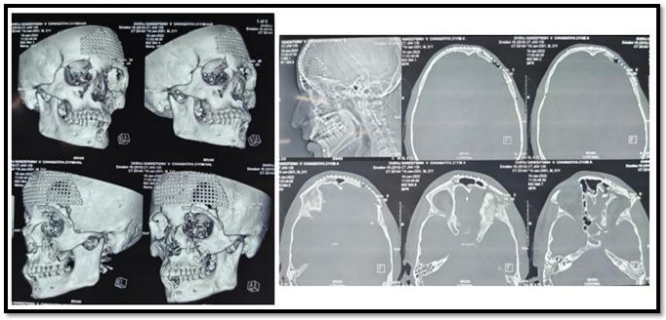

Figure 7: Postoperative 3DCT Face reconstruction

Figure 8: Follow-up profile after 4 months