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Case Report

An approach for reduction of pan-facial fractures using bi-coronal flap: a case report and a literature review

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ABSTRACT

Pan-facial trauma represents 4% to 10% of facial fractures, involving complex injuries across the upper, middle, and lower facial regions. These fractures present significant management challenges for even experienced maxillofacial surgeons. Treatment should commence with airway stabilization, as obstruction can be fatal. Various techniques exist for addressing pan-facial fractures, with no consensus on the ideal approach. The open reduction and internal fixation (ORIF) method predominantly utilizes coronal flap incisions, offering optimal access to intracranial injuries and critical facial structures like the frontal sinus and zygomatic-maxillary complex. Conversely, the anterior approach using lynch incisions may reduce risks of postoperative complications such as scarring and sensory deficits.

Keywords: Panfacial fracture, Coronal flap, Fixation, Open reduction

INTRODUCTION

Pan-facial trauma comprises 4% to 10% of all facial fractures and is characterized by complex injuries affecting the upper, middle, and lower thirds of the face. Managing these fractures poses significant challenges, even for seasoned maxillofacial surgeons. The treatment protocol should start with ensuring a clear airway, as airway obstruction can be life-threatening. There is no established consensus on the optimal treatment strategy for pan-facial fractures, with various techniques proposed in the literature. Open reduction and internal fixation (ORIF) for upper and middle-third facial fractures typically utilize coronal flap incisions. This posterior approach is preferred due to its excellent access to intracranial injuries, the frontal sinus, and the zygomatic-maxillary complex. The frontal sinus and zygomatic arch are particularly difficult to repair, but they can be accessed by retracting the temporalis muscle using the coronal flap incision. Alternatively, the anterior approach, which employs lynch incisions, can be beneficial as it generally presents a lower risk of postoperative complications, such as permanent facial scarring and sensory deficits.[1] The coronal incision offers excellent access to the zygomatic arch and zygomatic complex, facilitating optimal anatomical reduction while concealing the scar within the hairline. However, it has drawbacks, including prolonged operating time, potential facial nerve injury, scarring in patients with male pattern baldness, and paraesthesia at the surgical site. Consequently, this incision should be used judiciously and applied only under strict indications to avoid overuse.[2] The benefits of coronal incisions in maxillofacial surgery are well established. This incision offers excellent access to the upper facial skeleton, facilitating proper access, effective anatomical reduction of fractures, and concealing scars. However, the risk of bleeding when lifting a bicoronal flap raises concerns for novice surgeons, which can hinder the frequent application of this technique.[6] Eventually, the coronal incision technique for forehead lifts became widely accepted, with most surgeons opting to raise the forehead flap at the subgaleal plane. They found this plane to be the "natural" or most accessible option for dissection, making it the prevalent choice for foreheadplasty today. However, some surgeons have started to support the use of the subperiosteal plane, leading to ongoing debate about which approach is more reliable for raising a forehead flap.

Based on 25 fresh cadaver dissections and over 20 years of clinical experience with foreheadplasty, the author argues that using the subperiosteal plane rather than the subgaleal plane offers more significant benefits for patients. While both planes allow relatively easy dissection, elevating the forehead flap at the subperiosteal plane better preserves blood supply and ensures long-term preservation of frontoparietal scalp sensation. Conversely, the deep division of the supraorbital nerve, which supplies sensation to the frontoparietal scalp, is at risk of being transected when using the subgaleal approach. Additionally, the chosen skin incision method for the forehead flap can influence postoperative frontoparietal scalp sensation, as the deep division of the supraorbital nerve will always be severed with the coronal incision approach, regardless of whether dissection occurs at the subgaleal or subperiosteal level.[7]

CASE REPORT

A 19-year-old male patient unaware of any medical with no known allergy. He came to emergency department following a high frontal impact road traffic accident with death on the scene, he was on passenger scene and was extracted. Head and neck examination revealed left facial edema, forehead and cheek lacerations, eyebrow laceration, no active bleeding, no step deformities could be felt due to edema, bilateral sub-conjunctival hemorrhage, restriction of left eye movement, positive forced duction test, and no septal hematoma noted. Intraoral he had Le-fort I mobility noted, no teeth mobility, shipped crown of #25, left mucosal lacerations, no bone exposed, and no active bleeding. Upon computed tomography (CT) examination, the patient had a left zygomatic complex fracture, naso-orbito-ethmoid fracture, left infra-orbital floor fracture, nasal bone comminuted fracture, lefort I fracture, left coronoid fracture, and left frontal sinus anterior table fracture. CT planes are shown in Figure 1.

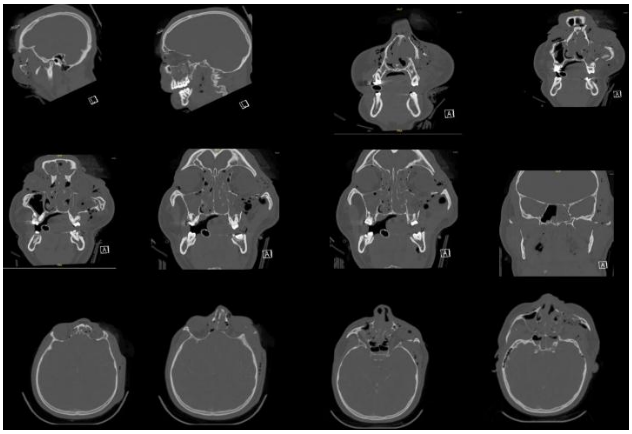

Figure 1: CT of axial, coronal, and sagittal planes.

The patient was brought to the OR, awake, oriented, and alert, he was placed in a supine position on the table. Monitors were connected to the patient, sub mental intubation was done.

The patient was prepared as usual (aseptic and draping). The area was marked. A waveform bi-coronal incision without auricular extension was done. Dissection of the skin, connective tissue, apeneurosis, and loose areolar tissue was done. The coronal flap is shown in Figure 3.

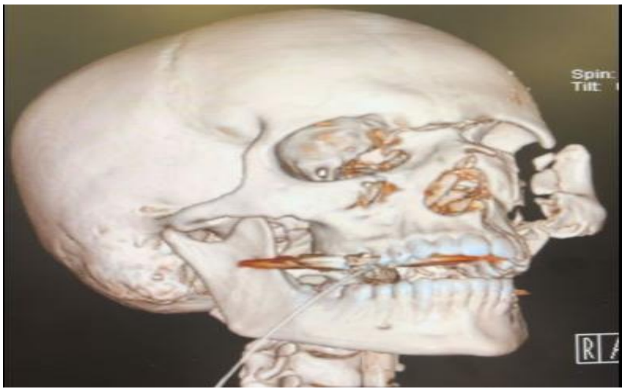

Figure 2: 3-D image of the CT.

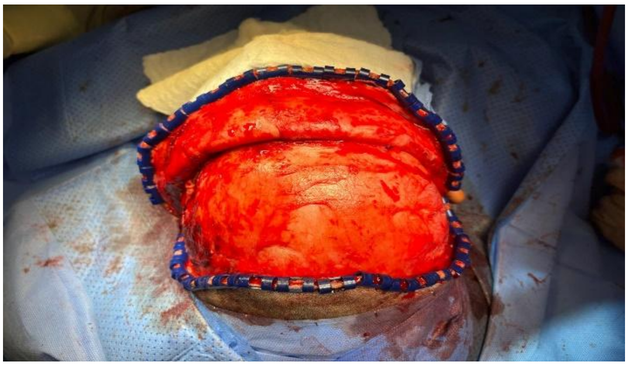

Figure 3: Demonstration of bicoronal flap.

Pericranium was not dissected. NOE fracture exposed. Later on, the pericranium was exposed only to the fracture site. Figure 4 showing periosteum exposing the NOE fracture.

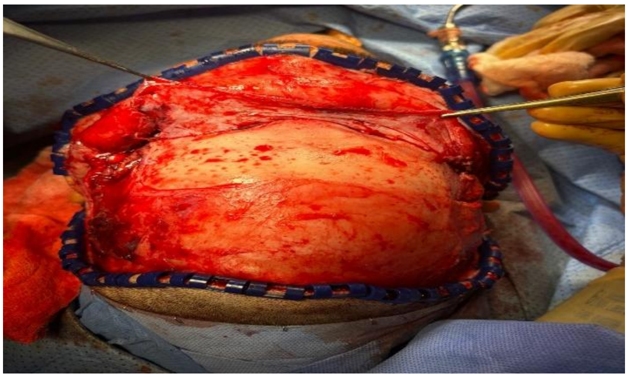

Figure 4: Exposed NOE fracture.

Left eyebrow skin subcutaneously then periosteum dissection. Fracture and zygomatic frontal suture were exposed. The first zygomatic frontal fracture was reduced and was fixated by MATRIX synthis 0.8 mm mini plate.

Later NOE fracture was reduced and fixed with a Y shape 0.8 mm MATRIX synthsis 0.8 mm. Appropriate reduction was achieved in Figures 5 and 6.

Figure 5: Reduced zygomatic frontal bone.

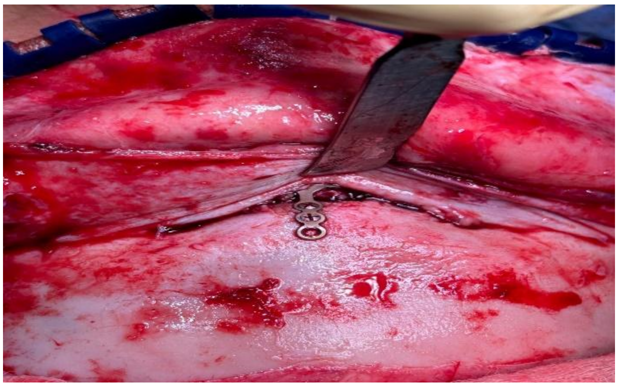

Figure 6: Reduced NOE fracture.

For the left orbital recon, a subtarsal approach was made. Skin subq 3 mm below the eyelash. The infraorbital rim was exposed and dissection of the orbital floor was done. The fracture was reduced, and the orbital floor was reconstructed using a 0.5 mm mesh with no complications. ORIF of the infraorbital rim by 0.8 synthesis plate, C-arm images showed appropriate reduction and no deep screws. Figure 7 shows reduced infraorbital fracture.

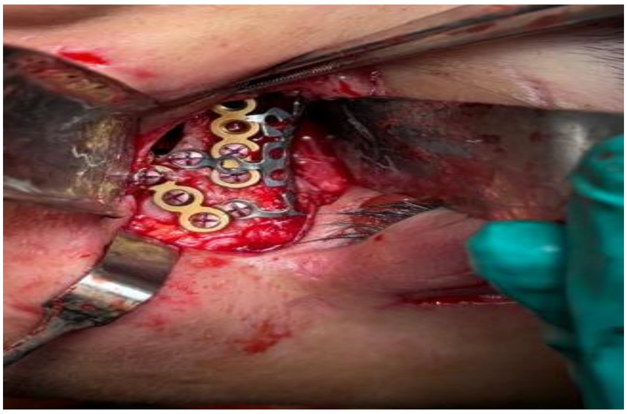

Figure 7: Reduced infraorbital fracture.

For the intraoral (ZMC, Lefort 1 and palatal fracture). Submucoperiosteal flap was reflected through the existing laceration. Arch bar was applied premolar to premolar without any issue. Lefort 1 fracture and ZMC fracture was reduced and fixated with a long plate 0.8 mm synthesis. The occlusion checked was suboptimal since the fracture was comminuted with severe bone and tissue loss. Figure 8 shows reduced ZMC fracture.

Figure 8: Reduced ZMC fracture.

For the nasal bone it was closed reduction by Walsh forceps, reduced with no issue, and nasal pack and splint was placed. For the closure, bicronal flap was closed using pericraneal 5.0 vicryl subq via vicryl 3.0 skin by staples and hemostasis was achived followed by pressure dressing application. For zygomatic frontal, periostum was closed by 3.0 vicryl skin by 6.0 monocreal. For subtarsal it was closed by periostum 5.0 vicryl subq and skin by 6.0 monocryle. Intra oral sutured by vicryl 3.0 and dehisced existing laceration were closed in a layer fasion after margines revision 3.0 vicryl and skin by 6.0 monocreal.

DISCUSSION

The coronal flap has recently emerged as a favored technique among otolaryngologists and head and neck surgeons needing to access the craniofacial skeleton and orbit. It has proven essential in various cases, such as craniofacial reconstruction, facial trauma, and tumor resection. This exposure method has become increasingly valuable due to the growing need for rigid internal fixation and primary bone grafting in managing complex facial fractures.[3] Pitak et al conducted a retrospective cohort study involving adult patients with craniomaxillofacial (CMF) fractures treated using the coronal approach at a German level one trauma center over a two-year period. The predictor variable examined was the trainees' background, specifically whether they were oral and maxillofacial surgery/craniofacial plastic surgery residents (OMFS/CFPS-Rs) or trainees in surgery (TS-Rs), with each group having five participants. All trainees were required to assist in at least two surgeries before performing independently. The primary outcomes assessed were the length of hospital stay (LHS) and complications related to the coronal flap (CFRCs). Statistical analyses were conducted with a significance level set at α=95%.

Among the 97 patients identified, 71 met the inclusion criteria (19.7% female; mean age 40.2±15.2 years; 46.5% operated on by TS-Rs; 38% presenting with combined upper and midfacial fractures). No significant differences were observed between the trainee groups regarding operative time, LHS, CFRCs, readmission rates, or post-discharge emergency room visits. Notably, 60% of CFRCs were characterized as visible or unfavorable scars, including hypertrophic scars with or without alopecia. The number needed to treat for shorter LHS was 44 (95% confidence interval [CI], 3.9 to 4.8), while the number needed to harm due to CFRCs was 14 (95% CI, 3.6 to 7.4), indicating a likelihood of benefit or harm at 0.32.[4] The coronal incision is a widely used and adaptable surgical technique for accessing the anterior cranial vault and the upper and middle facial skeleton. This flap allows extensive exposure of fractures in these areas. The bicoronal flap was initially introduced by neurosurgeons Hartley and Kenyon in 1907 to provide access to the anterior cranium. Its adaptation as a flap for the upper and lateral regions of the face was advanced by Tessier in 1971. Aesthetic considerations are favorable, as the surgical scar is concealed within the hair.[5]

CONCLUSION

In conclusion, the coronal flap has gained popularity as a key technique for otolaryngologists and head and neck surgeons requiring access to the craniofacial skeleton and orbit. Its utility spans a wide range of cases, including craniofacial reconstruction, facial trauma, and tumor resection. As the demand for rigid internal fixation and primary bone grafting in the treatment of complex facial fractures continues to rise, the coronal flap method has become increasingly valuable in surgical practice.

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