Surgical Dilemmas in Multiple Facial Fractures – Coronal Flap Versus Minimally Invasive: Case Report and Literature Review

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Abstract

The Rationale: Pan-facial fracture is a complex trauma that involves the upper, middle, and lower third of the facial bones. The surgical management of such complex cases is either by the posterior approach (coronal flap) or anterior approach through local incisions. **Patient Concerns:** This report describes the case of severe pan-facial trauma in a 52-year-old male who sustained a severe pan-facial trauma. **Diagnosis:** He suffered from multiple facial fractures that included: Frontal bone, skull base, Naso-orbitoethmoid (NOE), zygomatic and sub-condylar fractures. **Treatment:** He was managed by minimally local periorbital and lynch incisions. **Outcomes:** Fractures were properly reduced with resultant symmetrical facial dimensions. No postoperative complications were demonstrated including facial nerve function. **Take-away Lessons:** We should consider minimally invasive local incisions in pan-facial fractures when there is no need to restore the frontal sinus and the anterior-posterior dimensions of the zygomatic arch.

Keywords: Anterior approach, coronal flap, minimally invasive, pan-facial, posterior approach

Introduction

Pan-facial trauma accounts for 4%–10% of all facial fractures.[1] These fractures are defined as complex facial fractures that involve the upper, middle, and lower thirds of the face.[2]

The management of these fractures can be challenging even for the most experienced maxillofacial surgeons.[3] Treatment plan should begin with securing airway if needed, since the loss of a patent airway may be fatal.[4]

There is no consensus on the ideal approach to the treatment of pan-facial fractures, and several techniques have been proposed throughout the literature.[5]

The open reduction and internal fixation (ORIF) of the upper and middle-third facial fractures are performed mostly by coronal flap incisions.[6] The coronal flap (posterior approach) is the most popular approach and provides the best accessibility and superiority to both the intracranial injuries and the frontal sinus and zygomatic-maxillary complex.[2] The frontal sinus and the zygomatic arch are considered the most challenging to repair and can be visualized by releasing the temporalis muscle posteriorly by the coronal flap incision.[2]

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Website: www.amsjournal.com

DOI: 10.4103/ams.ams_452_20

Another management is the anterior approach, which includes lynch incisions.[2] This surgical approach could be an appropriate choice when considering the lower risk for postoperative complications such as permanent scarring of the face and sensory deficits.

We present a case of severe pan-facial fracture. This case illustrates that good surgical outcomes can be achieved with a standard anterior approach using minimally local incisions.

Case Report

Patient

A 52-year-old male presented with complex pan-facial trauma to our oral and maxillofacial department after

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Received: 14-12-2020 **Last Revised:** 21-03-2021
Accepted: 30-03-2021 **Published:** 24-07-2021

How to cite this article: Nseir S, Abu Shqara F, Krasovsky A, Rachmiel A. Surgical dilemmas in multiple facial fractures – Coronal flap versus minimally invasive: Case report and literature review. Ann Maxillofac Surg 2021;11:191-4.

being involved in interpersonal violence. He was brought to the emergency department with breathing difficulty and unconsciousness [Figure 1].

Clinical findings

On extraoral examination, he suffered from head bruising, epistaxis, and otorrhea. In addition, a retrobulbar hematoma and exophthalmos with increased intraocular pressure were demonstrated which necessitated an urgent lateral canthotomy in the emergency department setting.

Diagnostic assessment

Computed tomography (CT) was performed and manifested multiple facial fractures including a frontal bone, skull base, nasoorbitoethmoidal (NOE), zygomatic and sub-condylar fractures [Figure 2].

In addition, the examination showed rib fractures and an acute subdural hematoma with secondary high intracranial pressure which was treated with a burr hole procedure and installing of an intracerebral pressure catheter for drainage and monitoring.

Therapeutic intervention

The patient was planned for the surgical management of the facial fractures A tracheostomy was performed to secure the airway. Because of the severe midface comminution, we chose the "top-down and outside-in" sequence. The patient underwent ORIF of the pan-facial fractures using lynch and midtarsal skin incisions [Figure 3].

Follow-up and outcomes

Twenty four hours postsurgery, a three-dimensional CT was performed and showed proper facial fractures reduction with resultant symmetrical facial dimensions [Figure 4]. No postoperative complications were demonstrated.

The short-term follow-up of 3 weeks postoperatively showed a good healing process, incisions closed properly, and no infection or nerve injury were seen. Long-term follow-up of 12- and 18-months postsurgery included evaluation of esthetic and functional outcomes and revealed satisfying outcomes [Figure 5].

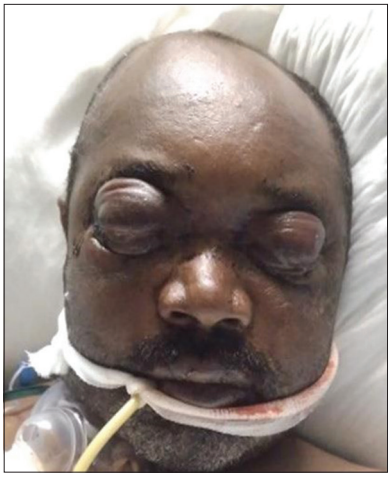

Figure 1: A preoperative frontal view that shows the extent of the fractures

Discussion

Pan-facial trauma can result from motor vehicle accidents, assault, and gunshot injuries.[1] The pattern of injury often accompanies concomitant injuries that can be a life-threatening event.[2]

The goals of surgical management are to achieve optimal operating conditions, secure the airway, and to gain a proper pretraumatic contour and function.[3] During the surgery, the occlusion must be properly established.[7] At the end of the

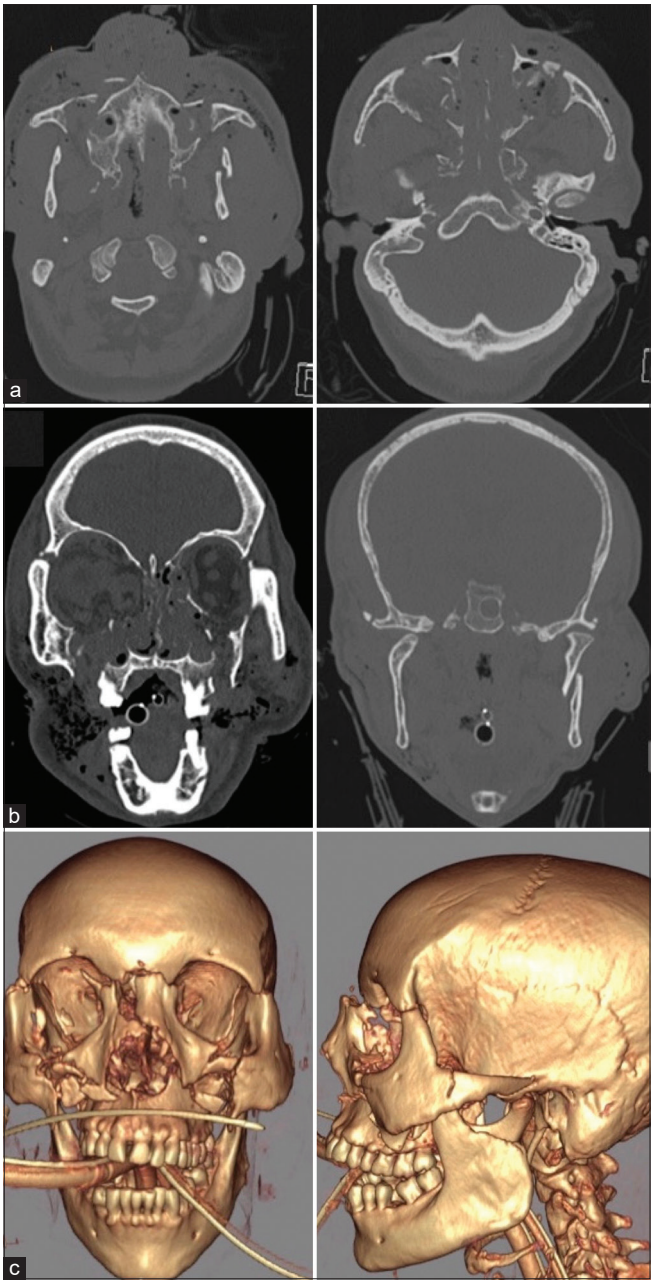

Figure 2: Computed tomography was performed and manifested multiple facial fractures including frontal bone, skull base, NOE, zygomatic and sub condylar fractures. (a) Axial CT sections, (b) Coronal CT sections (c) Coronal and sagittal 3D-CT sections

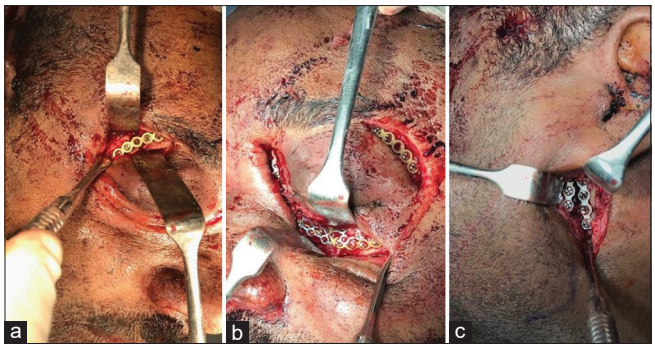

Figure 3: Intraoperative views of the patients who show the surgical incisions and the fixation plates. (a) Lateral eyebrow incision (b) Lynch and midtarsal incisions (c) Retromandibular approach for sub-condylar fracture reduction

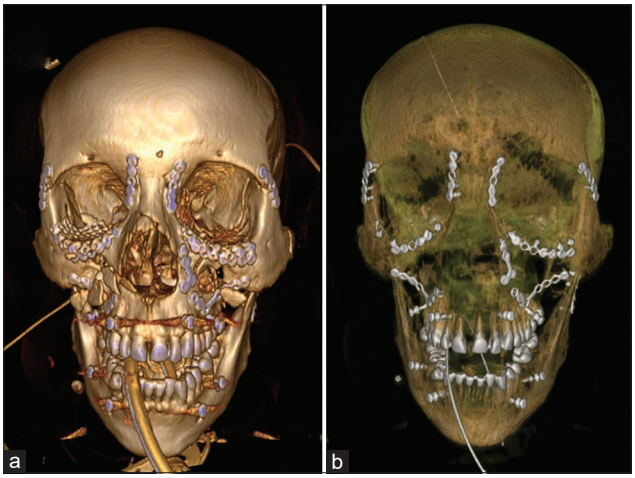

Figure 4: Postoperative three dimensional CT (3D-CT) demonstrates proper reduction of the facial bones (a) 3D-CT coronal section showing the fixation plates (b) Additional section demonstrating symmetrical facial dimensions

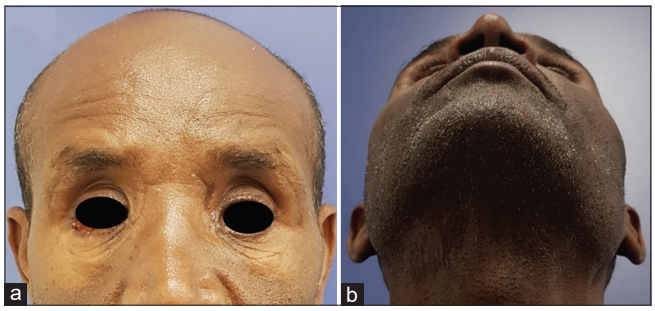

Figure 5: A clinical presentation after 18 months' follow-up period shows symmetric facial appearance and normal facial nerve function. (a) All surgical incisions were tightly closed and show satisfied esthetic outcomes. (b) The mandibular width and malar projection are fully restored

surgery, the mouth should be set closed with intermaxillary fixation (IMF) for maxillary and mandibular fixation. This surgical requirement prevents the use of an oral endotracheal tube. In cases when the IMF is not indicated, an oral tube may be an appropriate choice.[6] The second choice of airway management is nasotracheal intubation. Our patient suffered from NOE and base of skull fractures, in addition to bleeding and edema in the nasopharynx. Naso-endotracheal intubation is contraindicated in patients with midface fractures or fractures at the base of the skull.[7]

Submental intubation has been described as an alternative technique, as it offers a secure airway to the anesthesiologist and an opportunity for the surgeon to check dental occlusion.[4] Although submental intubation could be an optimal choice for our case, this procedure is not indicated when prolonged ventilatory support is required.[7]

In this case, we chose tracheotomy as the best modality for treatment despite the possible complications such as recurrent laryngeal nerve damage and life-threatening haemorrhage.[7]

Since a coronal incision is preferred in patients with complex facial fractures and in those with fractures in the upper and middle thirds of the face (especially frontal bone/sinus, orbital roof, and zygomatic arch fractures), a bone graft may be utilized to fill defects to support facial soft tissues, restore the bony buttress, and sustain facial height.[8]

Cobb *et al*.[9] classified the NOE fractures and stated that by applying bi-coronal flap in comminuted cases, the pericranium can be used as a vascularized flap to seal leakage of CSF if required or to supply soft-tissue coverage to augment the nasal dorsal tissues.

Recently, the anterior approach is gaining popularity because the dissection is simple and pre-existed lacerations may be used. Güven *et al*.[10] treated 16 patients with severe pan-facial fractures by minimally local incisions and exhibited satisfied functional and esthetic outcomes. However, the utilization of this approach still not popular because it has limited access to the upper and middle thirds of the face.[2,6]

In our case, the patient had an unfavorable hairline for a bi-coronal incision. Furthermore, the frontal sinus did not require any intervention and the zygomatic arch was not severely involved. Therefore, we decided to reduce these fractures using the anterior approach by applying lynch and periorbital incisions.

We then used the top-down and outside-in sequence because of the severe comminution of the midface and the relative stability of the upper third. However, other surgeons[11] suggest that starting "low" at the maxillary-mandibular unit is more comfortable as treatment progresses superiorly and is more suitable to stabilize the occlusion first.

The "top-down" approach uses a stable fronto-orbital frame from which to continue inferiorly and outside-in. The building up of the face begins by establishing the anteroposterior dimension by reconstructing the outer facial frame starting from the stable posterior regions and continuing toward the midline.[12]

The reduction of condylar fractures in pan-facial trauma is especially important.[6] The condyle affects the mouth opening, function of the temporomandibular joint, preserves

the posterior facial height and sagittal mandibular position. The management of the condyle aims to restore the mandibular width and midface projection.

In our case, the retromandibular approach was applied to gain access to the sub-condylar fracture. This approach had been chosen because of the medial override of the dislocated condyle as reported by Frenkel *et al*.[13] Furthermore, the need for an ORIF of the concomitant fractures that involved other regions favored the use of the extra-oral approach instead of the endoscopically assisted approach in managing the condylar fracture.

Conclusion

Minimally invasive incisions are gaining popularity in managing severe pan-facial fractures and should be considered in cases where there is no need to restore either frontal sinus or the anterior-posterior dimensions of the zygomatic arch.

Declaration of patient consent

Patient consent had been obtained in written forms. The patient has given his consent for clinical images and other information to be reported in the journal.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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