

STAGED SURGICAL MANAGEMENT OF MULTIPLE FACIAL BONE FRACTURES

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Abstract. Multiple facial bone fractures, including panfacial fractures, are complex injuries that affect facial structure, occlusion, and vital functions. This article analyzes staged surgical management, focusing on initial stabilization, airway control, fixation sequencing, and secondary reconstruction. The literature review indicates that treatment should prioritize life-threatening conditions, followed by definitive fracture reduction and fixation when clinically appropriate. The bottom-up and outside-in approaches are frequently used, but the surgical sequence should be adapted to each patient's injuries and stable anatomical reference points. Careful preoperative planning and coordinated treatment may reduce complications and improve functional and aesthetic outcomes.

Keywords: Facial fractures; panfacial fractures; staged management; fracture sequencing; facial buttresses; maxillomandibular fixation; airway management; secondary reconstruction; delayed repair.

Introduction

Multiple facial bone fractures are injuries in which several regions of the facial skeleton are broken at the same time. The term panfacial fracture is used when the upper, middle, and lower thirds of the face are involved, that is, the frontal bone, the midface, and the mandible. These injuries are usually caused by high-energy mechanisms such as road traffic accidents, falls from height, industrial trauma, and violence. They damage not only bone but also the airway, the eyes, the nose, the teeth, and the soft tissues, and they often occur together with head, cervical spine, chest, and abdominal injuries. The main surgical objective in these patients is to restore facial width, vertical height, and anteroposterior projection, together with a stable occlusion and the function of the orbits, nose, and jaw joints. In isolated fractures the surrounding intact bone serves as a guide for reduction, but in panfacial fractures all the usual landmarks may be lost. Because of this, the surgeon must create a stable framework step by step, starting from the most reliable reference points. In addition, the general condition of the patient often does not allow all repairs to be performed in a single operation. For these reasons, treatment is organized in stages that follow the clinical priorities: first life, then airway and function, then definitive reconstruction.

Relevance

Panfacial fractures represent one of the most demanding problems in craniomaxillofacial surgery. A single, universally accepted sequence of repair does not exist, and the choice between starting from the skull base and working downward (top-down), starting from the mandible and working upward (bottom-up), or working from the outside inward (outside-in) remains a subject of debate. Incorrect sequencing may lead to widening of the face, loss of projection, malocclusion, and orbital and nasal deformities that are very difficult to correct later.

Aim

The aim of this article is to analyze the principles and stages of surgical management of multiple facial bone fractures, with emphasis on timing of repair, sequencing of fixation, surgical approaches, and secondary reconstruction, and to summarize a rational staged approach for clinical practice.

Main part

The first stage of management is stabilization of the patient according to trauma life-support principles. Airway, breathing, and circulation take priority over facial repair. If the airway is compromised by bleeding, swelling, or unstable fragments, a definitive airway must be secured immediately. Severe intracranial, cervical spine, thoracic, and abdominal injuries must be excluded or treated before facial correction. Hemorrhage from the face and nose is controlled by direct pressure, nasal packing, and reduction of grossly displaced fragments, and only rarely does it require embolization or ligation of vessels. Facial fractures themselves are rarely an indication for emergency surgery, with the exception of uncontrolled bleeding and airway obstruction.

The choice of airway is especially important in patients who will need maxillomandibular fixation (MMF). Oral intubation is usually not compatible with MMF, and nasal intubation carries a risk of intracranial passage in patients with skull base and midface fractures. Tracheostomy is favored when prolonged ventilation or multiple trips to the operating room are expected, and it does not interfere with MMF. When prolonged intubation is not necessary, a submental pull-through technique is an acceptable alternative that allows access to the occlusion and the nose during surgery.

The second stage includes temporary stabilization and soft tissue care. Wounds are cleaned, foreign bodies are removed, and lacerations are repaired early with minimal debridement of viable tissue, since the face has an excellent blood supply. Antibiotic prophylaxis and tetanus prevention are given according to the wound. Open fractures of the sinuses, orbits, and mandible require particular attention to contamination. Large soft tissue injuries and avulsions can be covered temporarily and reconstructed later in a staged manner, and overall soft tissue lacerations and asymmetries are among the factors that often explain unfavorable results.

The third stage is imaging and planning. High-resolution computed tomography with three-dimensional reconstruction is the basic method that shows the number of fragments, the integrity of the facial buttresses, and the state of the orbits, nasoethmoid region, frontal sinus, and condyles. Dental casts, stereolithographic models, and virtual surgical planning are valuable, particularly for severely comminuted or delayed cases and in patients with missing or malaligned teeth. At this stage, the surgeon identifies the stable reference points, such as the dental arches and occlusion and the intact segments of the facial buttresses. The skeleton of the face is supported by three paired vertical buttresses and several horizontal buttresses, which are thicker bone that offers a firm base for rigid fixation and an anatomic reference for reduction.

The fourth stage is definitive reduction and fixation, and its timing is a central question. The best results are expected when fractures are repaired early, ideally in the acute period, before edema, fibrosis, and early bony union make reduction difficult. At the same time, definitive facial surgery is frequently postponed by days or weeks because of concomitant injuries, and delay is justified when life-threatening conditions are present. In delayed cases, preoperative planning becomes even more important, and osteotomies of the malunited segments are often required.

Several sequences of fixation are used in practice (Table 1). In the top-down approach, reconstruction begins with the frontal bone and the upper orbital rim, then continues to the zygomas, the central midface and nasoethmoid region, the maxilla, and finally the mandible. In the bottom-up approach, the mandible is repaired first and used together with the occlusion as the base on which the maxilla is positioned and then the zygomas and upper face are rebuilt. The outside-in principle starts with the outer, more stable frame (such as the zygomatic arches) and moves inward toward the thin and often comminuted central midface, which is harder to reduce and is therefore addressed last. More recently, the concept of major fragments has been suggested, in which large, minimally comminuted segments with clear landmarks are reduced and fixed first, even if they fall outside the usual direction, so that they serve as the known reference before the highly comminuted areas are approached. This concept is intended to complement directional sequencing, not to replace it.

Table 1. Approaches to the sequence of fixation in multiple facial fractures

Approach	Order of repair	Main features
Top-down	Frontal bone and upper orbits, zygomas, central midface, maxilla, mandible	Starts from the skull base; useful when the upper face is intact and the mandible cannot be fixed openly
Bottom-up	Mandible and occlusion, maxilla, zygomas, upper face	Uses the mandible and occlusion as the base; most often reported by oral and maxillofacial surgeons
Outside-in	Outer frame (zygomatic arches) first, then the central midface	Central thin bones are reduced last; combined with bottom-up in the preferred sequence
Major fragment concept	Largest, least comminuted segments first, regardless of direction	Creates known landmarks before comminuted areas; complements directional sequencing

Surgical access depends on the regions to be repaired. A coronal incision gives exposure of the frontal sinus, upper orbits, zygomatic arches, and central midface, especially when grafting is needed. The maxillary vestibular incision is used for the nasomaxillary and zygomaticomaxillary buttresses and for Le Fort fractures. The orbital floor is commonly approached through a transconjunctival incision, with a lateral canthotomy and cantholysis when wider exposure is needed. Intraoral and extraoral approaches are used for the mandible, and an extraoral approach helps to see the lingual cortex in bilateral condylar fractures with a symphyseal fracture. Buttresses that have lost their bony support may need immediate bone grafting. In the central midface, repositioning of the medial canthal tendon, transnasal wiring, or dorsal strut grafts are often necessary. In the so-called guardsman pattern, which combines a symphyseal fracture with bilateral condylar fractures, the width between the mandibular angles may increase, and this is prevented by transcervical access and pressure on the gonial angles, for example with a clamp, during fixation.

The fifth stage is secondary correction and long-term follow-up. Even with careful primary surgery, residual deformities may remain, and they include enophthalmos, telecanthus, nasal

deformity, malocclusion, scars, and soft tissue asymmetry. Secondary procedures, such as orbital reconstruction, canthal repositioning, rhinoplasty, orthognathic surgery, and soft tissue revision, are planned after swelling has resolved and the bones have healed. Postoperative care includes airway monitoring, control of infection, diet modification, oral hygiene, early functional exercises of the jaw, orthodontic follow-up, and regular imaging. A summary of the stages of treatment is presented in Table 2.

Table 2. Stages of surgical management of multiple facial bone fractures

Stage	Timing	Main tasks
1. Resuscitation and airway	Immediately	Life support; definitive airway if compromised; control of bleeding; exclusion of brain, spine, chest, and abdominal injury
2. Temporary stabilization and soft tissue care	First hours to days	Wound cleaning and early closure; reduction of gross displacement; antibiotics and tetanus prophylaxis
3. Imaging and planning	Before definitive surgery	CT with 3D reconstruction; dental casts and models; virtual planning; identification of stable reference points
4. Definitive reduction and fixation	Early when the patient is stable; delayed if life-threatening injuries exist	Choice of sequence; rebuilding of buttresses and occlusion; bone grafts where bone is lost
5. Secondary correction and follow-up	After healing and resolution of edema	Orbital, canthal, nasal, and soft tissue revision; orthognathic and orthodontic treatment; long-term review

Conclusion

Multiple facial bone fractures require a staged strategy that begins with resuscitation and airway control, continues with temporary stabilization, soft tissue care, and imaging-based planning, and proceeds to definitive reduction and fixation, followed by secondary correction and long-term follow-up. Definitive repair should be performed early whenever the general condition of the patient allows, and it may be delayed when life-threatening injuries are present. The most commonly reported and favorably evaluated sequence is bottom-up combined with outside-in, but the order should be adapted to the available stable reference points, and the main goals are restoration of facial width, height, projection, and occlusion. Careful planning with computed tomography and models, attention to soft tissues, and an organized multidisciplinary team reduce complications and secondary operations. Further comparative studies are needed to define the optimal sequence and timing of repair.

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