

Review Article

Le Fort fractures: a review

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ABSTRACT

Rene Le Fort proposed 3 classifications to determine the type of facial fracture based on the main facial lines with the least resistance, these being the places where facial fractures are most located. These fractures occur mainly because of high-velocity impact mechanisms. Le Fort fractures are difficult to manage and at the same time challenging, although it is not a common pathology, it is potentially lethal, and its initial approach and resuscitation are critical in the first hours. As in any other trauma, an initial evaluation must be carried out exhaustively and following the ABC, which mainly includes evaluation of the airway, breathing and circulation. Once a facial fracture is suspected, its extension and location must be determined through images such as x-ray or computed tomography. CT being the gold standard. Once the patient is stabilized, reconstructive surgery will be the indicated approach in most cases, with the main objective being the restoration of occlusion, direct exposure and manual reduction of the fractures, reconstruction of the medial and lateral bone buttresses, restoring the projection of the face and restore the width of the maxillary arch, nose and orbit. In general, some of the most frequently described postoperative complications are hemorrhage, infection, foreign body reaction, malunion, among others; however, these will vary depending on their classification.

Keywords: Le Fort fractures, Facial fracture, Facial trauma, Le Fort, Mandibular fracture, Trauma

INTRODUCTION

Le Fort fractures were initially described by Rene Le Fort in 1901, classifying them as I, II or III to determine the type of facial fracture based on the main facial lines with the least resistance, considering the extension from the nasofrontal suture through the frontal processes of the

maxilla, inferolaterally through the lacrimal bones and finally the inferior orbital floor. Additionally, it included the inferior part of the orbital foramen, and inferiorly through the anterior wall of the maxillary sinus, through the pterygomaxillary fissure, and through the pterygoid plates. Facial fractures are more commonly located in these places.¹ Le Fort fractures occur mainly as a

consequence of high-velocity impact mechanisms, which represent 20% of facial fractures, which are also frequently associated with intracranial injuries, spinal cord injuries, and internal neck structures.² Le Fort type I fracture includes those that are found in the horizontal plane inferior to the maxillary sinus and inferior to the orbital foramen, but superior to the teeth. Le Fort type II fractures include those that are lateral to the maxilla to the infraorbital edge and the nasofrontal junction, these are also known as pyramidal fractures. Finally, Le Fort

type III fractures are rare and include those fractures that cross the midline and the lateral orbital walls, the nasofrontal region and the zygomatic arches.³ (Figure 1) Le Fort fractures are difficult to manage and at the same time challenging, although it is not a common pathology, it is potentially lethal, and its initial approach and resuscitation are critical in the first hours. Once the patient is stabilized, reconstructive surgery will be the indicated approach in most cases.⁴

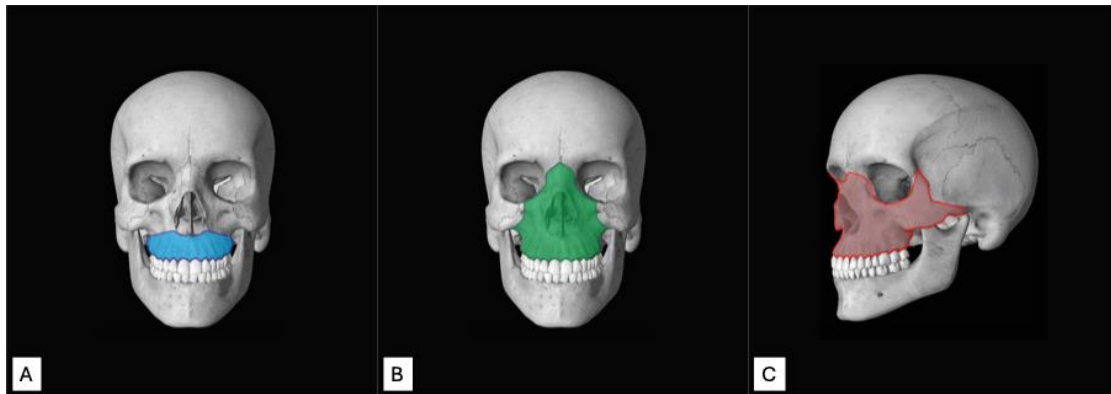


Figure 1: (A) Le Fort I, (B) Le Fort II, (C) Le Fort III.

EPIDEMIOLOGY

The epidemiology of facial fractures varies depending on the population and the period studied. An analysis of data from the Global Burden of Disease Study estimated more than 7 million new facial fractures worldwide in 2017.⁵ A review of the US National Trauma Data Bank showed that there were more than 400,000 emergency department visits in one year related to these types of fractures.⁶ In the general population, Le Fort fractures have been described more frequently in male patients, predominating in patients in the second and third decade of life and more frequently because of automobile accidents in 32%; 36% have been associated with assaults and a lower percentage have been associated with gunshot wounds. Within the geriatric population, falling from one's own height is the main cause of Le Fort fracture, something that would also indicate functional deterioration, which is why a third of these patients will require being transferred to a higher level of care after their injury.⁷

ETIOLOGY

Le Fort fractures have frequently been associated with the high-speed impact mechanism due to acceleration-deceleration. Likewise, falls from one's own height with a subsequent blow to the face were described as a causal agent of Le Fort I fractures and as a further causal agent. frequent Le Fort type II and type III fractures, the mechanisms of high-velocity trauma, and falls from more than 1 story high. Le Fort type III fractures were also concomitantly associated with head and neck injuries,

predominantly TBI, cervical injury, and skull fracture.^{2,8} In general, the most common mechanisms of injury include interpersonal violence, motor vehicle collisions, falls, sports injuries, workplace accidents, a male predilection has been observed. The nasal bones and jaw are the most frequently fractured structures.^{9,10}

CLINICAL MANIFESTATIONS

When a Le Fort I fracture is suspected, upon examination it is common to find facial disfigurement with severe edema accompanied by tears and soft tissue injuries that vary depending on the mechanism of trauma. If the fracture is displaced or impacted, it could generate a malocclusion with an anterior open bite and loss of the nasal base with subsequent stretching of the soft tissues in that area, generating a direct view of the nasal passages. Generally, the impacted jaw can be mobilized by supporting the upper teeth and generating an anterior movement, with a subsequent sensation of grating due to the movement of the fractured segments.¹¹ Le Fort II fractures will generate a marked facial disfigurement accompanied by the sign of raccoon eyes, along with periorbital edema, preventing an adequate ocular examination. In cases where the floor of the orbit is displaced, the enophthalmos will be seen differently. frequent way. Also, bilateral epistaxis with or without cerebrospinal fluid leakage is common. The loss of maxillary prominence will cause plate-face facies. When the maxilla is mobilized, its movement is transmitted to the infraorbital arch and nasal structure. Hypoesthesia is common in the region inferior to the orbital arch.¹² Le Fort III fractures are clinically very similar to Le Fort II,

but with more severe findings, such as complete occlusion of the eyelids due to edema, subconjunctival hemorrhage is common where identification of the posterior limit is not possible. An elongation of the face is generated because of the loss of continuity with the base of the skull and in addition, damage to Lockwood's suspensory ligament causes a drooping of the upper eyelid. Finally, it is common to find deterioration of the airway and speech, since the marked displacement of the jaw can cause the white palate to encounter the back of the tongue.² To clinically differentiate Le Fort II from Le Fort III, the step deformity of the infraorbital rim can be palpated.¹¹

Mandible fractures

After the nasoseptal region, the jaw is the second most common site of facial fracture and are usually described by anatomical references, they are frequently associated with dislocation in the temporomandibular joint, which is why a tomographic analysis is required in search of fractures and dislocations, as well as adequately describing whether there are displaced fragments, or whether there is extension of the fracture. into the periapical space, which could increase the risk of infection.^{10,13}

DIAGNOSIS

As in any other trauma, an initial evaluation must be carried out exhaustively and following the ABC, which mainly includes evaluation of the airway, breathing and circulation. Once the patient is stabilized, completing a detailed anamnesis is the next fundamental step, it may be on the part of the patient or, if not possible, on the part of the companions or pre-hospital care personnel, all of this to understand the mechanism of the trauma and analyze the different possible injuries caused. Likewise, the patient can be asked some of the following questions to make an initial diagnostic approach to possible affected lesions: Do you have vision problems after the accident? After the accident, do you have problems hearing? After the accident, do you feel hypoesthesia or anesthesia in any facial area? After the accident, have you had blood or fluid leak from your nose, mouth, or ear? After the accident, have you had problems breathing?³ Once a facial fracture is suspected, its extension and location must be determined using images such as x-ray or computed tomography. CT is considered the gold standard, but due to economic limitations as well as availability in certain regions, radiography could be useful in the emergency department. Radiographs with occipitontal view (10-30 degrees) and the Waters projection (37 degrees) are normally evaluated for viewing the paranasal sinuses. With these projections the Mcgregor-Campbell, Dolan and Rogers lines can be related (Table 1). Delbalso, Hall and Margarona described the 4''S'' as characteristics to be compared in the projection of waters in a comparative way with the unaffected side, these are: Symmetry, Sharpness, Breast,

Soft tissues.^{8,11} As mentioned previously, the gold standard for the diagnosis of complex facial fractures is non-contrast Computed Tomography in the three planes (axial, sagittal and coronal) together with a 3D reconstruction. These will not only show the severity of the injury, but will also inform and guide the surgeon in choosing the most appropriate surgical intervention when correcting the anatomical relationships prior to the trauma.¹⁴

TREATMENT

The management of Le Fort fractures is surgical, the main objective is the restoration of occlusion, they seek direct exposure and manual reduction of the fractures, reconstruct the medial and lateral bone buttresses to prevent elongation of the face, restore projection of the face and restore the width of the maxillary arch, nose and orbit. Finally, evaluate the need to use bone grafts for the reconstruction of missing or severely crushed bone.³ Also, possible aggravating factors such as soft tissue edema and swelling of structures within the oral cavity must be considered in a maxillary fracture, which may generate airway obstruction, with the securing of the airway by means of great importance being of great importance. nasotracheal intubation or tracheotomy in more severe cases.⁸ Finally, it is considered successful management if adequate reduction of the fractured jaw is obtained. This can be confirmed by adequate: dental occlusion, alignment of paranasal muscles, zygomatic and zygomatic bones, and adequate reduction of all observable fracture.¹¹

Table 1: Lines in facial radiographic projections.

Lines	Description of each line
McGregor-Campbell	Crosses the frontal zygomaticus, superior margin of the orbit and frontal sinus. Crosses zygomatic arch, zygomatic body, inferior orbital margin and nasal bone. Crosses condyles, coronoid process and maxillary sinus. Explore the mandibular branch, occlusal plane. Crosses the lower edge of the jaw from angle to angle (also called trapbell line).
Dolan	The orbital line traces the inner margins of the orbitals (lateral, inferior, medial) and the nasal arch. The zygomatic line traces the upper margin of the zygomatic arch and body with extension to the frontal process of the zygoma to the zygomaticofrontal suture. The maxillary line traces the lower margin of the zygomatic arch, the body and the buttress and lateral wall of the maxillary sinus.
Rogers Elephant	Dolan's second and third lines create the outline of an elephant's head.

Intermaxillary fixation

After securing the airway, functional occlusion is attempted. Historically, different selection methods have been used, including: Erich's arch bars and circumdental wiring, Ivy loops, wires/tapes for interdental embrasures, circummaxillary or mandibular wiring, or the use of splints. The performance of intermaxillary fixation has been reported with low rates of intraoperative time and less pain, although adverse events such as dental damage, among others, have been reported. When this is not a viable option, the method of internal fixation and open reduction will be used.

Internal fixation and open reduction

For this technique, a coronal approach can be performed in cases of Le Fort II and III. In Le Fort II the glabellar approach is also used and through intraoral incisions is frequent in Le Fort I.

COMPLICATIONS

It is common to find some complications in general such as hemorrhage, infection, foreign body reaction, malunion, among others. Specifically in Le Fort I, tooth necrosis and maxillary hypoperfusion were found more frequently. In Le Fort II, fistula in the palate, deviation of the nasal septum and leakage of cerebrospinal fluid were described. Finally, in Le Fort III fractures, facial paralysis and trigeminal nerve damage predominated.⁷

CONCLUSION

The Le Fort classification provides a guide to understanding the extent and severity of the injury. It is a challenging pathology that, if not addressed correctly, represents a mortal threat to the patient. These injuries, mainly associated with high-velocity trauma mechanisms, are found concomitantly with other intracranial and cervical injuries. Imaging diagnosis is essential when planning the definitive management, which is the surgical option, this is based mainly on the restoration of occlusion, facial anatomy, and its function. Internal fixation and open reduction, along with Intermaxillary fixation are frequently used techniques to achieve successful reconstruction. It is essential to consider the possible postoperative complications that vary according to the Le Fort classification. In summary, Le Fort fractures will require a comprehensive approach and surgical experience accompanied by adequate multidisciplinary management to obtain a successful recovery and prevent long-term complications.

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