

SURGERY INDICATION FOR NASO-ORBITO-ETMOIDAL FRACTURES

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ABSTRACT

Aim of the study The purpose of this study is to demonstrate our experience in establishing the indication of surgery for fractures of the naso-orbito-ethmoidal (NOE) complex. **Material and methods** We reviewed 24 cases of NOE fractures, of which 18 patients had indication for surgery due to the presence of important deformity of the central face, the presence of telecanthus, diplopia or important nasal obstruction. The remaining 6 did not undergo surgery due to concurrent neurosurgical conditions, the presence of a cerebrospinal fluid fistula or associated general conditions. **Results** The results were favourable regarding both morphologic reconstruction and function restoration. The complex shape and projection of the nasal and paranasal areas were restored. Diplopia resolved postoperatively, and a good patency of the nasal cavity was achieved. There were no infectious complications postoperatively and no cerebrospinal fluid fistulas developed following surgery. **Conclusions** Primary surgery for NOE complex fractures should be performed when accurately indicated for avoiding the occurrence of sequelae.

Key words: telecanthus, diplopia, fracture, naso-orbito-ethmoidal, reconstruction

INTRODUCTION

The naso-orbito-ethmoidal (NOE) complex is formed by the joining of the nasal, frontal, maxillary, ethmoid, lacrimal, and sphenoid bones, forming a centrally located, delicate bone structure. It is comprised in the space between the orbits and anterior cranial fossa. Due to the frailty of the composing structures, fractures usually involve more than one bone component and are therefore discussed together, as a complex (1).

The incidence of NOE fractures is approximately 5 % of facial fractures, but the accuracy is difficult to assess due to differences in the classification of facial fractures and frequent inclusion in either central facial fractures, nasal or orbital fractures (2, 3). In addition, this particular

fracture pattern is often misdiagnosed in the absence of adequate imaging. In more than half of the cases, they are associated to other fractures of the facial skeleton- 60% of NOE fractures are associated with zygomatic-orbital fractures and approximately 20% are encountered in the context of panfacial fractures (2, 4, 5).

The decreased resistance of the central portion of the face favours the occurrence of comminuted fractures with this topography (1, 6). The proximity of important anatomical structures such as the skull base, the optical nerve and lacrimal canal, implies caution in evaluating the indication and timing of surgery. The main goal is achieving an accurate morphological reconstruction with minimal risks. The management of such

fractures involves a multidisciplinary approach comprising of maxillofacial, ENT, ophthalmologic, neurosurgical and imagistic evaluation.

MATERIAL AND METHODS

We performed a retrospective review of facial fracture patients admitted in the Oral and Maxillofacial Clinic of the Saint Spiridon Hospital from Iasi between January 2013 and December 2017 and included 24 patients with fractures of the NOE complex, either isolated (n=5) or associated with other facial fractures (n=19). CT (Computed Tomography) or CBCT (Cone Beam Computed Tomography) were the means of diagnosing of the fracture pattern. There were eight bilateral NOE fractures and eleven unilateral fractures. Eighteen patients had indication for surgery, while in six patients the initial treatment was conservatory due to concurrent neurosurgical lesions (n=2), cerebrospinal fluid leakage

(n=1), surgery contraindication due to the general condition of the patient (n=3).

Indication for surgery was due to the presence of either morphologic, functional or associated disturbances, including severely displaced fractures causing important deformity of the central face (n=14), the presence of telecanthus (n=4), diplopia (n=2), or the presence of important nasal obstruction (n=6). Epiphora was present in six patients and infraorbital nerve hypoesthesia in seven patients. The surgical procedures involved reduction of the fractured fragments and immobilization by osteosynthesis at the level of the inferior orbital rim and nasomaxillary buttress (n=13), canthopexy (n=4), repair of the medial and inferior orbital walls (n=2), and reduction of the nasal bone fracture (n=6).

The surgical indications are exemplified by the help of a NOE fracture case selected from the included patients (**Fig. 1-3**).



Figure 1. Patient with bilateral fracture of the NOE complex and right zygomatic-maxillary complex: three-dimensional CT reconstruction demonstrating important comminution at the level of the central face.

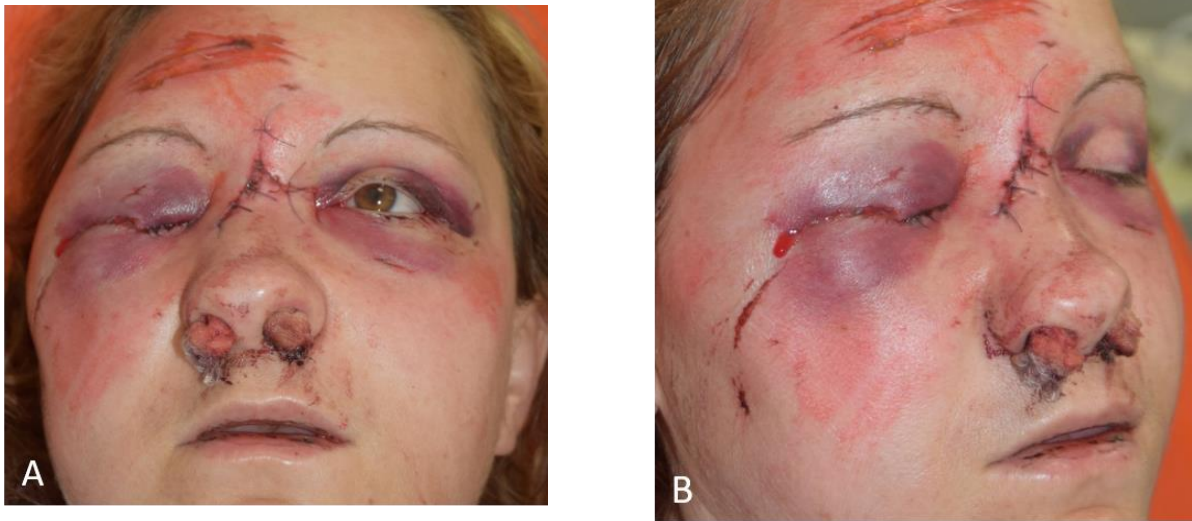


Figure 2. Patient with bilateral fracture of the NOE complex and right zygomatic-maxillary complex: preoperative clinical frontal (A) and halfprofile (B) view showing important deformity of the nasal, paranasal orbital and zygomatic regions and the presence of telecanthus.

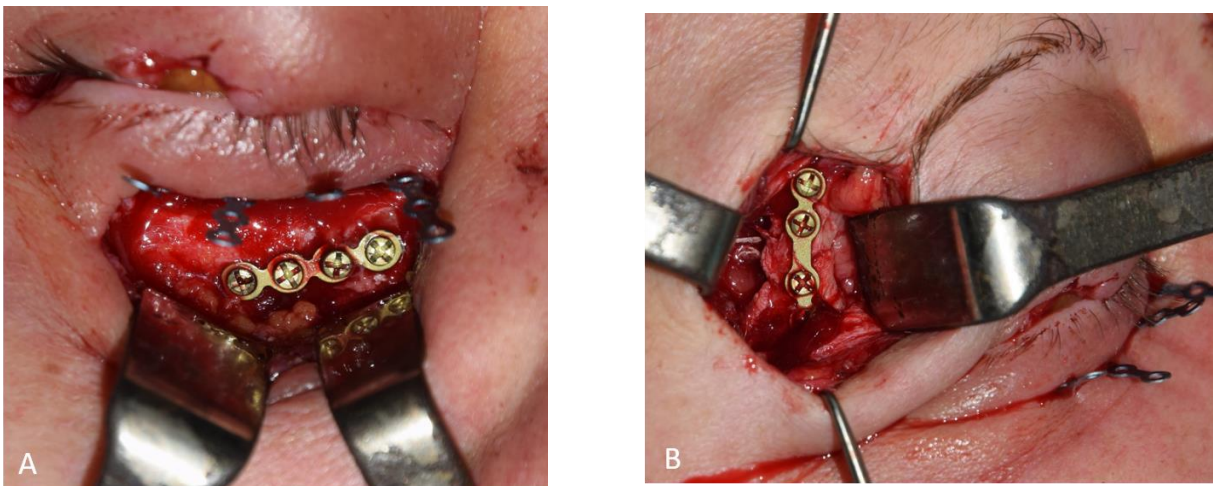


Figure 3. Patient with bilateral fracture of the NOE complex and right zygomatic-maxillary complex: Intraoperative view of osteosynthesis at the right inferior orbital rim (A) and right fronto-zygomatic suture (B), as well as reconstruction of the inferior and medial orbital floor using titanium mesh.

RESULTS

The aesthetic results were favourable with restoration of the intercanthal distance, nasal projection and central face shape and volume. In two cases minor volume adjustments were needed and lipofilling was performed at six months postoperative.

The functional disturbances were resolved

after surgery with disappearance of double vision and improved nasal patency in all cases. There was one case of persistent epiphora that underwent a further rhinodacryo-cystostomy procedure.

There were no cases of postoperative CSF fistulas and no infections.

The favourable outcome achieved is

exemplified by postoperative pictures of the same selected clinical case in **Figure 4**.



Figure 4. Patient with bilateral fracture of the NOE complex and right zygomatic-maxillary complex: clinical aspect immediately postoperative (A, B) and at one month after surgery (C, D) demonstrating the good outcome regarding the restoration of the central facial morphology and intercanthal distance

DISCUSSIONS

There are controversies in the existing literature regarding the surgical indication for NOE fractures. This is due to the delicate constituting bones, that are often comminuted and difficult to reduce and stabilize, to the complex three-dimensional shape and the easy to injure adjacent structures- the orbital content, lacrimal sac, naso-lacrimal canal, anterior skull base. In addition, the surgical access is challenging for achieving an accurate exposure of all the involved bone fragments while minimizing the risk of injuring adjacent structures. Increased experience is needed in performing this type of surgery. The goal of the surgical repair is to restore the lost form and function, while

minimizing complications (7).

Due to the location at the confluence of the workspace of several medical specialties, including maxillofacial surgery, otorhinolaryngology, ophthalmology and neurosurgery, NOE fracture patients are directed considering the main emergency following the traumatism. Frequently, concurrent neurosurgical traumatic lesions exist, and this is considered a priority with temporization of the fracture reduction procedure. In our case series, the surgery was delayed due to the presence of intracranial traumatic lesions or a CSF fistula in three patients. NOE fracture sequelae cases are frequently reported in the literature, and the main motive for late surgery is the presence

of concurrent traumatic lesions at other levels, especially neurosurgical lesions, due to the proximity of the anterior cranial fossa (5, 8).

Another occurrence is overlooking the NOE fracture due to the presence of massive epistaxis upon presentation, necessitating emergency nasal packing. In the context of posttraumatic oedema, hematomas, and associated lesions, the bone crepitation can be attributed solely to the nasal fracture and lesions of adjacent bones may be missed. This is also due to the presence of the nasal packing that immobilizes and supports the fractured fragments, unfortunately most often in a displaced position, but minimizing the mobility of the fractured fragments. A high index of clinical suspicion is necessary to recommend the adequate imaging investigations and therefore, achieve the correct diagnosis. CT or CBCT are the most useful investigations for NOE fracture diagnosis (1, 9, 10).

Most often, the stability of the fractured fragments is considered when indicating surgery, as well as the presence of morphological or functional disorders and the absence of local or general contraindications. These are also the criteria that guided our decision in recommending surgical correction in the included patients. Balancing the existing degree of functional or aesthetic disturbances in the traumatic context with the risk associated by the presence of additional traumatic lesions, general conditions and the possible intraoperative of injury to important anatomical structures is subject to debate between surgeons. Still, most authors agree that primary surgery should be performed in the presence of important deformity of the nasal and paranasal regions, as well as medial palpebral region, with the presence of an increased intercanthal distance, but most importantly when there are functional disturbances represented by diplopia,

important nasal obstruction, epiphora (1, 5, 11).

We obtained favourable results by performing primary surgery in the presence of aesthetic and functional disturbances. We targeted the repair of key areas of the involved bone complex. The primary site for osteosynthesis was the nasomaxillary buttress, but also the medial inferior orbital rim, as part of the vertical and horizontal resistance pillars of the central face. Reconstruction of the continuity of these structures allowed for contour restoration in the paranasal and inferior orbital areas. The nasomaxillary buttress of the facial skeleton serves as a supporting ground for the overlying soft tissues. Therefore, it is important to recognize and adequately reduce and immobilize fractures with this topography, since they can be overlooked in the context of recent trauma and associated oedema, when the paranasal bone crepitation is attributed to a nasal bone fracture (12). In our patients, the naso-maxillary buttress was surgically repaired in two thirds of the cases and its reconstruction was considered an important step in restoring the shape and projection of the central portion of the face, together with restoration of the nasal prominence.

A crucial step in reconstructing the fractured central face is considered by many authors to be the accurate repositioning of the medial canthal ligament in the correct vector and favouring the redraping of the suprajacent soft tissues (11, 13). We performed the repositioning of the medial canthal tendon when important displacement occurred, achieving the restoration of the normal intercanthal distance and eyelid length.

In our case series functional disturbances constituted an important argument for recommending surgery. Displaced nasal fractures were reduced with deobstruction of the nasal air passage and restoration of the

nasal projection. Diplopia was resolved by restoration of the continuity of the medial and inferior orbital walls.

In the absence of accurate indication, or in the presence of contraindication for surgery, untreated NOE fractures can result in sequelae involving telecanthus, shortened palpebral fissures, enophthalmos, dystopia, and saddle nasal deformity. Studies report less favourable outcomes in performing secondary surgery as opposed to primary

repair (9). In our experience, the primary treatment of naso-orbito-ethmoid fractures involves less complex procedures than the ones implemented in sequelae surgery and ultimately leads to good outcomes regarding form and function. Whenever possible sequelae occurrence should be avoided by adequately diagnosing the case, evaluating the benefits and risks and performing primary fracture repair surgery when indicated.

CONCLUSIONS

A primary repair of naso-orbito-ethmoidal fractures should be performed whenever possible to reduce the occurrence of sequelae.

In the presence of adequate indication, the outcome of NOE fracture surgery can be optimal, with morphologic and functional improvement, as resulting from our study.

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