Transconjunctival versus Subciliary approach in treatment of orbital floor fractures reconstructed by titanium mesh

(Comparative study)

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بسم الله الرحمن الرحيم

قالوا سبحانك لا علم لنا الا ما علمتنا انك انت العليم الحكيم

صدق الله العظيم

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Dedication

To my dear parents and sister for their unconditional love and support.

To my beloved wife Heba for her continued encouragement, patience and understanding.

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Introduction

Orbital floor fractures needs specific clinical attention for a number of reasons. Failure to recognize and treat them early may result in severe squeals, which must be prevented. However, despite surgical intervention, orbital floor fractures are associated with risk of persisting sensibility disorders, enophthalmos and permanent diplopia.

The treatment of orbital blowout fracture consists of orbital content reduction and orbital wall reconstruction with autologous or alloplastic materials to restore the anatomy and volume of the orbit. Although various synthetic materials for covering orbital wall defects have been used, the optimal material remains controversial yet.

The orbital floor must be approached for different surgical treatments, all of which can involve different incisions. The choice of approach and the incision placement are guided by the following goals: good intra-operative visibility, minimal postoperative scar formation and good aesthetic results. These can be achieved using either the transconjunctival approach or transcutaneous incisions. Both techniques have passionate supporters and both methods have different advantages, disadvantages and complications.

In this study, we compared the two different approaches in terms of the aesthetic results and complications to better define the superiority of one method.

Review of Literature

Epidemiology

The epidemiologic factors associated with facial trauma change according to the time of the study, demographics, culture, and social characteristics of the population considered. In Iran, a 5-year study of 237 patients with maxillofacial fractures revealed that motor vehicle accidents were the leading cause of fractures (54%), followed by falls (20.3%), assaults (9.7%), and sports injuries (6.3%) (1). Road traffic crashes were also the main cause of orbital fractures in Sweden. (2) However, among soldiers of the US army on active duty, a population without limitations of a specific geographic location and routinely screened for driving while intoxicated, an analysis of 3599 midfacial fractures showed that assault was the most prominent cause of trauma (28.2%), followed by motor vehicle accidents (23.7%), sports (20.1%), falls (7.1%), and machinery (4.2%). (3) Finally, in the pediatric population sports and accidents during play are the leading causes of orbital fractures for both girls and boys. (4)

Types of orbital fractures

Fracture classification systems are redundant and may even be confusing, which makes comparisons between studies difficult.

Depending on the point of impact on the facial skeleton, trauma can lead to a multitude of types of orbital fractures. Three patterns of fractures are well described: zygomatico-orbital, naso-orbito-ethmoid, and internal orbital (linear or pure blowout). The term trapdoor is used to describe blowout fractures with minimal displacement of the bone fragment. Different combinations of these basic patterns produce combined or complex orbital fractures. (5)

Symptoms and signs of an acute orbital floor fracture

The acute stage of orbital trauma is often associated with a periorbital hematoma and swelling, more or less making opening of the eye impossible without manual assistance. The orbital rims and malar prominence are unaffected in pure blow-out fractures, while in other zygomatico-orbital fractures the cheek contour is often flattened to varying degrees owing to dislocation of the zygomatic bone. The flattening may, however, be concealed by the swelling. Mouth opening capacity and occlusion may be affected when a dislocation of the zygoma is present, because of its close location to the coronoid process of the mandible and the masseter and temporalis muscles. (6)

The infra-orbital nerve runs along the orbital floor in the infra-orbital groove and enters the cheek after passing the infra-orbital foramen. Consequently, this nerve is often affected in orbital floor fractures, giving rise to disturbed sensibility in the cheek, nose, lower eyelid, upper lip and gum/teeth of varying degrees on the ipsilateral side of the face. (7)

Hypophthalmos or enophthalmos may be caused by displacement of the eye globe due to an enlargement of the bony orbit. It has been shown that a 0.8–1 ml increase of bony orbital volume corresponds to 1 mm on the Hertel exopthalmometer. Accordingly, an increase in the bony orbital volume of 1.5–2 ml will cause clinically evident enophthalmos (≥2 mm). Enophthalmos may be temporarily concealed and compensated for by hematoma and oedema. Likewise, exophthalmos may result from a reduced orbital volume or a swelling of intra-orbital soft tissues, or a combination of the two factors. A ‘sunken eye’ in the acute stage may be caused by the so-called ‘retraction syndrome’, an entrapment of the inferior rectus muscle causing the superior rectus muscle to exert a strong inward pull on the eye bulb as a reaction to the entrapped antagonist. (8)

Diplopia may be caused by displacement of the eye globe, as the two eyes are no longer in line with the same visual axis. Diplopia may occur when the enophthalmos is ≥5 mm. In such cases eye motility may still be unimpaired. Diplopia may also be caused by a temporary paresis, when the eye of the injured orbit does not show normal motility. The inferior branch of the third cranial nerve (oculomotor nerve) can be affected in an orbital floor fracture and cause a combination of pupillary paralysis and weakness of the inferior and medial recti and the inferior oblique muscles. This is, however, rare since the nerves are well protected and lie on the side of the muscle opposite to the fracture. [9]

Another cause of diplopia is mechanical restriction of the motility of an extra-ocular eye muscle. In orbital floor fractures the infra-orbital rectus muscle may be swollen or entrapped in the fracture, and may cause restricted vertical eye motility. [9]

The ‘orbital floor trap door’ fracture that occurs in children and adolescents is an example of the latter. The fracture is characterized by the features of the young elastic skeletal bone. Orbital soft tissue/the inferior rectus muscle becomes tightly entrapped in the fracture, leading to ischemia, and if not treated in time, fibrosis and permanent diplopia may develop. The symptoms and signs in the acute stage of an ‘orbital floor trap door’ fracture can be misleading and are often mistaken for those of cerebral concussion. The usual ‘black eye’ may be missing (the condition is also called the ‘white-eyed’ blow-out fracture). The patient suffers from pain and nausea and sometimes from vomiting, bradycardia and syncope (oculocardiac reflex). In these cases, acute surgery to release the entrapped tissue is urgent if serious complications, such as permanent diplopia, are to be prevented. [10]

Diagnostic methods

Thorough clinical examination in facial fractures is important. At any suspicion regarding vision, occlusion and/or mouth opening in association with the trauma, both an ophthalmologist and an oral and maxillofacial surgeon must be consulted.

Reliable diagnostic methods that reflect the true circumstances concerning anatomy and functioning after a facial trauma are essential to make a well-founded decision about whether to operate or not. However, the commonly used expression ‘orbital floor exploration’ indicates that the surgical intervention is used for diagnostic purposes, which raises the question whether routine pre-operative diagnostic methods are sufficient.

In trying to differentiate between patients who need acute surgical intervention and patients not needing an operation great demands are put on the accuracy of the diagnostic methods; not least when it comes to evaluating eye motility in cases where diplopia is present.

I. Imaging:

Radiographic evaluation of the orbital fractures includes a number of imaging modalities:

1. Plain radiograph:

Plain radiographs include the Waters' and Caldwell’s views. The radiographic findings on the waters' view cover a spectrum of findings, since in a blowout fracture the displacement of the fracture fragments is variable, resulting in a number of different relationships between the intact orbital rim and fractured orbital floor. These findings include increased distance between the palpable orbital rim and floor (greater than 2 mm) compared with the non-injured side, a fracture fragment hanging from the roof of the sinus, termed a trap door, and a complete absence of the orbital floor. Avulsed fragments may or may not be identifiable in the maxillary sinus. Avulsed or displaced fracture fragments may exhibit accentuation of their outlines if the x-ray beam strikes them in a tangential fashion; this phenomenon is sometimes termed the bright light sign. In addition to the osseous abnormalities, soft tissue abnormalities may also be noted on the waters' view. These include intraorbital air and soft tissue herniation into the superior aspect of the adjacent maxillary sinus. The Caldwell's view is important because it demonstrates the actual fracture site.

2. Computed tomography:

Imaging techniques have developed rapidly and compared with plain X-ray films, CT examinations provide more detailed information about the bony structures. The volume of the bony orbital volume can be calculated and the risk of enophthalmos development predicted. CT is especially important in the evaluation of blowout fractures because in many instances the fracture is not adequately demonstrated on plain film studies. Axial CT studies do not optimally demonstrate blowout fractures. The most common finding on axial CT sections is a prominent osseous fragment and/or soft tissue mass in the maxillary sinus. Adequate CT evaluation must include examination in both the direct coronal projection and the direct oblique sagittal projection. The direct coronal projection provides the best demonstration of orbital injury, especially lateral and medial extent of floor fractures; however, it does not provide optimal demonstration of the anterior and posterior limits of the fracture or displacement of the inferior rectus muscle. By contrast, the direct oblique sagittal projection adequately demonstrates both the anterior and posterior extent of the fracture and the status of the inferior rectus muscle.

Three-dimensional (3D) CT has proved to be helpful in planning treatments such as facial reconstructive surgery, providing more information without additional radiation to the patient. (11)

Cone beam computed tomography (CBCT) seems to be suitable for computer-assisted planning in the management of orbital trauma with precise calculations and less radiation. [12]

3. Magnetic resonance Imaging (MRI) :

MRI has the advantage of displaying the status of the soft tissues with great accuracy. This is important in orbital floor fractures, giving the possibility of visualizing entrapped soft tissues. [13] Only, MRI is insufficient in assessing the bony structures and therefore needs to be combined with CT.

II. Functional tests

Essential functions at risk in orbital floor fractures involve eyesight and the mouth opening capacity. Disturbed sensibility in the distribution area of the infra-orbital nerve is frequent, but has commonly been regarded as an inferior problem. Methods used to assess these functions are described in the following section.

1. Methods of assessing affected eye motility and diplopia

It is important to establish whether or not diplopia in association with an orbital floor fracture is caused by entrapment of soft tissues. Entrapment causes restricted eye motility, but as CT scans and MRT only provide stills, the clinician can no more than guess the presence of entrapment. Eye motility can only be demonstrated by a functional test.

A number of tests are available to assess whether diplopia is present and whether eye motility is affected. They include the forced duction test and the forced generation test and other tests. Often, however, eye motility is tested simply by asking the patient to fixate and follow the movement of a penlight in the nine cardinal directions of gaze while the examiner observes the movement of the eyes. [14] [15]