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Orbital Floor Fractures

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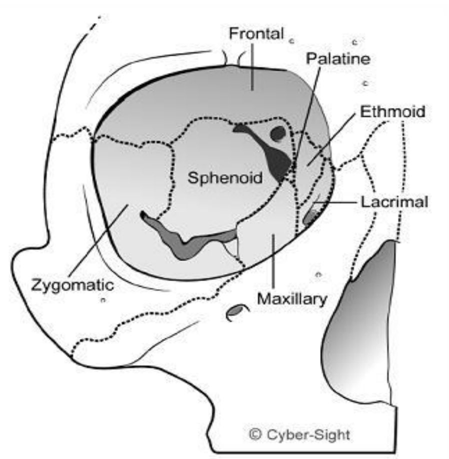
Abstract: *Orbital fractures are one of the most commonly seen facial fractures, caused by blunt trauma in road traffic accicents. The floor of the orbit gets affected more commonly than the other walls. Patients usually complain of enophthalmus or diplopia. In certain cases, medical management would suffice but in most situations, surgical management becomes mandatory to prevent loss of vision for the patient. Auto genous grafts and allografts can be used. The latter is preferred. Recently, resorbable plates and mesh are used and has proven to be successful.*
Keywords: *Orbital fractures, Enophthalmus, Resorbable mesh, Orbital floor fractures.*

I. Introduction

Orbital fractures are frequently caused by blunt trauma which also results in damage to the surrounding bones and soft tissues. A wide range of specialities like maxillofacial surgeons, ophthalmologists, otolaryngologists, neurosurgeons and plastic surgeons can be involved in the evaluation and treatment of orbital fractures.[1] Anatomically, the anteromedial one-third of the orbital floor comprises the orbital face of the maxilla, whereas the posteromedial one-third is formed by the palatine bone and the lateral one-third is formed by the zygomatic bone. Usually, fracture occurs over the medial wall and floor of the orbit following trauma.[2]



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II. Classification

When the orbital rim is not involved, it is termed as a pure orbital blow-out fracture or isolated orbital floor fracture, and when the rim is involved, it is termed as an impure orbital blow-out fracture.[3]
Harris et al[4] classified isolated orbital fractures according to the relationship between the fractured bone fragments and the soft tissues with the help of CT images:

Type I. Trap-door fractures in which bone fragments realign.
Type IA. No orbital soft tissue is visible within the maxillary sinus.
Type IB. Orbital soft tissue is visible within the maxillary sinus.
Type II. Bone fragments are distracted and soft tissue is displaced towards the maxillary sinus through spaces between those fragments.
Type IIA. There is no herniation of soft tissue or the displacement of the soft tissue is less than the distracted bone fragment.
Type IIB. The herniation of soft tissue is greater than the distracted bone fragment.
Type III. Displaced bone fragments surround displaced soft tissue.

Type IIIA. Soft tissue and bone are moderately displaced towards the maxillary sinus.
Type IIIB. Soft tissue and bone are markedly displaced towards the maxillary sinus.

III. Mechanism

There are two mechanisms that are accepted to be the cause of the orbital floor fractures:

- The **buckling mechanism** proposed by Fujino[5] suggests that when there is posterior displacement of the infraorbital rim, the force is transmitted to the orbital floor which buckles and fractures while the rim returns to its normal position without fracturing.
- The **hydraulic theory** given by Smith and Regan[6], suggests that when an object larger than the entrance of the orbit impacts the upper eyelid and the globe, it transmits the kinetic energy to the periocular tissues[7]. This results in an increase in the intraorbital pressure. To relieve this, the floor blows out into the maxillary sinus.

Symptoms:

Clinical features[3] in a patient with an orbital floor fracture are

- Intraocular pain
- Numbness in certain regions of the face
- Inability to move the eye
- Diplopia
- Blindness
- Enophthalmus
- Oedema
- Haematoma
- Infraorbital anaesthesia
- Globe displacement
- Cranial nerve injuries

Globe displacement[3] can be in the form of:

- Proptosis
- Vertical displacement
- Horizontal displacement
- Traumatic herniation into maxillary sinus
- Enophthalmus

Enophthalmus is by far the most commonest type of globe displacements.[3] It can be defined as the reduction in the balance of the orbital contents and orbital volume. Clinically, it is defined as a backward and usually downward displacement of the globe into the bony orbit.[8] Diplopia [3] is also common in orbital blow out fractures. Diplopia or double vision is a debilitating problem that causes the patient to see one object in two places in space.

IV. Management

Treatment of orbital fractures can be broadly classified into three: conservative treatment, immediate surgical treatment and delayed surgical intervention.[9]

For the reconstruction of orbital floor defects, both autogenous as well as alloplastic materials can be used. Each has its own benefits and defects.[10]

For autogenous bone grafts, cranial bone grafts have been used extensively.[11] The prime disadvantage of using cranial bone grafts is the donor site. They pose a risk for potential intracranial injury. Other autogenous grafts include rib, ileac crest, mandibular symphysis, nasal septum, and fascia.[12-18]

In relation to alloplastic material, titanium is the most extensively used.[11]Other implants include silicone and porous polyethylene. Their use is extensive considering advantages such as donor site morbidity and ready availability, but they have a high risk of causing infection.[19,20]

Recently, resorbable polymers are being used in the form of screws, plates, sheets and mesh panels.[21] Once these resorbable implants are placed on the floor of the orbit, they allow a sheet of fibrous tissue to form in the first 2 months after insertion.[10] By 6 months, these implants undergo resorption and undergo a volume reduction by 95% by 9 months.[21]

V. Procedure

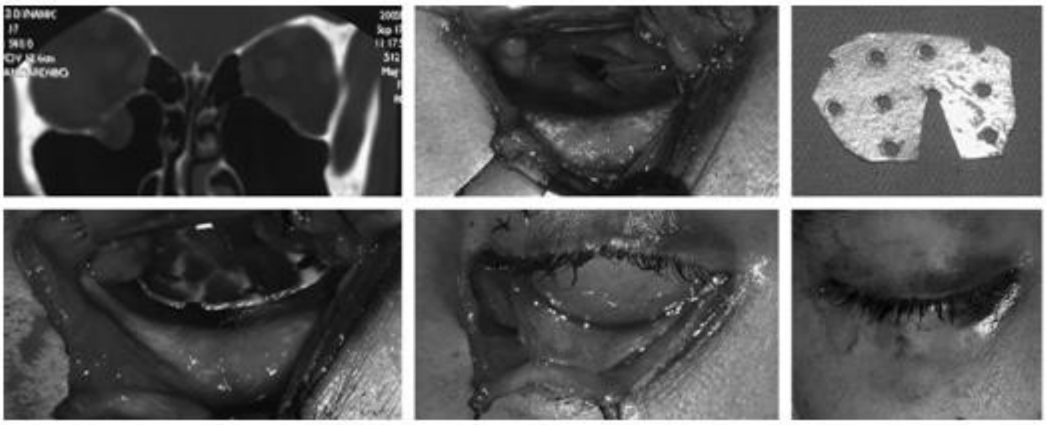
Surgical access for orbital floor fractures can be subcilliary, subtarsal or transconjunctival.[3] Subcilliary incisions are made 2 mm below the edge of the eyelid. Subtarsal incision is made between the edge and the orbital rim. Transconjunctival incision was first described by Tessier. There are two methods here; preseptal, where the incision is made at the edge of the tarsus, and retroseptal, which involves an incision 2 mm below the tarsus. Transconjunctival approach is the most preferred because it does not involve any disruption to the outer surface of the eyelid and hence provides excellent aesthetic results.[3]

In a recent study, Larry H Hollier et al[10] treated 12 consecutive patients using 0.25 mm resorbable mesh. The criteria to select patients here was that the defect should be greater than 1 cm^2 as measured on computed tomography scans taken preoperatively and it was confirmed on intraoperative examination. A lower eyelid transconjunctival incision was made with a lateral canthotomy. An empty foil suture pack was used as a template to measure the defect. The resorbable implant used here was a copolymer made of polylactic and polyglycolic acid in the form of plates and screws. A sheet of the implant was cut and heated to conform to the shape of the template. This was then positioned over the defect and then contoured over the infraorbital rim.

The patients were called back for follow-up. Enophthalmus was observed in 2 patients due to improper placement of implant. One patient developed foreign body reaction which required the removal of the excessive portion of the implant.

In another study done by Persons BL et al, resorbable perforated plates of 25 x 25 mm, 0.65 mm thickness were used through an access of 1 cm^2 antral bone flap to the maxillary sinus and infraorbital floor in five patients. There was no report of enophthalmus or infection in any of the patients who returned for follow-up.[22]

In a study done by Serhan Tuncer et al[23] in 17 patients with orbital floor fracture, between 2002 and 2004, resorbable plate was easily cut using scissors and curved into the anatomical shape and fitted over the orbital floor defect 0.5 mm posterior to the inferior orbital rim. It was ended with skin or conjunctival closure. No patient showed any evidence of infection due to the resorbable mesh on the orbital floor.[23]



Other methods:

In certain cases just medical management would suffice. The patient is advised to use nasal decongestant sprays and is asked to avoid blowing of nose for several weeks after the injury to prevent orbital emphysema and visual compromise.[24]

Prophylactic antibiotics have also been prescribed to prevent potential orbital cellulitis from bacterial spread if there is a communication between the orbit and the sinuses.[24]

To reduce orbital oedema steroids may be used.[24]

VI. Conclusion

Orbital blow out fractures are commonly caused by road traffic accidents. The blunt trauma also causes damage to the surrounding tissues. It commonly causes diplopia, enophthalmus, oedema, haematoma and in severe cases even loss of vision. To prevent this appropriate treatment has to be given. From most recent studies, the use of resorbable plates and mesh has been proved to the best type of treatment with minimal complications.

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