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Orbital Blowout Fracture Repair with Titanium Mesh: A Case Report

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ABSTRACT

Blunt trauma to the orbit often results in orbital *blowout* fracture involving the floor or medial wall of the orbit. Additionally, herniation of fat, connective and muscular tissues through the fractured segments usually arise and may necessitate intervention. A 47-year old woman presented at the hospital of study, with a 7-day history of pain and bruising in the right periorbital region secondary to a fall. Examination revealed periorbital ecchymosis with associated subconjunctival haemorrhage as well as diplopia. A CT scan of the face revealed a defect in the right orbital floor, with herniation of orbital tissues into the right maxillary antrum. Surgery was done 11 days after injury using titanium orbital mesh after herniation of orbital soft tissue was relieved. Post-operative review was uneventful.

Keywords: *Orbital blowout, titanium mesh.*

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INTRODUCTION

The eyeball is a well-protected organ in a quadrangulo - pyramidal shaped vault that tapers into an orbital apex. The average adult orbit is reported to have a volume of 30cc, while the globe averages 7cc. A modest change in the position of the bony walls can have a significant impact on the orbital volume and globe position.¹

Fractures of the orbit are amongst the commonest fractures of the midface. Blunt trauma to the orbit often results in *blowout* fracture involving the floor or medial wall of the orbit with some reports linking orbital fracture location to ethnicity.¹⁻⁴ Orbital floor fracture typically involves herniation of fat, connective and muscular tissues through the fractured segments, and may necessitate intervention.⁵ Absence of which may lead to muscular or perimuscular fibrosis, with consequence limited motility resulting in diplopia in adults and amblyopia in children.⁶

Orbital wall repair is necessitated in recreating the orbital volume necessary to allow repositioning of the globe to its normal anatomical position. The goals of primary repair of blowout fracture are to restore the configuration of the orbital walls, return prolapsed orbital contents into the orbit

proper, and eliminate the impingement or entrapment of orbital soft tissues.^{7,8} Indications for repair of orbital blowout fracture include diplopia that persists for more than 7 to 10 days, signs of entrapment, relative enophthalmos greater than 2mm and fracture that involves greater than 50% of orbital floor. Indication for urgent repair is entrapment that causes oculocardiac reflex with resultant bradycardia and cardiovascular instability.^{1,8}

Surgical approaches comprise: transconjunctival, subciliary and the infraorbital incisions. Numerous materials have been described in the literature for the reconstruction of orbital fractures. These include porous polyethylene, bioresorbable polydioxanone, nylon, gelatin film, titanium mesh and autogenous bone grafts. Reported complications included blindness, orbital haematoma, infection of hardware, migration of hardware, entropion and diplopia.⁹⁻¹¹

The repair of the orbital floor fracture has a high difficulty index due to its delicate anatomical region with limited intraoperative view.¹² The objective of this report has to document our findings of a case of orbital blowout fracture (involving the floor) treated at our hospital with Titanium Mesh.

CASE DESCRIPTION

A 47-year old woman presented at the hospital of study, with a 7-day history of pain and bruising in the right periorbital region, secondary to a fall. Examination revealed periorbital ecchymosis on the right side of the face with associated subconjunctival haemorrhage of the right outer quadrant and mild periorbital edema (as shown in

figure 1). On further examination, there was tenderness of the right infraorbital region, limitation of upward gaze as well as diplopia. As part of the study institution's protocol, patient was referred for an ophthalmology evaluation.

A CT scan (5mm cut) of the face revealed a defect in the medial aspect of the right orbital floor, with right antral opacity and herniation of orbital tissues into the right maxillary antrum (Figure 2). The orbital floor defect measured 1.8cm x 2.1cm using Osirix Dicom Viewer. A diagnosis of right orbital blowout fracture was made. Upon consultation with the patient, a decision was taken to proceed with a surgical intervention under general anaesthesia.



Figure 1: Periorbital ecchymosis of the right orbit



Figure 2: CT Scan reveals defect in the medial orbital floor with orbital tissue herniation
Surgery was carried out 11 days after the fall.

Access to fracture site was approached via a subciliary incision (Figure 1). A 1:200,000 adrenaline solution (6mls) was infiltrated along the incision line and a compulsory 10 minutes wait was observed. A forced duction test was done which showed restriction of globe motility. A skin incision was made along the outline with a no. 15 blade. A cutting diathermy was used to separate the skin from the orbicularis oculi muscle and using blunt dissection, the infraorbital rim was exposed. An orbital retractor was used to carefully elevate the globe upwards and the orbital floor fracture was exposed with the entrapped orbital fat visualized (Figure 3).



Figure 3: Orbital floor fracture with entrapped orbital fat



Figure 4: Placement and Adaption of orbital mesh

The herniated orbital fat was relieved from the maxillary antrum. An orbital floor titanium mesh (KLS Gebrueder martin) was then trimmed and contoured to bridge the floor defect while adapted to the remainder of the orbital floor. The mesh was then adapted over the orbital rim and screwed with four 1.0mm micro screws (Figure 4). The operation site was irrigated with normal saline and the incision was closed in layers using 3/0 vicryl and 4/0 proline sutures for muscle and skin respectively.



Figure 5: Postoperative CT Scan at 3 weeks

Patient was discharged from hospital 5 days post operatively. The operative site healed satisfactorily with very little event; there was mild oedema but no significant ocular symptoms. Patient was able to experience an improved upward motility of the globe as early as 4 weeks post operatively. A post-operative CT scan was taken to show release of herniated soft tissue and mesh adaptation (Figure 5).

DISCUSSION

In 1957, Smith and Regan coined the term blowout fracture for isolated orbital floor fracture. Orbital blow out fractures were further classified into pure (not involving the orbital rim) and impure (involving the orbital rim) blowout fracture.^{5,13} The basic patterns of pure orbital fractures has been described as trapdoor and punched out fractures.¹³ By definition, they are limited to one wall and are typically 2cm or less in diameter. Blow out fractures are the most common of orbital fractures and usually arises when a blunt object larger than the eye hits the orbit.¹² In a retrospective study in Nigeria by Owuoye et al.⁴ RTA was the most common cause of orbital blowout fracture. At variance, our patient sustained her orbital

blowout fracture as a result of a fall. The most commonly involved orbital walls in a blow out fracture are the floor and medial orbital walls. Our patient had a fracture on the medial part of the orbital floor.

Smith and Regan advocated early surgical intervention for orbital floor fracture repair. As a sequel to this, Converse and Smith endorsed surgical exploration and repair of all orbital fractures within the first three weeks of injury.^{5,6} However, the timing of repair remains debatable. Michael Burnstine, after a meta-analysis came up with the following recommendations; immediate repair for: cases of diplopia with CT evidence of entrapped muscle or periorbital tissue associated with non resolving oculocardiac reflex, bradycardia, heart block, nausea, vomiting or syncope and early enophthalmos/hypoglobus causing facial asymmetry. If a surgical intervention is not carried out in the first 24 hours, it should be delayed 10 days to allow for the resolution of the oedema. Fracture repair should then be done prior to 14 days to prevent scarring.¹⁴ In the 5 case studies by Owuoye et al.⁴, the average time interval between injury and surgery was 48 days. A delay in repair why admissible, may result in fibrosis and tethering of orbital soft tissues thus causing persistent enophthalmos and other symptoms.⁴ Our fracture repair was done 11 days post injury.

Clinical presentation of orbital blow fractures includes periorbital ecchymosis, difficulty in elevating the globe, diplopia, enophthalmos amongst others. The absolute indications for surgical intervention in traumatic cases include persistent diplopia within 30° of primary gaze lasting more than 10-14 days post injury, enophthalmos of greater than 2mm and restriction of ocular movement especially in upward gaze resulting from inferior muscles entrapment.¹⁵ Our patient had diplopia, difficulty in globe elevation and also a CT evidence of entrapped periorbital tissue in the right maxillary antrum.

Many materials are used in orbital blowout fracture repair. These include autogenous bone (calvaria, iliac, maxillary and ribs), allografts such as metallic implants (titanium mesh, titanium plate), non-metals such as Gore-tex, silastic, silicone, methyl methacrylate and resorbable implants. No consensus has been reached recognizing any one material as the optimal choice for orbital floor repair.⁸ In general, factors influencing the decision of which material to use includes surgeon experience and comfort, severity and extent of orbital floor fracture, individual characteristics and cost associated with the material.^{8,9} In Owuoye et al.⁴ review in Nigeria,

Silicone and bone implants were used for orbital floor repair. Titanium mesh was used in this repair of the orbital floor in this patient. The advantages of titanium mesh include availability, biocompatibility, ease of intraoperative contouring, and rigid fixation. However, in comparison with other alloplast materials, titanium mesh is not cost effective.¹⁰. This patient however did not have any financial constraints.

CONCLUSION

Orbital floor fracture is not an uncommon injury in the maxillofacial region. It can result in significant visual impairment and hence may necessitate surgical intervention.

Repair of orbital fractures is optimal when undertaken not more than 14 days post injury. The ideal material for orbital floor reconstruction has remained elusive with each having its own advantage and disadvantage. Cost of material, availability and the surgeon's skill and preference are some of the factors influencing the material used for reconstruction. Titanium mesh is one of the preferred materials used for orbital floor fracture repair because of its biocompatibility, malleability and rigidity.

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