

The Evaluation of Complications of Titanium Mesh Reconstruction in Orbital Floor Fractures

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ABSTRACT:

BACKGROUND:

The facial symmetry is a specific measure of bodily symmetry and it influences judgements of aesthetic traits, therefore special attention and care must be paid during orbital fracture treatment to consider every detail in the scenario of surgical reconstruction. Many materials have been used for treatment of orbital bone fractures and titanium mesh is widely used implant for this purpose therefore it is worthwhile to study it.

AIM OF STUDY:

Evaluate the complications of using titanium mesh in the treatment of orbital floor fractures.

MATERIALS AND METHODS:

The study included 13 patients (11 males and 2 females) presented to Oral and Maxillofacial Surgical Department in Al-Yarmook Teaching Hospital Iraq/ Baghdad in the period from January 2018 to June 2019 with traumatic orbital floor fracture and they underwent reconstruction with titanium mesh.

RESULTS:

The results showed that the most common cause for trauma was road traffic accident (53.8%). Preoperative diplopia was found in 12 patients (92.31%) followed by persistent diplopia found in only one (7.69%). Preoperative enophthalmos was (61.5%) in eight patients, six of them improved after treatment and returned to the normal condition but only two had postoperative enophthalmos with less severity.

CONCLUSION:

The reconstruction of orbital floor using titanium mesh was successful in most of the cases and the results were good and satisfactory aesthetic and functional results.

KEYWORDS: Orbital fracture, titanium mesh, diplopia, enophthalmos, Hertel exophthalmometer

INTRODUCTION:

The orbit is the bony socket of the eye which encloses and protects the eye and its appendages. The configuration of the bony structure of the orbit is that of a pyramid with its base facing anteriorly, with each orbit having an intrabony volume of approximately 35 ml. Each bony orbit is composed of seven bones (frontal bone, zygomatic bone, maxilla bone, lacrimal bone, ethmoid bone, sphenoid bone and palatine bone) (Fonseca, 2013).

In craniomaxillofacial trauma orbital structures are involved in up to 40% of the cases due to its exposed position and its limited bone thickness (Hoffmann et al., 1998). A summary of possible clinical findings in isolated orbital floor fractures (Perry et al., 2016):

- Periorbital ecchymosis
- Subconjunctival haemorrhage
- Diplopia
- Limitation of eye movement especially in upward gaze
- Enophthalmos
- Ipsilateral epistaxis especially when it is part of zygomatic complex or Le Fort fractures.
- Paresthesia within distribution of infraorbital nerve.

Historically, there has been debate as to whether the mechanism of injury results in a blow to the globe transmitted to the orbital floor (hydrostatic theory) or a blow to the lower orbital margin (buckling theory) (Brennan et al, 2017).

The materials used for orbital reconstruction can be classified by (Brennan et al., 2017) into:

1. Autogenous (bone or cartilage).
2. Non-autogenous:
 - a. Resorbable.
 - b. Non-resorbable Non-Metal
 - c. Titanium sheet
 - d. Custom-made prosthesis

AL-Yarmook Teaching Hos.

RECONSTRUCTION TITANIUM MESH

Titanium mesh has been approved by the Food and Drug Administration (FDA) since 1984, and now is accepted throughout the world to be used in the craniomaxillofacial surgery, especially in large defects (Ling-Xiao Ye et al., 2016). Titanium plates are thin, stiff and easy to contour. They are easily stabilized, maintain their shape, and have the unique ability to compensate for volume without the potential for resorption. When titanium plates were introduced, it believed that they needed no removal, since titanium is a highly biocompatible material (Bremer et al., 1988).

Rubin and coworkers (1992) compared the use of custom-shaped orbital floor titanium plates or vitallium mesh with autogenous bone grafts. They reported no significant complications related to the orbital implants. Metal implants were easier to use than autogenous bone grafts.

MATERIALS AND METHODS:

Patient's Sample:

This was a prospective study included 13 patients who underwent reconstruction of orbital floor and inferior orbital rim using titanium mesh performed in the department of maxillofacial surgery in Al-Yarmouk Teaching Hospital, Baghdad, Iraq from January 2018 to June 2019.

Eleven patients were males and two were females. Patient's ages ranged between 18-47 years. The mean age was 29.77 years.

Preoperative evaluation:

History and examination: The information about the patient and the injury were collected in the case sheets. Patient chief complain, past medical and surgical history had taken. Inspection if there is ecchymosis, subconjunctival hemorrhage, chemosis or globe rupture. Palpation if there is any foreign body and to check bony deformity and tenderness. Diplopia is tested by holding a finger or an object arm's length in front of the eyes and asking the patient to report double vision as the finger is moved. It was recorded in

each of the nine positions of gaze. The vertical globe level was checked by using a short clear plastic ruler, which is held horizontally with a reference to symmetric landmarks, and the ruler must pass through the pupil of the uninjured eye. Vertical displacement of the injured eye can be noted with respect to the other side. Forced duction test was performed for all cases intraoperatively. Evaluation of neurosensory changes in the infraorbital nerve had been done using two objects (first using cotton stick then using pin of needle) each one pressed gently on multiple areas of the nerve distribution while the patient closed his eyes to rise his hand if he felt anything. This test repeated post operatively in each follow up visit. The study depended on Hertel exophthalmometer for measuring enophthalmos as Fig. (1).

Surgical technique: The approach that used in all cases was infraorbital approach. Forced duction test done for each patient intraoperatively twice, before the beginning and after completion the surgery to checking the releasing of the ocular muscle.

Tarsorrhaphy was used for corneal protection as in fig. (2). Incision at the transition between the thin eyelid skin and the thicker cheek skin. The skin, orbicularis oculi muscle (step ladder technique), and the periosteum are incised. The fracture site was visualized with freeing the entrapped tissues until reaching a stable bone. Measuring the defect by using the graduated globe retractor to know the size of mesh required. Preparing the titanium mesh slightly larger than the defect and manipulate it to accommodate the floor anatomy. Fixing the mesh in the position by its microscrews on the orbital rims again forced duction test to ensure completely freeing the muscle before closing the surgical site. Closing with two layers, the periosteum and the muscle by simple interrupted with 4/0 polyglactin suture (Vicryl), and the skin

by subcuticular suturing with 6/0 polypropylene.



Figure 1: The Hertel exophthalmometer used for measurement of enophthalmos.

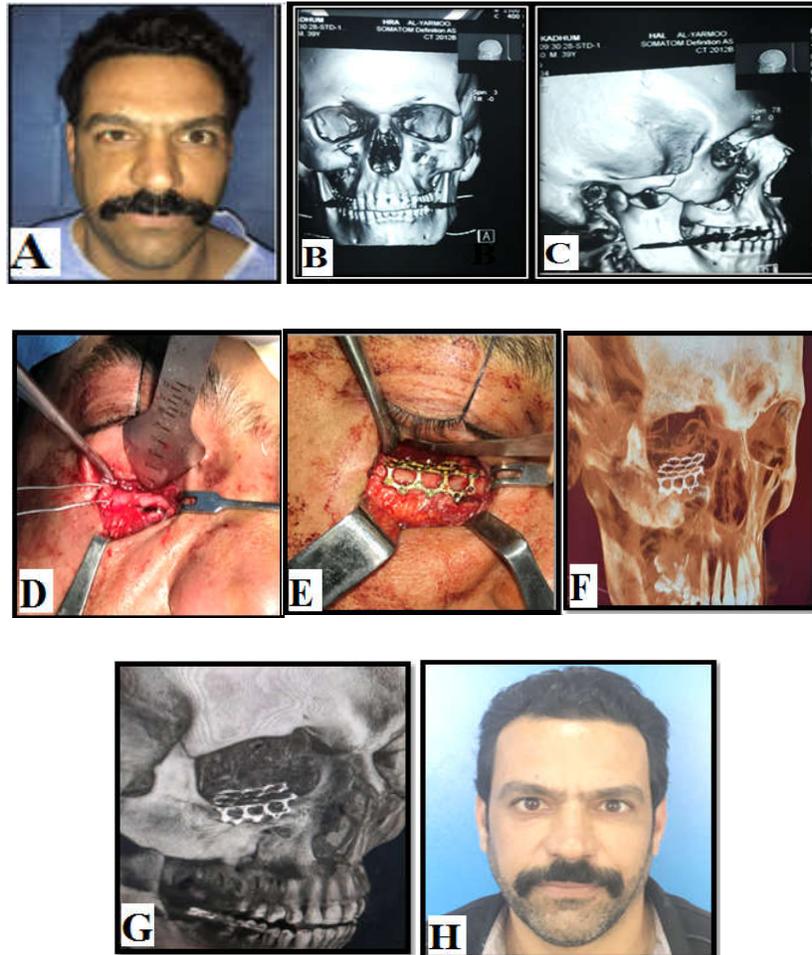


Figure 2: A/ frontal picture of 37 years old patient with history of 3 days trauma of the right orbit. B, C/ preoperative 3D CT-scan showing the fracture extent and fragments overlapping. D/ Intraoperative views of the fracture site. E/ the mesh was fixed. F, G/ postoperative CBCT. H/ 3 months postoperative frontal picture with good esthetic result.

RESULTS:

In this study there were 13 patients, 11 males (84.62%) and only 2 females (15.38%). The male to female ratio was (5.5:1). The ages of the patients ranged from 18 to 47 years with mean age range 32.5 years. The highest percentage of patients was found in age group 20-29 years (30.76%). The main cause of orbital floor fractures was the road traffic accident in 7 patients. Most of the cases in the study presented with orbital floor fracture as part of zygomatic complex (impure type) 12 patients (92.3%) and only one patient (7.7%) had pure blow out fracture. Patients with preoperative diplopia

were 12 (92.3%) and 8 patients presented with enophthalmos (61.5%), 7 patients of them (53.8%) had both enophthalmos and diplopia as in table (1). During the follow up, one week post operatively, ten patients diplopia improved within days postoperatively, one improved after one month and another one had persistent diplopia (table 2). The eight patients those had enophthalmos improved postoperatively except two which had reduced the posterior displacement of the globe but did not improve completely.

Table 1: Preoperative diplopia and enophthalmos.

Sign and symptoms	No. of the patients	%
Isolated Diplopia	12	92.3
Isolated Enophthalmos	8	61.5
Both	7	53.8

Table 2: Postoperative complications.

Complication	No. of patients	%
Persistent diplopia	1	7.69
Enophthalmos	2	15.38
Both	1	7.69

Dystopia, in clinical examination there were only two patients with obvious dystopia one of them got symmetrical pupil level postoperatively but the other did not.

The complication result in one patient only (7.7%) in persistent diplopia in both up and dawn gaze. He also had enophthalmos (6mm) preoperatively then became (3mm) after reconstruction and his dystopia had not been corrected to an acceptable level.

Ectropion had resulted in 5 patients (38.7%) but all of them improved to normal and symmetrical eyelid contour with in the first month follow up

Discussion The predominant age group were at twenties (20-29) in percentage of 30.76% because in this period of life the activities and outdoor time is high especially for the men. This result also found in most trauma studies so the study agreed with them like (Gabrielli et al., 2011) but it differed from (Scolozzi et al.,2009) which included 10 patients their ages ranged from 19 to 71 years (mean age, 41.5 y) .

In this study the highest proportion for etiology was road traffic accident in (53.8%). Since March 20, 2003, maxillofacial surgeons in Iraq encounter several trauma cases that result from conventional war, civil unrest, crimes, and car explosions. But this had been changed relatively in the last two year due to improvement in the security status in the country generally and in Baghdad especially but the road traffic accident still high may be because there is defect in road traffic legislation and in motorcycle helmet obligation.

For correction of diplopia of twelve patients, only one did not return to his normal visual acuity. Eight patients had enophthalmos, six of them corrected to normal and only two did not. The patient who had the persistent diplopia is the same one with largest postoperative

enophthalmos (3mm) and dystopia and this might be because he had zygomatic-maxillary complex and insufficient reduction and fixation of the bones which used to support the titanium mesh in spite of the bone graft which used the reconstruction . He admitted to the intensive care unit for one month due to intracranial hemorrhage and loss of consciousness then referred to maxillofacial department. This delay in the treatment led to fibrosis in the site and surgical difficulty both in bones reduction and recontouring the orbit all these factors redounded in treatment drop back and he needed secondary correction. The study is in agreement with (Al-Anezi et al., 2018) they reported eight patients had enophthalmos who improved postoperatively and only one late enophthalmos. The study is in less agreement with (Scolozzi et al., 2009) who reported four from total ten patients with enophthalmos all of them improved.

Ectropion occurred in 5 cases (38.7%) and all them resolved with in first month. In this the study agreed with (Gabrielli et al., 2011).

There was no postoperative complication of retrobulbar hemorrhage, infection or implant extrusion. Twelve patients (92.3%) were satisfied with their final functional and esthetic results.

CONCLUSION:

Titanium mesh is available and easily malleable. It is safe implant for the repair of orbital defects. Large defect with obvious enophthalmos require good bone support at the edge of the mesh to get good reconstruction. Low complications rate and the good esthetic and functional result encouraged as to consider the titanium mesh as good reconstructive material for orbital floor fractures.

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