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PROSPECTIVE EVALUATION OF EFFICACY OF AUTOGENOUS ILIAC BONE GRAFT IN ORBITAL BLOWOUT FRACTURE

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KEYWORDS :

INTRODUCTION

Orbital wall fracture is a common outcome of orbital injuries. Fracture of orbit may lead to enophthalmos, limitation of orbital movement, diplopia and anaesthesia or paresthesia of the infraorbital nerve[1].Pre-requisites for successful repair of fractures of the orbital complex: a thorough understanding of the regional anatomy; an accurate diagnosis; unimpeded exposure and in some cases, rigid fixation of the fracture. The goal of surgery is to reposition herniated orbital fat and tissue within the orbit, and repair of the post traumatic defect [2]. Orbital wall defects have been repaired with several types of autogenous grafts [3] or alloplastic [4] or allogenic implants[5] to lift the eyeball into its correct position and avoid enophthalmos. Iliac bone is easy to harvest, and the medial cortex of the anterior iliac crest is relatively easy to shape to fit the internal orbital wall [6]. The purpose of the present study was to clinically and radiologically evaluate the outcome of internal orbital reconstruction with an iliac bone graft in orbital blow out fractures.

MATERIALS AND METHOD

The present study included 10 cases of orbital blow out fracture with associated Zygomatico-maxillary complex fracture, who reported to the department of Oral and Maxillofacial Surgery in our centre. We treated the orbital floor defects using iliac cortical graft.The inclusion criteria were presence of Impure orbital blowout fracture of floor, enophthalmos, hypoglobus, diplopia, radiological evidence of orbital content herniation in floor defect and mechanical restriction in ocular motility (positive forced duction test).The exclusion criteria were systemic conditions contraindicating surgery, generalized bony disorders, optic neuropathy/post-trauma blindness, globe perforation/retinal detachment, affected eye is the only seeing eye and any positive history of fracture in pelvis.

All 10 patients were male patients in age range of 21-40 years. All cases except for three were treated within 6 weeks of trauma.

Preoperative assessment of the patients was done. Computed Tomography (CT) scan imaging was done for all patients using GE Discovery VCT Workstation 4.4. The area of defect was measured in cm^2. The volumetric assessment of the orbit was done with the aid of Volume viewer (an installed application) using 0.625-mm sections and measured in cubic centimeter (cm^3).

PREOPERATIVE ASSESSMENT

1. Evaluation of the patient included a thorough and detailed history, clinical examination including general examination and ophthalmological examination, facial photographs and radiographical examination.
2. CT scan – Coronal, sagittal, axial views

- 3D reformatted image
- Area of defect assessment
- Orbital volume assessment

The orbit was explored through the infraorbital approach or pre existing scar. After repositioning of the orbital content, the graft was placed subperiosteally . The size of defect was measured using CT scan imaging, and the bone graft harvested from the medial wall of the anterior ilium was trimmed with the drill bit to cover the defect. The graft harvested were corticocancellous bone from ilium by subcrestal window technique. At the posterior section and medial wall of the orbit, a stable bone was identified for bony support. The associated maxillofacial injuries were treated appropriately.

The success of the surgical repair and post operative status was evaluated at periods of 1 week, 1 month, 3 months and 6 months. The reconstruction was evaluated using the following parameters:

- Globe position and facial symmetry
- Diplopia charting
- Graft rejection- follow-up for 6 months
- Post operative extra ocular movements
- Post operative nerve (infra orbital) involvement
- Wound infection/ dehiscence
- Donor site morbidity
- Overall patient satisfaction
- CT-based orbital volume assessment

RESULTS

In the study 10 cases of impure orbital blow out fractures were treated by floor reconstruction with autogenous bone grafts from anterior iliac crest/medial cortex. All patients had impure blow out fracture of floor with infraorbital rim fracture, of which four patients had associated zygomaticomaxillary complex fracture. All the orbital floor fractures except three were treated within 6 weeks of trauma. The three cases included post-traumatic secondary deformities.

All the cases were approached via infraorbital approach/pre-existing scar. The associated maxillofacial injuries like zygomaticomaxillary complex fracture were treated by reduction and fixation using stainless steel miniplate and screws. One case had a scar and contracture of upper eyelid with notching deformity, treated by scar revision.

The results of the CT-based study showed that the Orbital volume changes of less than $3cm^3$ can be effectively reduced. Orbital volume changes of more than 4.5 cm^3 could not be effectively restored inspite of using larger iliac graft. Resorption of the iliac graft is not significant on 6month follow up, this can be confirmed only by further long-term follow-up of the cases.

POSTOPERATIVE ASSESSMENT

The success of the surgical repair and postoperative status was evaluated at periods of 1 week, 1 month,3 month and 6 months.

Globe position and facial symmetry

The patients were assessed for globe position in two planes in frontal plane the success of correction of hypoglobus was assessed using the canthal plane as guideline. All 10 patients had satisfactory correction of hypoglobus. The degree of enophthalmos correction was assessed clinically in Worm's view/ Hertel exophthalmometry (in cases applicable). The same assessment was also done using CT scan axial, coronal and sagittal sections. When compared to preoperative values, except for 2 enophthalmos was corrected satisfactorily to less than 1 cm^3 difference.

Diplopia charting

All patients were assessed for diplopia postoperatively and charted. Preoperatively three patients had symptomatic binocular diplopia. Diplopia resolved in all three patients postoperatively between 4th day and 2nd week. All except 1 had diplopia in extreme upward gaze.

Graft rejection

In the follow-up period of 6 months there were no signs or symptoms of graft rejection.

Postoperative extraocular movements

Preoperatively two patients had limited ocular movements mainly in upward gaze. Both patients showed improvement in ocular movements postoperatively.

Postoperative infraorbital nerve involvement

Preoperatively all except three patients had infraorbital nerve paresthesia. Postoperatively three patients showed gradual improvement between 1st and 4th week. Two patients had persistent infraorbital nerve paresthesia which took 3 months to resolve.

Wound infection /dehiscence

In the 1st postoperative week, wound healing in all surgical sites were satisfactory with no signs of infection or hemorrhage.

Donor site morbidity

All the patients showed no evidence of meralgia paresthetica, hematoma or gait disturbance. All patients became comfortably ambulatory in 48 hours.

Donor sites showed uneventful healing in all 10 cases. There was neither aesthetic deformity of chin nor functional deficit of lower limbs/ abdomen.

Overall patient satisfaction

At the follow-up examination none of the patients reported experiencing problems like infection, migration or extrusion of graft, which might have indicated complication. One patient, postoperatively had epiphora for 3 days which resolved spontaneously. All except one patient was satisfied with the outcome of the surgery.

DISCUSSION

In orbital blowout fracture entrapment or injury of the extraocular muscle, especially the inferior rectus muscle, damage of nerves, and change in the height of the eyeball caused by the reduction of intraorbital volume, are the most common causes of diplopia. Enophthalmos, another problem in blowout fracture, is attributed to several causes: loss of ligament and bone support for the globe and fat atrophy or fat loss[12].

Management of orbital blow-out fractures reconstruction requires release of herniated orbital contents, avoidance of enophthalmos, diplopia, and dystopia, return of physiologic function of the extraocular muscles, and an effective barrier against infection from the antrum[11]

Iliac crest graft has been established as the gold standard for autogenous bone grafts for orbital floor reconstructions. It can yield enough volume of cortico-cancellous graft for restoring the volume loss of the floor of the orbit[7]. However due to the associated donor site morbidity, necessity for additional training in harvesting and the distance from the surgical site, and its higher resorption rate due to its endochondral origin.

The advantages of autologous bone are its inherent strength and rigidity, and its vascularization potential. Because autologous bone grafts are incorporated as living tissue and do not elicit an immune reaction to self-antigens, foreign body reactions such as infection, extrusion, capsule formation and ocular tethering are minimized[9]

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However bone is not always easy to form into the desired shape and can break if it is bent beyond its capacity. For large defects with fractures of multiple walls and disruption of bony buttresses, it is not always possible to use autologous bone as the sole material[10] can be used with titanium mesh plate. Degree of resorption can be quite variable and, at times, unpredictable. Membranous embryological origin is less prone to resorption than is bone of endochondral origin (iliac bone).

Iliac graft harvested from a remote donor site, including an increase in operating time and time under general anesthesia. As well, donor site morbidity is a concern, General risks for the harvesting of a donor site include infection, hematoma, seroma, neurovascular injury, use of drains, increased time of recovery, increased postoperative pain, a bony defect at the donor site and an additional surface scar.[9]

CONCLUSION

The study states that even endochondral orgin has high rate of resorption, on 6 month follow up shows sufficient support for the ocular muscles to maintaine the volume and can be used for even large volume defect reconstruction. Rigidity ,vasularization potential, clinicoradiological outcomes suggest iliac bone graft is better option in orbital blow out fracture.

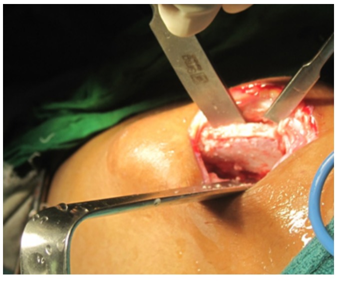

Figure 1 : Sub crestal window technique of harvesting iliac bone graft.

Figure 2 : Reconstruction of floor defect with iliac bone graft with reduction and fixation of orbital rim and wall.

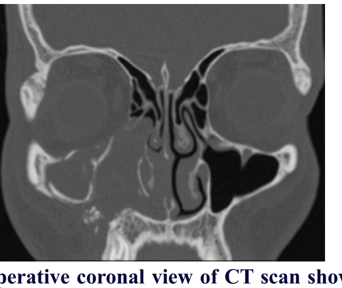

Figure 3 : Preoperative coronal view of CT scan shows blowout fracture.

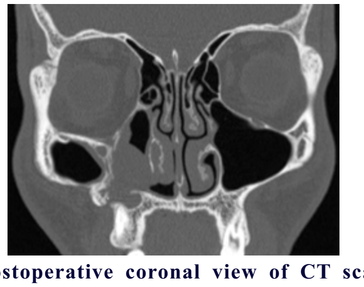

Figure 4 :Postoperative coronal view of CT scan shows reconstruction of orbital floor with iliac bone graft.

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