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Original Research Article

Polypropylene mesh and conchal cartilage composite graft: a novel technique for orbital floor reconstruction

Nithya Venkataramani[1]*, Satish Kumaran[2], Ravi Sachidananda[1], Srividya Rao Vasista[1], Romir Navaneetham[2], Anuradha Navaneetham[2]

[1]Department of Integrated Head and Neck Services, People tree Hospitals, Bangalore, Karnataka, India
[2]Department of Maxillofacial Surgery, HOSMAT Hospital, Bangalore, Karnataka, India

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***Correspondence:**
Dr. Nithya Venkataramani,
E-mail: nithya.venkataramani@gmail.com

ABSTRACT

Background: Fractures of the orbital floor can occur as a part of maxillofacial trauma and be associated with prolapse of orbital contents into maxillary sinus. It may be associated with entrapment signs mandating surgical repair of the orbital floor. Aim of the study was to study the role of a composite graft in the repair of orbital floor fractures in a tertiary care center.
Methods: Retrospective chart review of 16 patients who underwent orbital floor repair in a tertiary care center was undertaken. All patients underwent surgical repair with a composite graft made of cartilage and polypropylene mesh by subciliary approach.
Results: Post-operatively, none of the patients had restriction of mobility, diplopia, or globe asymmetry. Mild entropion was noted in two patients but did not require any intervention. No extrusion of the implant was seen.
Conclusions: Conchal cartilage and polypropelene mesh composite graft is a reliable and easily available material for the repair of orbital floor defects in almost all kinds of orbital floor fractures.

Keywords: Orbital floor fractures, Conchal cartilage, Polypropylene mesh

INTRODUCTION

Orbital floor fractures are commonly encountered facial fractures. They may be isolated or as part of multiple faciomaxillary fractures. Fractures of the orbital floor or medial wall in isolation are called "blow-out fractures".[1] They result in the prolapse of fat or muscle into the maxillary sinus. This is associated with a change in the orbital volume, consequently impacting the vision. When inadequately treated, these fractures may lead to enophthalmos, diplopia, restricted ocular mobility, and infraorbital hypesthesia.[2] The treatment options depend on the severity of the fracture and the evidence of muscle entrapment. Treatment involves the release of prolapsed contents and repositioning, with augmentation of the floor with a graft.

Various materials have been used for orbital floor reconstruction; these may be alloplastic, allogeneic or autologous. The autologous materials like bone, fascia, or cartilage or alloplastic material like titanium, porous polyethylene, and polymers to name a few. There is no consensus in the medical literature regarding ‘the ideal material’ for reconstructing the floor of the orbit and researchers have proposed algorithms. In general, the choice is often made based on surgical expertise, comfort with the material used, severity and extent of orbital floor fracture, and cost implications with the material.[3]

We had used a combination of conchal cartilage and polypropylene mesh as a cost-effective yet stable assembly to reinforce the orbital floor.

Objectives

The objective of this study was to evaluate the efficacy of this composite graft in the repair of orbital floor defects in sixteen consecutive patients.

METHODS

A retrospective chart review of 16 patients (15 males and 1 female) who presented in the 6-year period (2014-2019) with orbital fracture and underwent orbital floor repair was conducted in a secondary care center-People tree hospitals Bangalore. All patients were evaluated with clinical examination and computed tomography scan of the head and facial bones with three-dimensional reconstruction at the time of presentation. Patients were evaluated by an ophthalmologist for enophthalmos and diplopia. Symptomatic patients with significant orbital floor fractures with prolapse and/or impaction of inferior rectus underwent orbital floor repair using composite conchal cartilage and polypropelene mesh.

Inclusion criteria

Patients with symptomatic orbital fractures, presence of diplopia, enophthalmos, CT findings of prolapse of orbital contents were included in the study.

Exclusion criteria

Patients with absence of ocular motility dysfunction were excluded from the study.

All procedures were performed through subciliary approach and transmaxillary endoscopic assisted approach in three cases. The parameters evaluated before and after surgery included visual acuity, extraocular motility, diplopia, and patient-perceived poor cosmesis.

Technique

All surgeries were performed within 5 days after the initial injury. The subciliary incision was placed 2 mm below the lower lash line in the skin crease from the level of the punctum medially and was extended laterally. A soft tissue plane was created underneath the orbicularis oculi muscle and dissection carried out downwards to reach the periosteum of the infraorbital rim. The infraorbital fractures were fixed with an infraorbital plate. The periorbital periosteum was incised and the floor of the orbit was accessed by using multiple malleable retractors. The globe was gently retracted with a malleable retractor. A complete reduction was confirmed by ensuring that the bony orbital floor has been cleared of periosteum circumferentially. The posterior ledge of the fracture was identified. Herniated orbital contents were repositioned and the size of the defect was assessed and measured in anteroposterior and mediolateral direction (3 patients required endoscopic assistance through canine fossa to reposition the impacted orbital fat). The wound was temporarily packed and conchal cartilage graft was harvested.

Conchal cartilage was harvested by post-aural or anterior approach (Figure 1) based on the patient preference. A drain was placed and the skin wound was sutured and then stabilized with a mastoid bandage. Polypropylene hernia mesh of appropriate size was cut and wrapped around the cartilage graft and secured with sutures (Figure 2). This composite graft was placed on the orbital floor and the contents were gently allowed to rest on the graft (Figure 3). The mesh was anchored anteriorly to the infraorbital plate or to the infraorbital margin with a drill. The subciliary incision was closed in layers by absorbable sutures (5-0 Vicryl rapide). Post-operatively, the patient was given IV antibiotics and steroids for 24 hours and the patient was discharged in a day or two. The extraocular motility was assessed in 1 week, 1 month, and at 6 months.

Microsoft excel 2013 was used for tabulation of results.

Figure 1: Anterior approach to conchal cartilage harvest.

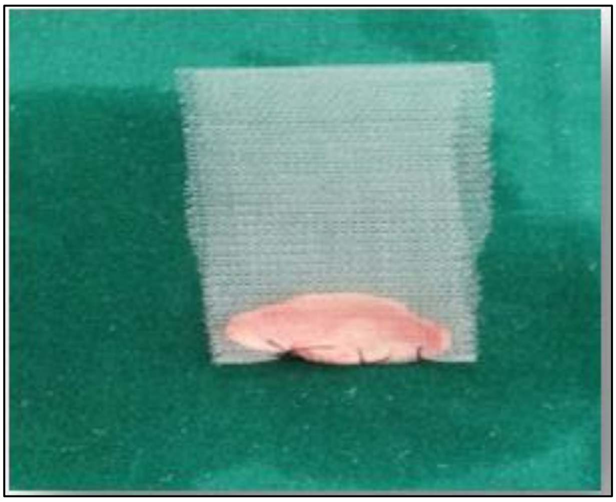

Figure 2: Composite graft made of conchal cartilage and polypropylene mesh.

Figure 3: Graft placed *in situ.*

RESULTS

We included 16 patients (1 female and 15 males) in the age group ranging from 19 to 45 years. Almost all patients had injuries as a result of road traffic accidents except one who had blunt trauma caused by a hard object. Preoperatively, all patients had signs of entrapment in the form of diplopia or restricted ocular motility.

Post-operatively none of the 16 patients had significant complications. Post-operative visual acuity matched to the preoperative levels in all the patients and none of the patients had restriction of mobility, diplopia, or globe asymmetry. There was no donor site morbidity except for a small haematoma in one patient needing drainage. Mild entropion was noted in two patients but did not require any intervention. No extrusion of the implant was seen.

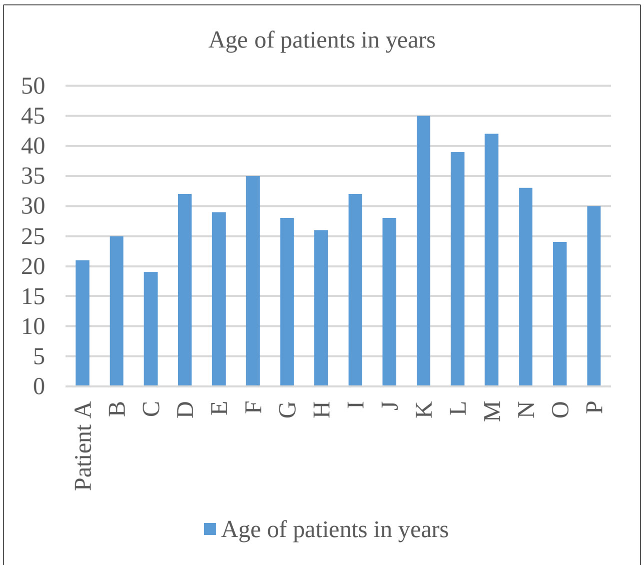

Figure 4: Age distribution of patients.

DISCUSSION

Orbital fractures can be isolated or can be a part of other maxillofacial injuries. The medial wall and floor of the orbit are the most common sites to be involved in fractures.[4,5] The aetiology is usually a road traffic accident.[6] The other modes of injury are assault and sports-related injuries. In our study too, the most common mode of injury was road traffic accident. Different theories exist regarding the biomechanics of a blowout fracture. Injury to the floor may occur either by transmitted impact from the walls or due to direct impact of the globe on the weak orbital floor. The other mechanism is increased intraorbital pressure causing the weak floor to give way.[7]

The clinical features of these fractures include periorbital edema and bruising, subconjunctival haemorrhage, double vision, restricted eye movements, enophthalmos, and numbness in the infraorbital region.[7] Computed tomography (CT) scan of the facial bones with three-dimensional reconstruction is the investigation of choice to diagnose and assess these patients.[8] CT scan shows the breach in the continuity of orbital walls and reveals the soft tissue entrapment in the maxillary sinus. Apart from diagnosing the presence and extent of fractures, CT is also helpful in screening for associated intracranial bleed or oedema.

Management of these fractures depends on the extent of the fracture, degree of enophthalmos, and signs of entrapment.[8] There is no clear consensus on the management protocol for orbital floor injuries. In the absence of entrapment, some of these fractures can be managed conservatively.[9] The definite indications for emergency intervention are muscle entrapment with oculocardiac reflex and retrobulbar haemorrhage.[10] A study by Felding et al has proposed other relative indications like persistent diplopia and enophthalmos with a large defect (>50% of the orbital floor).[10]

Various materials have been used for the reconstruction of the orbital floor.[11] These materials can be autologous, allogenic, or alloplastic. The choice of material partially depends on the size of the defect, however, there is no clear consensus on which is the best material.[12] The allogenic materials like lyophilized cartilage or bone from a bone bank, dura, and fascia, though readily available without donor site morbidity are associated with risk of resorption and a rare risk of transmission of infections.[11]Alloplastic materials are easily available and usually permanent, although some materials are partially resorbed.[13] The main advantage is the reduced surgical time with no donor site morbidity. The common materials used are titanium, silicon, polypropylene, and polydiaxonone.

The choice of autologous materials includes bone grafts (rib, maxillary wall, or iliac crest), cartilage grafts (septal and conchal cartilage), and fascia (fascia lata). Bone grafts have the advantage of inherent strength and low risk of graft rejection or foreign body reaction. However, it has the disadvantage of donor site morbidity and a variable degree of resorption. Cartilage is a very good alternative in small orbital floor defects (<2 cm^2).

Septum and concha are the most common cartilage donor sites.[14] Aural cartilage has the advantage of strength and stability, and its inherent curvature is suitable for orbital floor reconstruction.[15] It is also relatively less vascular and thereby has a low resorption rate.[11] Easy accessibility and minimal donor site morbidity, when harvested through a post aural approach are also further advantages. It is a better alternative to nasal septal cartilage which is normally straight and difficult to contour. Cartilage grafts can be used for small-medium defects and are not suitable for large orbital floor defects due to limited tissue availability.[15]

Bangennavar et al studied the efficacy of polypropylene mesh in traumatic midface defects and found that these are versatile and biocompatible and can be used effectively in properly selected cases.[16] Unfortunately being very pliable it does not offer the stability of porous polyethylene or titanium. Surgeons have used a combination of composite grafts for example (titanium mesh with porous polyethylene) for stability, biocompatibility, and integration of the implant.[17] We have used conchal cartilage and polypropylene mesh as a composite graft which from our experience gives the right combination of strength, stability, pliability, and reinforcement to rebuild the floor of the orbit. Furthermore, in our short series, we have had no extrusion and minimal donor site morbidity.

The use of this technique is limited in severely comminuted fractures (with no salvageable bone fragments) of both the infraorbital rim and floor of orbit with hardly any support where this technique may not be reliable. The approach to infraorbital fractures can be transconjunctival, subtarsal, or subciliary.[18] Each of these techniques has its advantages and disadvantages.[19] The subciliary approach has a good aesthetic outcome and gives good exposure particularly if a lateral extension is deemed necessary to fix any other coincident fractures. However, this is associated with the risk of scleral show and ectropion.[20] In our study, all orbital floor fractures were addressed by the sub ciliary approach. Mild entropion was noticed in 2 patients, all patients had very good healing with a barely noticeable scar.

CONCLUSION

Conchal cartilage and poly propelene mesh composite graft is a versatile, safe and reliable technique for the repair of orbital floor defects in almost all kinds of orbital floor fractures.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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