Endoscopic Management of Inferior Orbital Wall Fractures with Medpore Grafts

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Abstract

Objective: To describe endoscopic management of orbital floor fractures through the maxillary sinus along with placement of medpore grafts to reconstruct the orbital floor defect.

Study Design: Prospective study.

Level of evidence: 2b

Setting: University medical hospital.

Subjects and Methods: From January 2008 to March 2011, 13 patients with orbital floor fracture (11 males, 2 females, age range from 17-45 years) were included in this study. Inclusion criteria were; isolated orbital floor fracture, orbital floor fracture associated with non displaced zygomatic maxillary complex fracture, entrapment of inferior rectus muscle, diplopia, and with orbital floor defect size more than 1.5cm. Exclusion criteria included orbital floor fracture associated with displaced zygomatic maxillary complex fracture, inferior orbital rim fracture, and orbital floor defect size less than 1.5cm. Endoscopic repair of the orbital floor fractures was done endoscopically through maxillary sinus. Outcome assessment was done clinically and with preoperative and postoperative CT scan.

Results: The follow-up period ranged from 8-30 months. Cause of injury was motor cycle accident (MCA) in 6 patients, motor vehicle accident (MVA) in 3 patients, personal assault in 2 patients, and fall down in 2 patients. Endoscopic repair of the orbital floor fracture was successfully done for all patients without need for conversion to an external approach. Medpore (1.5mm) grafts were used for all the patients to graft orbital floor defect.

Conclusion: Endoscopic repair of orbital floor fracture is an excellent and highly successful and safe alternative to the traditional external eye lid approach. It enables early surgical intervention without lid complications and safe assessment and identification of the fracture site with easy graft placement.

Key Words: Orbital floor fracture – Transmaxillary endoscopy – Medpore grafts – Posterior ledge of bone.

Introduction

FRACTURE of the inferior orbital wall can occur directly by extension from orbital rim fracture or indirectly through increase of the intraorbital pressure which causes the orbital bones to break through its weakest pint, i.e. floor and medial wall. Disruption of the bony orbital wall can lead to diplopia, strangulation of the inferior rectus muscle, prolapsed orbital fat into the maxillary sinus causing enophthalmous or even to visual loss along with paraphthalmous or even to visual loss along with paralysis along the course of the infraorbital nerve [1].

Various approach for repair of the orbital floor fractures have been described. The first attempt to repair such a fracture was done by Walter through a Caldwell-luc approach that had been replaced by other external approaches as subcilliary, lower eye lid, transconjunctival due to postoperative high failure rate [2]. The external approach allowed for good visualization of the fractured orbital floor with a good chance for placing a graft along with reconstruction of any associated orbital rim fractures by rigid fixation. However, these open approaches have been reported to have certain complications like external eye lid scar, scleral show, and different degree of lower lid ectropion. Another point of challenge of the external approach is the difficulty to visualize and approach the posterior fixed unfractured bony segment of the orbital floor. The prolapsed orbital content into maxillary sinus along with the narrow angle makes it difficult for the dissection to be completed and the chance for identifying the fixed bone shelf unlikely [3-7].

In the field of Otolaryngology Head and Neck Surgery, there is a trend towards minimally invasive
surgical interventions. Endoscopic surgery has been expanded to include different areas including facial fractures as frontal, orbital and subcondylar fractures [8-15]. In this study, we discuss our technique for treating orbital floor fracture through endoscopic approach through the maxillary sinus along with placement of medpore grafts to reconstruct the orbital floor defect.

Material and Methods

Study design: From January 2007 to March 2011, 13 patients with orbital floor fracture (16 males, 2 females, age range from 17-45 years) from the department of Otolaryngology-Head and Neck Surgery, Zagazig University Hospitals, Zagazig Egypt were included in this study. Inclusion criteria were; isolated orbital floor fracture, orbital floor fracture associated with non displaced zygomatic maxillary complex fracture, entrapment of inferior rectus muscle, diplopia, and orbital floor defect size more than 1.5cm. Exclusion criteria included orbital floor fracture associated with displaced zygomatic maxillary complex fracture, inferior orbital rim fracture, and orbital floor defect size less than 1.5cm.

Preoperative assessment included; complete facial, maxillofacial and ophthalmologic examinations including globe mobility and forced duction test. CT-scan of maxillofacial and orbital region with axial, coronal and 3D reconstruction cuts was done for all patients preoperatively and one month postoperatively. Details of the endoscopic surgical procedure and its potential risks along with a possibility to shift to external approach if needed were discussed with patients or their relatives. Zagazig University IRB approved the study.

Surgical procedure:

At the upper gingivolabial sulcus, 5CC of local consisting of 1:200,000 epinephrines and 2% lidocaine was infiltrated to achieve good hemostasis. A monocularlary is used to incise the mucosa down to the bone. Superiosteal dissection of the anterior face of the maxillary sinus is cautiously done with preservation of the infra orbital nerve exposing area from pyriform aperture to the zygomatic maxillary buttress. Any associated fractures bone segment of the anterior maxillary wall is gently removed with enlargement of the maxillary window as needed. In cases not associated with bony fracture an osteotomy of 1.5-2cm wide was done using fine osteotome or cutting bur.

Saline irrigation of the maxillary sinus was done followed by introduction of A 30 degree telescope to visualize and assess the orbital floor fractures and prolapsed orbital contents. Slight globe pressure was placed to the globe and the transmitted movement of the orbital contents was visualized endoscopically to assess the site and size of the orbital floor fractures (Fig. 1). With fine Blakesly forceps and other sinus instrument any lacerated mucosa covering the herniated orbital contents is removed gently along with area of sinus mucosa adjacent to the border of fractures. The course of the infraorbital nerve is defined and all fractured segment of the inferior orbital wall is gently removed. Prolapsed orbital contents were reduced gently into the orbit using a gentle curved periostea1 elevator. About 3mm of periorma along the fracture border was elevated out of the rest of the orbital floor to accommodate the medpore graft.

Medpore graft (1.5mm thickness) was prepared and trimmed to the degree that its size exceeds the orbital floor defect by 3mm all around. The medpore sheet was gently introduced through the osteotomy into the maxillary sinus and gently placed under the orbital contents to graft the floor defect. First a gentle pressure is placed at the posterior edge of the medpore to place it over the posterior fixed bone shelf of the inferior orbital wall, and then placed all around over the rest of the orbit floor to completely reconstruct the orbital floor defect (Figs. 2,3). External pressure was applied to the globe and endoscopically we assessed the integrity of graft placement to be sure that all the prolapsed orbital contents and entrapped muscle were successfully reduced. Forced duction test is done to be sure that the globe is freely mobile all around. The gingivolabial incision closed with 4-0 vicryl. Broad spectrum antibiotic and ciprofloxacin eye drops were given for 1 week postoperatively.

Results

The follow-up period ranged from 8-30 months. Cause of injury was motor cycle accident (MCA) in 6 patients, motor vehicle accident (MVA) in 3 patients, personal assault in 2 patients, and fall down in 2 patients. Endoscopic repair of the orbital floor fracture was successfully done for all patients without need for conversion to an external approach. Medpore (1.5mm) grafts were used for all the patients to graft orbital floor defect. Postoperative CT scan showed complete anatomical reconstruction of the orbital floor (Figs. 4-7). Postoperatively, enophthalmous was improved in all cases. Preoperatively 5 patients showed entrapment of the inferior rectus muscle. Postoperatively all the entrapped muscles were successfully freed.
out of the fracture sites. Diplopia improved in all patients except two patients who persisted to complain of postoperative diplopia in upward gaze. Those 2 patients were operated upon at 32 and 35 days after the trauma. Three patients complained of persistent parasthesia of the check and upper lip for 6 months. None of the patients had blindness, new diplopia or new infraorbital nerve anesthesia.

Table (1): Some of the patients' characteristics.

<table>
<thead>
<tr>
<th>Sex</th>
<th>Age</th>
<th>Associated fractures</th>
<th>Cause of injury</th>
<th>Interval from injury to surgery</th>
<th>Entrapment</th>
<th>Diplopia</th>
</tr>
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<tr>
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<td>Orbital rim</td>
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</table>

ZMC = Zygomatic Maxillary Complex Fracture, MVA = Motor Vehicle Accident, MCA = Motor Cycle Accident.

Fig. (1): Endoscopic transmaxillary view showing prolapsed orbital contents into maxillary sinus.

Fig. (2): Endoscopic transmaxillary view showing medpore graft reconstructing the orbital floor after complete reduction of the prolapsed orbital contents. Notice, the medpore is completely placed inside the orbit.

Fig. (3): Another endoscopic transmaxillary view showing medpore graft reconstructing the orbital floor after complete reduction of the prolapsed orbital contents.

Fig. (4): Preoperative coronal CT scan showing comminuted orbital floor fractures and prolapsed orbital contents into maxillary sinus.
Discussion

Indications for surgical repair of orbital floor fracture have many controversies and not all orbital floor fractures require surgery. Diplopia associated with entrapment of soft tissue orbital contents and inferior rectus muscle, early post trauma enophthalmos, orbital floor fracture more than 1.5 to 2 cm size defect are indication for early repair to prevent a permanent complications [18]. Delayed surgical intervention is advised by some authors to facilitate surgical reconstruction and intraoperative assessment of adequate surgical correction in absence of entrapment. However, delayed surgery will be more difficult due to scarring and distorted anatomy [18,19].

Orbital floor fractures have been managed by standard external approaches through subciliary, lower eye lid or transconjunctival incisions. Various complications can occur with those external approaches such as lower eye lid scar, ectropion or entropion or scleral show. Those complications occurs in 3-42% of the patients [3,9,20]. External approaches either through subciliary or transconjunctival incisions needs a lot of subperiosteal dissection along the orbit floor to reduce the herniated prolapsed orbital contents out of the maxillary sinus. This dissection with direct manipulation of the prolapsed orbital content can cause direct trauma to such a delicate inferior rectus muscle. Also, to assure excellent orbital reduction of the herniated orbital content, one needs to safely dissect far posterior through the orbital floor to reach a fixed non fracture posterior piece of bone so as to make the floor graft to rest upon it to achieve excellent reconstruction and avoid posterior fall down of the graft into the maxillary sinus. In many situations it is very hard to reach that fixed posterior bone ledge through the external approach due to the narrow angle of vision and fear to violate the optic nerve.

Ikeda and others used the endonasal and transmaxillary approach to reconstruct the orbital floor fracture through placing a urethral catheter to support the fractured orbital floor. This procedure resulted in insufficient surgical repair. Pearsons reported the first case with endoscopic transantral repair of orbital floor fracture with direct grafting [19,8].

Endoscopic repair of orbital floor fractures has many advantages over the traditional external approach. First, endoscopic intervention can be safely done early to repair orbital floor fracture associated with hyphema and inferior rectus muscle entrapment. Endoscopic approach can achieve reduction of the entrapped inferior rectus muscle safely without manipulation of the orbital content, which is commonly practiced during external approach. This will eliminate any increase of orbital pressure and avoiding any deterioration of the hyphema and intraocular bleeding. Second; endoscopic intervention avoids the lid complications
associated with external incisions such as external scares, ectropion, entropion, and sclera show. Third; endoscopic intervension give an excellent assessment of the prolapsed orbital contents. With endoscopy, it is safely and easily to remove a comminuted fracture bone specules of the orbital floor out of orbital content, inferior rectus muscle, and infraorbital nerve. Fourth; identification of the posterior fixed bone ledge is easily and safely done with endoscopy making the complete reduction of prolapsed orbital content and placement of a graft completely done over the posterior ledge of bone. Fifth; one of the advantages of endoscopic approach is the magnification given by working on the screen. The magnification of the surgical field makes the identification of fracture and related structures accurately done. Working from inside the maxillary sinus gives an excellent chance to clear the maxillary sinus ostium out of any bony fractured specules that if left may obstruct the natural ostium and predispose to maxillary sinusitis. Lastly, endoscopic reduction of the prolapsed orbital fat can be achieved gently without direct manipulation and orbital fat will continue to keep its volume inside the orbit without atrophy. In external approach, reduction of the prolapsed orbital fat out of the maxillary sinus is commonly done through direct manipulation that may lead latter to atrophic fat changes and bulk reduction, a common cause of persistent postoperative enophthalmous in spite of good bony repair.

On the other hand, endoscopic approach has certain limitation. Fractures of the orbital floor that extends lateral to the infraorbital nerve seem difficult to be repaired endoscopically as dissection through the orbital floor laterally may jeopardize the nerve making the likelihood of nerve injury to increase. Also, orbital floor fractures associated with displaced adjacent fractures like zygomatic maxillary complex or orbital rim is hard to be repaired endoscopically making the external approach to be more logic for such fractures.

Motor cycle accident represent 46% and motor vehicle accident represented 23% as a leading cause for orbital floor fractures in this study which is totally different from most published studies [24]. This reflects a new situation where these uncontrolled motor cycles started to widespread as a cheap transportation tools in our locality. Persistent Diplopia, that failed to improve after good repair of orbital floor fracture is estimated occur in 5-35% of the cases [7,20,22-24]. In this study we had 2 patients (15%) who persisted to complain of diplopia in spite of good repair of the orbital floor. The first possible explanation is that the entrapped inferior rectus muscle functions imperfectly due to direct trauma, contusions during entrapment, and intramuscular hematoma that may lead to fibrosis of part of the orbital muscle leading to its dysfunction. Also, there may be loss of the bulk of the orbital fat due to trauma leading to unequal position of the globe relative to the orbit. Those two patients with persistent diplopia were advised to have strabismus surgery to correct their diplopia. None of the medpore grafts reported to be infected or extruded. In conclusion endoscopic repair of orbital floor fracture is an excellent and highly successful and safe alternative to the traditional external eye lid approach. It enables early surgical intervention without lid complications and safe assessment and identification of the fracture site with easy graft placement.

References