

The Experience of Using Various Modalities For Orbital Floor Fracture Reconstruction

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Background: Fractures of the orbital floor require surgical intervention in group of patients with cosmetic problems and/or vertical diplopia. The surgical management of these patients provides a great challenge to the surgeon. A variety of implant materials have been used to recreate normal bony orbital dimension or supplement deficient orbital volume which include alloplastic or autogenous materials. The purpose of this case series was to assess the aesthetic and functional outcome of orbital floor reconstruction performed with calvarial bone graft, titanium mesh, absorbable mesh and "Turkish Delight" diced cartilage graft.

Patients and Methods: From 2006-2010, we treated eight patients with orbital blowout fracture using various modalities. We used titanium mesh, absorbable mesh, calvarial bone graft and "Turkish delight" diced cartilage. These various modalities were chosen based on clinical examination, patient satisfaction, radiographic investigations and the cost on managing patient.

Result: Calvarial bone graft were performed in two patient, "Turkish delight" diced cartilage in one patient, absorbable mesh in one patient, and titanium mesh in four patient. All patients had satisfactory result with adequate volume correction and reduction in vertical diplopia.

Summary: All four materials, calvarial graft, titanium mesh, absorbable mesh, and "Turkish delight" diced cartilage graft have the potential to be useful reconstructive materials in orbital floor blowout fractures based on holistic consideration.

Keywords: orbital floor fracture, calvarial bone graft, "Turkish Delight" diced cartilage graft, absorbable mesh, titanium orbital mesh

Latar Belakang: Fraktur dasar orbita dengan gangguan kosmetik dan/atau diplopia vertikal membutuhkan intervensi pembedahan. Jenis pembedahan ini masih merupakan tantangan. Berbagai jenis material implan telah digunakan untuk membentuk dimensi normal rongga orbita dan memberikan volume rongga orbita yang normal. Material yang digunakan mencakup bahan alloplastik dan autogen. Serial kasus ini bertujuan menilai hasil estetik dan fungsional setelah rekonstruksi dasar orbita dengan menggunakan calvarial bone graft, titanium mesh, absorbable mesh dan "Turkish delight" diced cartilage.

Pasien dan Metode: Dalam periode tahun 2006 sampai 2010, terdapat 8 pasien dengan blow out fraktur orbita yang mendapat berbagai modalitas terapi. Institusi kami menggunakan titanium mesh, absorbable mesh, calvarial bone graft dan "Turkish delight" diced cartilage. Pemilihan jenis terapi dilakukan berdasarkan pemeriksaan klinis, kepuasan pasien, pemeriksaan radiologis dan pembiayaan pasien.

Hasil: Dua pasien mendapat terapi dengan calvarial bone graft. "Turkish delight" diced cartilage pada satu pasien, absorbable mesh pada satu pasien dan titanium mesh pada empat pasien. Semua pasien merasa puas dengan koreksi volume yang adekuat dan berkurangnya diplopia vertikal.

Ringkasan: Keempat material, calvarial graft, titanium mesh, absorbable mesh dan "Turkish delight" diced cartilage graft memiliki potensi untuk menjadi materi yang digunakan dalam rekonstruksi blowout fracture di dasar orbita berdasarkan pertimbangan holistik.

Kata Kunci: orbital floor fracture, calvarial bone graft, "Turkish Delight" diced cartilage graft, absorbable mesh, titanium orbital mesh

Fractures of the orbit are still among the most difficult and complex maxillofacial fractures to address. There are two main theories on the mechanism of orbital blowout

fracture: a theory proposed by Le Fort and the hydraulic theory first outlined proposed by Pfeiffer. The Buckling theory states that orbital wall fracture with an intact orbital rim are produced by the transmission of force by bone conduction through orbital rim. According to the hydraulics theory, the force of the blow

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received directly by the globe is transmitted by it to the orbital wall. Orbital floor fractures can be broadly classified as pure blowout fractures (isolated orbital floor fracture) or impure blowout fractures (associated with an orbital rim fracture). Impure blowout fractures include the orbital margins and sometimes other facial bones as well as the orbital walls. Impure blowout fractures often require surgical intervention usually performed by maxillofacial surgeons. Pure 'blowout' fractures involve only the orbital walls. One of the goals of treatment is to prevent functional and anatomic deficits. Indications for surgical intervention in pure blowout fractures include the following: (1) unresolving diplopia present at 14 days after injury, (2) extensive soft tissue herniation into the maxillary antrum, (3) sufficient trapping of tissue to cause globe retraction on upward gaze or, (4) enophthalmos of more than 3mm. Surgery may be performed immediately or postponed until the edema has resolved, usually within a three-weeks intervals from the time of the injury. To date, the best method of reconstruction remains debatable. Many materials are available and used depending on an surgeon's preferences. Until now, the choice of the best implant material for reconstruction of the fractured orbital floor is still a matter of discussion.⁽¹⁻⁹⁾

PATIENT AND METHODS

A case series of patients with orbital floor fractures either due to motor vehicle accidents or other causes and receiving treatment in the emergency room Cipto Mangunkusumo during the period January 2009 until January 2010.

Orbital fracture can be classified as direct fracture of the orbital floor which can extend from orbital rim fractures, and indirect fractures of the orbital floor that may not involve the orbital rim. The cause of the fracture is thought to be increased intraorbital pressure, which caused the orbital bones to break at their weakest point. Another theory is that compression of the inferior orbital rim causes direct buckling of the orbital floor. In

both cases, if intraorbital pressure is great enough at the time of injury, contents can be

RESULT

forced into the fracture side and possibly into maxillaris sinus.⁵

Eight orbital fracture patients were admitted to the study, all were male patients with the mechanism of trauma was motor vehicle accidents. Physical examination and investigation (CT scan) were performed. Physical examination showed signs and symptoms such as diplopia, palpebra hematoma, subconjunctival edeme and lacerations around the eye.

Reconstruction were done with various modalities, four patients had surgery using titanium mesh, one patient with absorbable mesh, one patient with diced cartilage and two patients with calvarial bone graft. Illustration of the cases seen in Figure 1 to 4. Patient summary shown in Table 1.

DISCUSSION

Treatment of orbital floor fracture aims to prevent long-term sequelae such as enophthalmos, persistent diplopia, orbital dystopia, and reduced globe mobility. In the treatment of blow-out fractures it is important to reconstruct and maintain the accurate anatomical structural support of the orbit against herniation forces during the initial phase of healing to obtain functional and aesthetic result. There is general consent that the ideal orbital floor inlay material should be inexpensive, readily available in sufficient quantities, adaptable to the regional anatomy (i.e, easy to contour and sharpen), easy to position, suitable for all types of defects, able to provide support to the orbital content, biocompatible, nontoxic, noncarcinogenic, free of any potential for disease transmission and other systemic effects, inert, or biodegradable to zero remnant. These can be classified as either autologous, allogeneic, or alloplastic materials. Autologous materials include periosteum,



Figure 1. Patient with reconstruction using absorbable mesh (above: pre operation ; middle and below: post operation)



Figure 2. Patient reconstructed using diced cartilage graft (above: pre operation; middle and below: post operation)



Figure 3. Patient with reconstruction using diced cartilage graft (left: pre-operation; right: post-operation)



Figure 4. Patient with reconstruction using titanium mesh (left: pre-operation; right : post-operation)

Table 1. Patients with orbital fracture reconstruction using various modalities

No.	Name	Age	Diagnosis	Diplopia	Distopia	Timing of operation
1	H	34	Bilateral zygomaticomaxilaris + Ptosis of right palpebra	+	-	14 week
2	R	25	Right ZMC Fr	+	-	17 days
3	S	50	Right orbital floor fr	+	-	6 days
4	AS	27	Left ZMC fr & left orbital floor fr	+	-	
5	RA	24	Old frontal fr & right orbital floor fr	+	+	10 months
6	N	20	Right orbital floor fr	+	-	12 days
7	HS	24	Panfacial fr	+	-	7 days
8	WP	40	Panfacial fr	+	-	3 days

nasoseptal cartilage, rib graft, and mandibular bone. All share the morbidity of a donor site and are associated with a variable degree of resorption. Allogeneic materials include lyophilized dura and lyophilized cartilage. Alloplastics can be further subdivided into nonresorbable and resorbable materials. Non-resorbable materials include silicone, Teflon, Medpor (Porex, Newmann, GA) and titanium mesh. Examples of resorbable materials include poly(L-lactide), polydioxanon (PDS), Vicryl mesh (polyglactin-910) and polyglycolic acid. Autologous tissue is the first choice, and to some extent, this is the best implant choice. The main disadvantages are morbidity of the donor site, increase in operating time, limited availability (especially in large fractures) and modelling properties of the graft. On the other hand, bone grafts provide good stability and reduced cost. Moreover, these materials do not cause adverse reactions, but donor site risks can be a problem. It is our practice to use bone in small fractures (<1 cm diameter) to avoid a greater morbidity. Further complications after using allogenic materials, such as displacement and extrusion, extraocular muscle entrapment, infection, globe elevation and visual loss have been reported.^{3,4,9,10,11}

Advantages of resorbable alloplastic material is not limited to material needs, reducing operation time, no donor morbidity and complications, no risk of transmission infection, prevent long-term complications associated with the material nonresorbable (infection, migration, extrusion). The advantages associated with the use of titanium mesh plates in craniofacial reconstruction over bone grafts have been well documented: flexibility (allowing conformation and molding even to a complex bone contour), a modulus (degree of elasticity or stiffness) adapted to match that of cortical bone easily, three-dimensional rigidity and stability, no donor site morbidity, and little risk of infection even when exposed to the paranasal sinuses. Another advantages using Medpor® titanium mesh is the good results, because of its shaping features and greater biocompatibility. It is also preferred in significant fractures (>1 cm) with large

defects. Reconstruction with titanium implants orbital reconstruction requires expertise and takes longer, especially in the defect area. The disadvantages include the high cost of the technical infrastructure needed (software, hardware, and navigation system), an extensive preoperative planning process, which makes this technique far from being useful routinely, and the impossibility of obtaining an accurate replica of all the thin orbital walls with the current stereolithographic techniques.^{4,9,12}

The main disadvantages of alloplastic materials are long-term infections frequently requiring removal of the implant, extrusion or migration, foreign-body reactions and encapsulation. In addition to these problems, there are reports of some of these materials being inflammable, developing excessive heat (methyl methacrylate) or are very difficult to remove if required (titanium and vitallium).⁹ Use of alloplastic material in our center has a disadvantage in price, as is well known that Indonesian Gross National Income is 1880 U.S. dollar a year while the cost of alloplastic materials ranging 750-1000 U.S. dollars, approximately 40% of revenue a year.¹³

SUMMARY

The choice of basic orbital fracture reconstruction lacks a consensus. Ideal material is influenced by many factors, including characteristics of fractures, costs, patient selection and surgeon experience. In this study we conclude that the material which can be used are orbital mesh, titanium mesh, diced cartilage graft and calvarial bone graft.

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