A COMPARATIVE STUDY ON THE OUTCOMES OF ORBITAL FLOOR RECONSTRUCTION WITH AUTOGENOUS GRAFTS VERSUS POROUS POLYETHYLENE (MEDPOR) IN HOSPITAL UNVERSITI SAINS MALAYSIA FROM 2004-2007

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Disclaimer

This dissertation consist entirely of my own work except where assistance was required which is specifically acknowledged.

The sources of all references are clearly acknowledged.

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Wahid Abdullah Salem Wajih

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I wish to express my appreciation to all of my lecturers in the Department of Ophthalmology, School of Medical Sciences for their excellent teaching and encouragement through out completing this dissertation.

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A COMPARATIVE STUDY ON THE OUTCOME OF RECONSTRUCTION WITH AUTOGENOUS GRAFTS VERSUS POROUS POLYETHYLENE (MEDPOR) IN HOSPITAL UNVERSITI SAINS MALAYSIA FROM 2004-2007

ABSTRACT:

Purpose: To determine the difference in surgical outcomes of orbital floor reconstruction between the use of two different reconstructive materials.

Method: All patients who underwent orbital floor reconstruction in the study period were divided into two groups according to the materials used for the grafts. All patients underwent comprehensive ocular examinations, Goldmann perimetery, Hess chart test and exophthalmometry.

Results: Thirty-five patients underwent orbital floor reconstruction within the study period in our center. Twenty-six patients were analyzed. Autogenous grafts were used in 14 patients (53 %), and medpor in 12 patients (46.2%). Among our patients, 84.6% of them were males and 15.6 % females. The mean age was 24.5(8.2) years. Motor vehicle accidents were attributed to 96.2%. Motorcyclists were the most common victims (76.9%). The most common clinical presentations were diplopia 61.6% and enophthalmos 50 %. In our study 50% of orbital floor reconstructions were carried out within 2 weeks and 73.1 % of the cases were approached through blepharoplasty incision. Postoperatively there was no diplopia in primary gaze. In all cases however diplopia in the inferior and peripheral gaze was found 11.5 % and 26.9 % respectively in autogenous group, and 3.8 % and 26.9 % in medpor group (P = 1.24).

Enophthalmos was 11.4 % in autogenous graft group and 15.3 % in medpor group (P= 0.465). Hess chart was found to be abnormal in 11.4 % for each group (P = 0.062).

Restricted extraocular movements were seen in one (3.8 %) patient of autogenous group and 7.7 % of patients in medpor group (P = 0.574).

Conclusion: The outcome of orbital floor reconstruction by medpor was comparable and as good as autogenous graft, and there was no statistically significant difference between the two groups. Goldmann perimetry was a more objective binocular visual field test to detect diplopia and extraocular deficits.

ABSTRAK

Objektif: Untuk mengetahui perbezaan hasil penggunaan antara dua jenis bahan rekonstruktif di dalam pembedahan rekonstruksi lantai orbital.

Untuk menentukan perbezaan kepada hasil pembedahan rekonstruksi lantai orbit dengan penggunaan dua jenis bahan rekonstruktif.

Kaedah: Semua pesakit yang menjalani pembedahan rekonstruksi lantai orbit dalam jangkamasa kajian dibahagikan kepada dua kumpulan berdasarkan bahan yang digunakan sebagai graf. Semua pesakit menjalani pemeriksaan mata yang komprehensif, ujian perimetri Goldmann, ujian carta Hess dan pengukuran eksoftalmometri.

Keputusan: Tiga puluh lima pesakit menjalani rekonstruksi lantai orbit sepanjang jangkamasa kajian di Hospital USM. Dua puluh enam pesakit telah dianalisa. Empat belas (53%) pesakit menjalani pembedahan mengguna graf autogenus manakala dua belas (46.2%) menggunakan medpor. Pesakit lelaki terdiri dari 84.6% manakala 15.6% lagi pesakit perempuan. Min umur pesakit ialah 24.5(8.2) tahun. Kemalangan kenderaan bermotor menyumbangkan 96.2% daripada kes. Penunggang motosikal merupakan mangsa terbanyak (76.9%). Simptom paling kerap adalah diplopia 61.6% dan enophthalmos 50 %. Sebanyak 50% pembedahan dilakukan dalam jangkamasa dua minggu. Sebanyak 73.1% menggunakan '*blepharoplasty approach*'. Pemeriksaan menunjukkan tiada diplopia selepas pembedahan. Secara keseluruhan, 11.5 % mendapat diplopia ke arah pandangan bawah dan 26.9% diplopia ke arah '*periphery*' dalam kumpulan autogenus manakala 3.8% dan 26.9% masing-masing dalam kumpulan medpor (P=1.24). Sebanyak 11.4% mendapat enoptalmos dalam kumpulan graf autogenus manakala 15.3% dalam kumpulan medpor (P=0.465). 11.4% mendapat keputusan carta Hess tidak normal dalam kedua-dua kumpulan (P= 0.062). Pergerakan mata terhad diperhatikan dalam seorang pesakit (3.8%) kumpulan autogenus manakala 7.7% dalam kumpulan medpor (P= 0.574).

Kesimpulan: Tiada perbezaan ketara di dalam keputusan hasil pembedahan rekonstruksi lantai orbit di antara kumpulan graf autogenus atau pun medpor dalam populasi kajian kami. Ujian perimetri merupakan ujian objektif paling tepat untuk menentukan diplopia.

1

Introduction

CHAPTER I

1. INTRODUCTION

The complex structure of the orbital walls and the prominent position of the orbit within the craniofacial skeleton predispose this region to injury. The fracture patterns vary considerably in their location as well as in their degree of severity. Multiple portions of the orbit can be fractured and several internal orbital walls therefore injured simultaneously.

The degree of bony orbital disruption is frequently related to the amount of energy producing the injury which is classified into;

Low-energy orbital fractures: these lead to simple linear or circular blow-out fractures (less commonly, blow-in fractures) of one or two walls. Typically in this type of fracture there is inward displacement into the orbit most frequently noted in the orbital roof (without involvement of the orbital rim). This fracture type rarely need for reduction or fixation.

Middle-energy orbital fractures: typically involve at least two orbital walls. These types of fractures are usually accompanied by fracture of the orbital rim and variable degree of bone displacement. Usually these fractures may be isolated to the middle portions of the orbit and does not involve the most posterior portion of the orbit.

High-energy orbital fractures: Lead to extreme disruption of multiple segments of the orbital rim and orbital walls. Frequently these injuries are circumferential, with three or four walls of the internal orbit destroyed (Meyer 2000 and Paul N. et al 1990).

Orbital wall fracture implies a situation where a disruption of the walls or floor has been occurred. It is a defect fracture where bone fragments with torn periosteum are pushed outside of the original bony orbit. There is no intact bone even near the defect area except the thin bone rim surrounding the defect fracture (Kontio 2004 and Manolidis et al 2002).

Fractures of the orbit are seen in a significant number of patients who have blunt trauma to the face and skull. Blunt trauma to the upper part of the face particularly, the zygomatico-orbital complex; impair the three-dimensional (3-D) structure of the bony orbit at the weakest vulnerable areas especially in the orbital floor (Tuncer et al 2007).

Elmazar et al (2003), Reha et al (2004), Kosaka et al (2004), Cruz et al (2004), Cohen and Mercandetti (2005), Snikovic (2006) reported that the orbital floor fracture can be either pure fracture (orbital floor fracture only), or impure fracture (involvement of orbital rim or it may be part of more extensive facial injuries). The orbital floor fracture was one of the most frequently damaged parts of the maxillofacial skeleton during facial trauma because it is thin and concave surface (Figure: 1).

The recognized sequelae of orbital floor fractures present with varying degree of severity and extension. However, even simple, isolated orbital blow-out fractures may cause functional and cosmetic problems like residual dystopia and diplopia. The extraocular muscle dysfunction caused by muscles entrapment, ischemia, hemorrhage, or nerve injury. Enophthalmos due to herniation of the orbital soft tissue content into the maxillary sinus. Infraorbital nerve injury leads to infraorbital anesthesia. Bone displacement leads to disfiguring facial contours. Difficulty in chewing and tearing due to obstruction of the nasolacrimal duct are other manifestations (Tuncer et al 2007 and Burnstine 2003).

Orbital fractures may be limited to the anatomic boundaries of the orbit itself or may be associated with more extensive fractures of the craniofacial skeleton. Orbital floor fracture can vary from simple small with or with out displacement of the bony fragments. The simple fracture may not need any surgical intervention while a fracture with displaced bony fragments corrected surgically (Taylor et al 2004).

In orbital trauma there are several advances available such as the new techniques in radiologic imaging, the use of endoscopy and new treatment indications for certain types of fractures, the advances in alloplastic material development; new surgical instruments and techniques, and the studies of the natural course of posttraumatic sequelae. All these new technologies allow for earlier rehabilitation and decreased morbidity of patients through a greater emphasis on the restoration of the functional anatomy of the traumatized orbit. In some cases, the pathophysiologic understandings of the causes of long-term damage have dictated earlier intervention (Maus 2001).

Orbital floor fractures are some of the more challenging injuries faced by the surgeons. The most minor asymmetries following facial trauma can be distressing to the patient. In treating these patients, there are certain crucial aspects of both diagnosis and management that are critical to obtaining an optimal result. These include a careful preparative eye examination focusing on extraocular motility and evidence of optic nerve compression.

Candidates for surgery must be carefully selected based on firm indications such as a large orbital floor defect (>1 cm^2), evidence of orbital soft tissue entrapment or persistent diplopia in the primary field of gaze (Cole et al 2007, and Burnstine 2003).

Matteini et al (2004) reviewed their experience with 108 consecutive cases of pure orbital fractures to investigate the differences in surgical timing and the correlations with patient age, clinical and radiographic findings. In this analysis, surgical timing of pure orbital fractures was strongly related to the combination of these parameters. Their data suggested that urgent surgery was indicated in severe orbital apex fractures and in orbital fractures with cerebrospinal fluid leakage, penetrating objects, or exposure.

Early surgery was necessary within 3 days in children with diplopia and within 7 days in adults with double vision. Delayed surgery (performed between 7 and 12 days) was performed on fractures with no visual impairment or no orbital rim fractures. The data from this retrospective analysis suggested that good postsurgical results could be obtained by performing surgery within 12 days, which is earlier than previously recommended. While Cole et al (2007) report that the immediate surgical interventions in nonresolving oculocardiac reflex, the "white-eyed" blowout fracture, and early enophthalmos.

The goal of successful orbital reconstruction following traumatic fracture or orbital surgery depends on thoughtful preoperative planning, meticulous operative dissection, and proper selection of implant type, size, and contour. Numerous materials have been used in internal orbital reconstruction, including autogenous grafts (such as bone or cartilage), alloplastic materials (such as silicone, nylon sheets, polytetrafluoroethylene, hydroxyapatite, gelatin film, and porous polyethylene), and metal sheets or mesh (such as titanium). Each type of implant possesses unique performance characteristics that determine its utility in particular reconstructive set (Garibaldi 2007).

1.2 Anatomy of Bony Orbit

The orbital bones develop by ossifying in two ways. Endochondral bones ossify from a cartilage precursor. Membranous bones do so from connective tissue without a cartilaginous stage. The maxillary, frontal, zygomatic, palatine, and lacrimal bones and portions of the sphenoid bone are of membranous origin. The ethmoid bone, the lesser wing of the sphenoid bone, and the optic canal are endochondral bones. By the time of birth, orbital ossification is complete, except at the apex.

The adult bony orbit resembles a four-sided pyramid that becomes three-sided near the orbital apex. The anteriorly oriented base approximates a rectangle 40mm wide by 32mm high. The point of maximal height and width is about 1 cm posterior to the orbital rim. The medial walls are separated by 25mm and are parallel. In contrast, the lateral walls are perpendicular to one another, and they extend laterally 45 degrees from the midsagittal plane. The anteroposterior axes at the center of each orbit subtend a 45-degree angle. The volume of the orbit is approximately $30cm^{3.}$ Comparison with the quadrilateral pyramid, fail with the floor which is the shortest orbital wall, which dose not reach the apex, the cavity being triangular in section in this region (Figure: 2).

The maxillary, zygomatic, and palatine bones form the orbital floor. It is composed almost entirely of the orbital plate of the maxillary bone, which is the roof of the maxillary sinus. The zygomatic reinforces the floor anterolaterally, and the palatine makes a minor contribution at the most posterior aspect. The medial boundary is the maxilloethmoid suture; the lateral, an imaginary line through the axis of the inferior orbital fissure.

The floor of the orbit is triangular. It slopes slightly downwards and laterally. Its lowest part is an anterlateral concavity about 3mm deep. The floor is the shortest orbital wall, extending 35 to 40mm from the rim to the inferior orbital fissure. Thus, it is not present at the apex.

The orbital floor is traversed by the infraorbital sulcus which runs forwards from the inferior orbital fissure. Usually near the floor's mid point the sulcus becomes a canal completed by a plate of bone passing from its lateral side to the medial at the infraorbital suture which can be traced over the orbital margin into the medial side of the infraorbital foramen.

The infraorbital canal descends in the orbital floor to open at the infraorbital foramen about 4 mm below the orbital margin. It transmits the infraorbital vessels and nerve. Lateral to the opening the nasolacrimal canal a small pit or rough area occasionally marks attachment of the inferior oblique muscle. Between the orbital floor and the medial wall is a fine suture; posteriorly the lateral wall is separated from the floor by the inferior orbital (sphenomaxillary) fissure, but is continuous with it anteriorly.

Although the floor is not the thinnest orbital wall, it is involved most frequently in orbital fractures that spare the rim. These most commonly occurs medial to the infraorbital sulcus and canal, where the maxillary bone is only 0.5-1mm thick and the thinnest part at the infraorbital canal and groove. The inferior rectus muscle adjoins the floor near the apex of the orbit, but it is separated form it anteriorly by the inferior oblique muscle and fat.