RECONSTRUCTION OF ORBITAL FLOOR BLOW-OUT FRACTURES WITH SILICONE IMPLANT

MWANZA J-C. K., NGOY D. K.**, KAYEMBE D.L.**

ABSTRACT

Aim: To evaluate the outcome of orbital floor blow-out fractures treated surgically with silicone implant.
Methods: The patients were examined in a prospective study from October 1993 to December 1999. Over this period 11 patients were diagnosed as having orbital floor blow-out fractures. The study was restricted to those who were both treated surgically and followed-up at least three months after the discharge from hospital. Only six patients (five males and one female), ranging in age from 6 to 30 years, fulfilled the inclusion criteria. The fractures occured during brawls in 3 patiens, car accidents in 2 patients and child's play in 1 patient. The diagnosis was based on history, clinical grounds and coronal computed tomography. The surgical procedure was the same in all patients, using silicone implant to reconstruct the defects. The mean follow-up time after surgery was 4.8 months.
Results : The interval between injury and diagnosis ranged from 6 to 85 days (mean: 34.8 days). Limitation of vertical eye movements was present in all 6 patients, diplopia in 4 patients, enophthalmos in 3 patients and hypoesthesia in the distribution of the infraorbital nerve in 1 patient. The mean interval time between injury and surgery was 55.3 days and the majority of the patients (83%) had late repairs ($>$ 14 days) after injury. Postoperatively, satisfactory results were obtained with regard to limitation of vertical eye movements, diplopia, enophthalmos and hypoesthesia. Only one patient had a persistent and partially reduced enophthalmos. Silicone implant was well tolerated in all 6 cases since complications such as infection, tissue reaction and extrusion were not observed.
Conclusion : Satisfactory results may be obtained after late repair of orbital floor blow-out fractures. Silicone implant has the potential to be used successfully in orbital floor fractures.

RÉSUMÉ

But: Evaluer l'évolution des cas de fractures du plancher orbitaire par blow-out après réparation chirurgicale avec lame de silicone.
Méthode: Etude prospective de six patients avec fracture du plancher orbitaire par blow-out. Pour faire partie de l'étude, les patients devaient à la fois être traités chirurgicalement et être suivis pendant au moins trois mois après la sortie de l'hôpital. Sur un total de 11 patiens reçus d'Octobre 1993 à Décembre 1999, seuls six patients (cinq hommes et une femme) âgés de 6 à 30 ans ont rempli les critères d'inclusion. Le diagnostic était basé sur les données cliniques et tomographiques. Le procédé chirurgical utilisé était le même chez tous les patients, avec mise en place d'une lame de silicone pour la réfection de la fracture. Le follow-up moyen était de 4.8 mois.
Résultats: L' intervalle de temps moyen écoulé entre l'accident et le diagnostc était de 34.8 jours (limites: 6-85 jours). Tous les patients présentaient une limitation de l'élévation du globe en pré-opératoire. La diplopie, l'énophtalmie et l'hypoesthésie dans le territoire de la deuxième branche du trijumeau étaient notées respectivement chez quatre, trois et un patient. Le délai moyen entre l'accident et la réparation chirurgicale était de 55.3 jours (limites: 7-98 jours). Cinq patients ont été pris en charge tardivement (délai $>$ 14 jours). Les résultats postopératoires ont été satisfaisants dans tous les cas,

.....

* *Department of Ophthalmology, University Hospital of Kinshasa, Kinshasa, Dem. Rep. of Congo.*

** *Department of Ophthalmology, Kinoise Hospital, Kinshasa, Dem. Rep. of Congo. At the time the study was conducted, he was attached to the University Hospital*

received: 22.01.01
accepted: 28.03.01 Hospital.

excepté la persistence partielle de l'énophtalmie chez un patient. Les lames de silicone ont été bien tolérées, dans la mesure où les complications comme l'infection, la réaction tissulaire et le rejet n'ont pas été observées.
Conclusion: Des résultats satisfaisants peuvent être obtenus après réparation chirurgicale tardive des fractures du plancher orbitaire en utilisant des lames de silicone.

KEY-WORDS:

Blow-out fracture, orbital floor, silicone implant.

MOTS-CLÉS:

Fracture blow-out, plancher orbitaire, lame de silicone.

INTRODUCTION

A ″pure″ blow-out fracture is a fracture of the orbital wall without involvement of the orbital rim (15,16). Subsequently, disruption of the orbital contents into adjacent sinuses with permanent entrapment of orbital tissue can occur in various degrees. When an eye is struck forcibly by a large blunt object, the globe, as a rule, does not rupture, but a blow-out fracture may happen (15). This type of fracture must be distinguished from a ″complex″ blow-out fracture where the orbital rim and adjacent facial bones are involved.

Two theories have been advanced to explain the mechanism of a blow-out fracture: 1) the ″hydraulic″ theory with compression of the orbital contents, increased intraorbital pressure, and fracture of the thin orbital floor (14), 2) the ″buckling″ theory with stress transmitted directly from the orbital rim to the orbital floor. In the hydraulic theory, a blow-out fracture acts like a pressure blow-out valve in that the force of the blow to the eye, besides being absorbed by the elastic ligaments of the eye and orbital fat, is also absorbed by the bony rupture, usually of the floor and medial wall of the orbit, and by compression of air in the paranasal sinuses (14). This mechanism would protect man's eye from injury in fights and accidents.

Although authors have demonstrated that some patients with blow-out fracture and severe acute symptoms may improve spontaneously without surgery (4,14), the management of orbital floor blow-out fracture remains a surgical issue. However, the surgical approach sometimes has complications such as orbital cellulitis, worsening of the diplopia, persistent post-operative pain, blindness, chronic sinusitis, extrusion of implant, chronic skin-orbital floor fistulas, maxillary sinus-orbital fistula, late proptosis, post-operative mydriasis, intraorbital hemorrhage, dacryocystitis, loss of lacrimal pump mechanism and others.

There are numerous reports on blow-out fractures of the orbital floor from western countries. In contrast, in subsaharian Africa data on this condition are rare. Thus, we undertook this study to evaluate the outcome of 6 cases of orbital floor blow-out fractures treated surgically.

MATERIAL AND METHODS

Cases were consecutive patients with a diagnosis of orbital floor blow-out fracture treated surgically at the Department of Ophthalmology, University Hospital of Kinshasa, from October 1993 to December 1999 and followed-up at least three months after the discharge from hospital. During this period, this diagnosis was made in 11 patients. Five of them were excluded from the study, 2 because they refused to undergo the surgical procedure and 3 because they were lost early after discharge. Thus, only 6 patients were evaluated. The patients (five males and one female) ranged in age from 6 to 30 years (mean 19.8 years). The fractures occurred during brawl in 3 patients, car accidents in 2 patients and child's play in 1 patient.

The diagnosis of orbital floor blow-out fracture was based on history, clinical examination and coronal tomography. On history, the patients were questioned about symptoms relative to cosmesis, diplopia and hypoesthesia. The clinical examination included visual acuity (VA) testing, pupillary reflex and ocular motility evaluation including the Lees screen test, Hertel exophthalmometry, slit-lamp biomicroscopy, applanation tonometry, fundus ophthalmoscopy and evaluation of sensitivity in the distribution of the infraorbital nerve in all patients.

The surgical decision was taken in presence of diplopia, enophthalmos, limitation of vertical eye movements and/or hypoesthesia in the distribution of the infraorbital nerve. The operative procedure, performed by the same surgeon (KDL), was the same in all patients, using a 2 mm thick and pliable silicone implant (Dow Corning Ltd, USA). A skin incision was made in the lower eyelid at 5 mm below the subciliary fold following the natural curve of the lid. A dissection was then carried down until the periosteum is reached at the level of the orbital rim. The incision was then carried through the periosteum just below the orbital rim. The reflection of the periosteum was made over the rim using a periostal elevator until the fracture is visualized. To relieve any orbital structure entrapment and to restore the orbital contents to their original place, a forced traction of the globe was made. The silicone implant was then cut, adapted to the fracture, inserted into the breach and fixed with prolene 5-0 to the periosteum in order to prevent ulterior migration or extrusion. The periosteum was closed with 5-0 chromic gut and the subcutaneous tissue approximated. The 6-0 silk was used to close the skin. The mean follow-up time was 4.8 months (range: 3-10 months). The results of the orbital floor reconstruction were analysed on the basis of the post-operative results.

RESULTS

The findings in all 6 cases are summarized in the table 1. The interval between the injury and the diagnosis ranged from 6 to 85 days (mean 34.8 days).

Preoperatively, 4 patients had symptomatic diplopia, 6 had limitation of vertical eye movements, 3 had enophthalmos, 1 had hypoesthesia in the distribution of the infraorbital nerve and 2 had maxillary sinus hemorrhage. Enophthalmos was 4mm in 4 patients and 3 mm in 2 patients. The mean interval time between injury and surgery was 55.3 days (range 7 to 98 days). Only one patient had early repair ($<$ or $=$ 14 days) after injury while the remaining had late repairs ($>$ 14 days).

Postoperatively, no patient complained of worsening of the preoperative diplopia or induced diplopia. The diplopia improved completely within 30 days after surgery in all 4 patients. Enophthalmos resolved completely in 2 patients while in one patient it resolved partially. The unique case of hypoesthesia in the distribution of infraorbital nerve was normalized within 3 weeks. No major complication such as extrusion of implant or infection was observed. All 6 patients had satisfactory results with regard to limitation of vertical eye movements.

DISCUSSION

The predominance of male patients suffering from blow-out fracture observed in our series is comparable to the results of other previous reports (3,13). In contrast to western countries where patients with blow-out fractures present to ophthalmologists or maxillo-facial surgeons within hours or days after injury, the

Table 1. Summary of findings in the 6 patients with orbital floor blow-out fractures

	N° of patients					
	1	2	3	4	5	6
Sex	M	F	M	M	M	M
Age (years)	22	21	30	25	15	6
Eye	L	R	R	R	L	R
Circumstance of injury	CA	Brawl	Brawl	CA	Brawl	Child's play
I-D (days)	6	46	85	53	7	12
I-S (days)	7	98	88	98	17	24
Follow-up (months)	10	3	5	4	4	3
Limitation of VEM	+(-)	+(-)	+(-)	+(-)	+(-)	+(-)
Enophthalmos	-(-)	+(+)	-(-)	+(-)	+(-)	-(-)
Diplopia	+(-)	+(-)	-(-)	-(-)	+(-)	-(-)
Hypoesthesia	+(-)	-(-)	-(-)	-(-)	-(-)	-(-)

I-D = interval injury-diagnosis, I-S = interval injury-surgery, VEM = vertical eye movements, CA = car accident
Signs inside parentheses indicate post-operative results.

mean delay in presentation was 34.8 days in our series. This is mainly due to the fact that appropriate referral is made very late due to missing the diagnosis by general physicians. The delay between diagnosis and surgery observed in this study was due to financial problems or delay in informed consent.

In the present study, half of the cases of orbital floor blow-out fractures occured during brawls. In western countries such as USA and UK, most of the condition are sustained during sports (7) (especially soccer) that are not practised in our country.

The management (indications and timing of surgical intervention) of orbital floor blow-out fracture has generated more controversy. Mathog (10) suggested that in order to minimize the sequelae of the blow-out fracture, surgery should be performed at 7 to 10 days after trauma. Dutton (2), Chen et al (1) and Gatot et al (5) also pointed out that early repair of the orbital floor blow-out fracture is more successful. Thaller et al (17) clearly indicated that exploration of the orbital floor has the potential to significantly decrease the incidence of serious post-traumatic complications, especially enophthalmos. On the other hand, other authors (8,9) proposed a wait and see policy, keeping the patient under observation. Putterman et al (14) showed in their study that most patients who suffer a pure blow-out fracture of the orbital floor will have no serious sequelae when surgery is not performed. All this means that both surgical and non-surgical approaches have a place in the management of orbital blow-out fractures. Although surgery was performed late (mean = 55.3 days) after trauma in our patients, satisfactory results were obtained. Indeed, five of the patients were either very satisfied or satisfied with their functional and cosmetic results. The tolerance of silicone implant was excellent in all six patients. Thus, we conclude that satisfactory results can be obtained after late repair of orbital floor blow-out fracture. Complications previously reported as associated with silicone implant such as tissue reaction (6), infection and migration of the implant causing a significant rate of removal of this material (11,12), were not observed in the present study. In contrast, our results indicate that silicone orbital floor implant has excellent characteristics, provides stability to correct enophthalmos and doesn't cause foreign body sensation. However, compared to other studies some limitations to our study must be considered, such as the small number of patients and the short follow-up time. In addition, the cost-benefit ratio, which is an important issue in such a study, was not addressed in this study since silicone was the only available material.

REFERENCES

(1) CHEN JM, ZINGG M, LEADRACH K, RAVEH J. – Early surgical intervention for orbital floor fractures: a clinical evaluation of lyophilized dura and cartilage reconstruction. *J Oral Maxillofac Surg* 1992; 50: 935-941.

(2) DUTTON JJ. – Management of blow-out fractures of the orbital floor. *Surv Ophthalmol* 1991; 35: 279-280.
(3) ELLIOTT D, O'BRIEN TP. – Trauma. In Varma R ed: Essentials of Eye Care. The Johns Hopkins Wilmer Handbook, Lippincott-Raven Publishers, Philadelphia, 1997, 468.
(4) EMERY JM, VON NOORDEN GK, SCHLERNITZAUER DA. – Orbital floor fractures. Long-term follow-up of cases with and without surgical repair. *Trans Am Acad Ophthalmol Otolaryngol* 1971; 75: 802-806.
(5) GATOT A, TOVI F. – Early treatment of orbital floor fractures with catheter ballon in children. *Int J Pediatr Otorhinolaryngol* 1991; 21: 97-101.
(6) GREGORY GF. – Silicone-associated reaction: a dilemma for oral and maxillofacial surgeons. *Br J Oral Maxillofac Surg* 1995; 33: 180-184.
(7) JONES NP. – Orbital blow-out fractures in sport. *Br J Sports Med* 1994; 28: 272-275.
(8) MAGNOCAVALLO M, KLAINGUTI G. – Blow-out orbital trauma and diplopia. Conservative or surgical approach. *Klin Monatsbl Augenheilkd* 1992; 200: 478-480.
(9) DE MAN K, WIJNGAARDE R, HES J, DE JONG PT. – Influence of age on the management of blow-out fractures of the orbital floor. *Int J Oral Maxillofac Surg* 1991; 20: 330-336.
(10) MATHOG RH. – Management of orbital blow-out fractures. *Otolaryngol Clin North Am* 1991; 24: 79-91.
(11) MAURIELLO JA jr, HARGRAVE S, MOSTAFAVI R, KAPILA R. – Infection after insertion of alloplastic orbital floor implants. *Am J Ophthalmol* 1994; 117: 246-252.
(12) MORRISSON AD, SANDERSON RC, MOOS KF. – The use of silastic as an orbital implant for reconstruction of orbital wall defects: review of 311 cases treated over 20 years. *J Oral. Maxillofac Surg* 1995; 53: 412-417.
(13) OUADAH A, GERARD M, MALPUECH F et al. – Le traitement des fractures du plancher de l'orbite: réfection par lame de Téflon. Analyse des résultats sur 5 ans. *Rev Stomatol Chir Maxillofac* 1998, 99; supp 1: 120-121.
(14) PUTTERMAN AM, STEVENS T, URIST MJ. – Nonsurgical management of blow-out fractures of the orbital floor. *Am J Ophthalmol* 1974; 77: 232-238.
(15) SMITH B, REGAN WF JR. – Blow-out fracture of the orbit. Mechanism and correction of internal orbital fracture. *Am J Ophthalmol* 1957; 44: 733.
(16) STASIOR OG. – Blow-out fractures. In Modern Ophthalmology, Sorby A ed, Butterworth and Co London, 1974, 900.
(17) THALLER SR, YVORCHUK W. – Exploration of the orbital floor: an indicated procedure. *J Craniofac Surg* 1990; 4: 187-190.

.....

Correspondence and reprints to:
MWANZA J-C K., University of Bergen, CIH,
Armauer Hansen Building,
Haukeland University Hospital,
N-5021 Bergen, NORWAY.
E-mail: Jean-Claude.Kasongo@student.uib.no,
Fax: +47 55 97 49 79

936