Injury, Int. J. Care Injured 48 (2017) 1408–1416

Contents lists available at ScienceDirect

Injury

journal homepage: www.elsevier.com/locate/injury

Prospective study on ocular motility limitation due to orbital muscle entrapment or impingement associated with orbital wall fracture

Babak Alinasab[a,*], Abdul Rashid Qureshi[b], Pär Stjärne[a]

[a] Department of Clinical Sciences, Intervention and Technology, Division of Otorhinolaryngology, Karolinska Institutet, Karolinska University Hospital, Stockholm, Sweden
[b] Department of Otorhinolaryngology at Sophiahemmet University, Sweden

ARTICLE INFO

Keywords:
Orbital blow out fracture (BOF)
Prospective
Impingement
Entrapment
Ocular motility
Limitation
Restriction
Management
Surgical indication

ABSTRACT

Introduction: The recommended urgent surgical management of ocular motility restriction due to orbital muscle entrapment or impingement associated with orbital wall fracture needs to be elucidated.
Aim: To evaluate the importance of the time from injury to surgery for the outcome in ocular motility and diplopia, the time lapse of ocular motility, diplopia and hypesthesia recovery.
Material and methods: Patients with entrapment or impingement of orbital contents due to orbital wall fracture were followed up prospectively over 1 year regarding ocular motility, diplopia, hypesthesia and cosmetic deformity.
Results: 21 patients (10 entrapments and 11 impingements) were included and treated surgically. The median time from injury to surgery was 36 (8–413) h for the entrapment group and 168 (48–326) h for the impingement group. The median time from study inclusion to surgery was 0 (0–1) days for the entrapment group and 1.0 (0.2–4.8) days for the impingement group. All the patients had ocular motility limitation and diplopia at the inclusion. Ocular motility improved gradually and was normal at final visit. Diplopia resolved gradually in all patients except in two with non-disturbing diplopia, at the final visit. Forced duction test was positive in 90% of the patients in the entrapment group and 70% in impingement group. At final visit, hypesthesia was found in none of the patients in the entrapment group but in 4 patients in the impingement group.
Conclusions: In this, the first prospective long term follow up of orbital wall fractures with ocular motility restriction, we did not find any significant correlation between the time from injury to surgery and the outcomes in ocular motility and diplopia. An entrapment requires surgery as soon as possible; however, the surgical reduction is at least as important as surgical timing. Surgery should be delayed until it can be performed by an experienced surgeon. Ocular motility restriction causing diplopia due to impingement is not an ophthalmologic emergency and surgery is recommended if the diplopia and ocular motility has not improved over time. Clinical examination of ocular motility and not CT scan findings is crucial to determine whether a limitation of ocular motility exists or not.

Introduction

In orbital wall fracture, orbital contents such as, fat, connective tissue or muscle may become herniated or entrapped within the fracture [1]. An entrapment of orbital tissue may result in ocular motility restriction [2]. This complication occurs more often in children due to the increased elasticity and flexibility of the bony orbit [3,4]. It has been recommended that an entrapped inferior rectus muscle should be released within hours [3] to prevent ischemia and scarring leading to permanent diplopia [5]. Entrapment of the inferior rectus muscle sheath and not the muscle itself has also been reported, but still clinically presents as restriction in ocular motility [6]. Although orbital blow out fracture (BOF) with herniation of the orbital contents is usually evident on computed tomography (CT) [7], certain BOF with ocular motility limitation can present with little or no abnormalities in imaging [8,9]. Entrapment of periorbital contents may appear in a trapdoor fracture, where entrapment refers to the soft tissues and the trapdoor to the type of bony injury (Fig. 1). In an open door fracture with a clinically verified ocular motility limitation, an impingement of the periorbital tissue would explain the prevention of normal eye movements (Fig. 2).

* Corresponding author at: Department of Otorhinolaryngology and Head & Neck Surgery, Karolinska University Hospital, Karolinska vägen 171 76 Solna, Sweden.
E-mail address: babak.alinasab@karolinska.se (B. Alinasab).

http://dx.doi.org/10.1016/j.injury.2017.04.039
0020-1383/

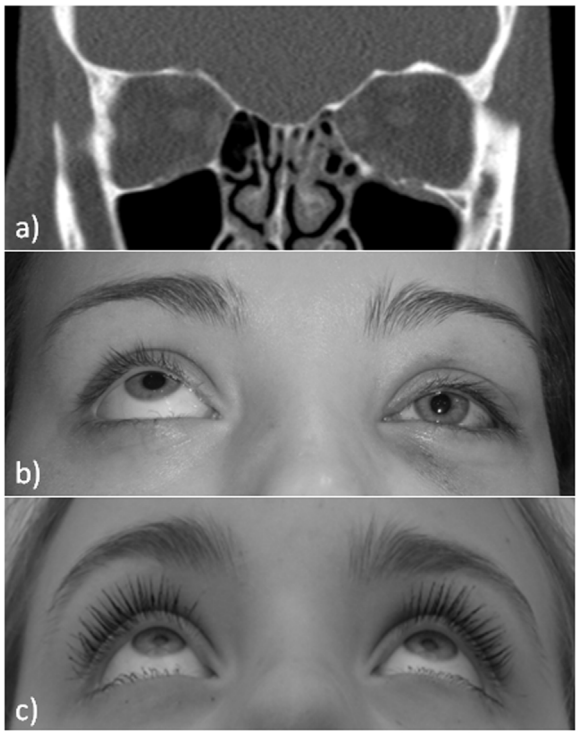

Fig. 1. CT scan (a) of a patient with left orbital wall fracture, with limitation to elevate the left eye 1 day after the injury (b), and normal eye movement at 1 year postoperative (c). This patient was considered to have entrapment of the left rectus inferior muscle.

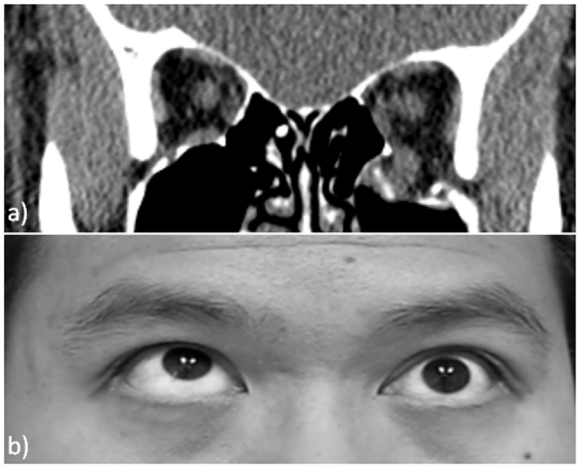

Fig. 2. CT scan (a) of a patient with BOF in left orbit with limitation to elevate the left eye, remaining 13 days after the injury (b). This patient was considered to have impingement of left inferior rectus muscle.

A motility restriction due to an entrapped inferior rectus muscle is commonly seen, however, the medial rectus may also be involved. These patients are more likely to present with paresis of the affected rectus muscle with restriction in adduction of the affected eye. In such a case similar recommendations to inferior rectus muscle entrapment apply, as in to release the entrapped muscle (Fig. 3) [10,11].

In this prospective study we aimed to evaluate: (i) the importance of the time from injury to surgery in relation to outcomes in ocular motility and diplopia, (ii) the time line for ocular motility and diplopia recovery and (iii) the degree of and recovery from hypesthesia.

The ethics committee

The Ethics Committee of the Karolinska Institute (EPN) Stockholm, Sweden, approved the study protocols and informed consent was obtained from each individual included in the study. The studies were conducted in adherence to the Declaration of Helsinki.

Material and methods

This was a prospective observational study performed at the Department of Otorhinolaryngology and Head & Neck Surgery at the Karolinska University Hospital in Stockholm, Sweden. Patients with orbital trauma that presented with acute ocular motility limitation due to entrapment or impingement of orbital contents were asked to participate in the study between 2011 and 2016. All the included patients had clear ocular motility limitation in at least one direction and a CT scan verifying an isolated unilateral inferior, medial or inferomedial orbital wall fracture. Patients were treated according to current guidelines with urgent to early surgical intervention to release the affected ocular muscle and if needed a reconstruction the orbit.

After the inclusion, patients were followed for a minimum of one year with five clinical examinations. At each visit, patients completed a self-reported questionnaire and a clinical examination was performed by a physician for functional symptoms such as ocular motility, diplopia, hypesthesia of the infraorbital nerve, as well as cosmetic deformities such as enophthalmus, hypoglobus and superior sulcus deformity. The measurement of enophthalmus was performed using a Hertel exophthalmometer [12]. Hypoglobus and superior sulcus deformity were noted if they were visible.

A forced duction test [13] was performed under general anesthesia prior and at the end of the surgery in order to determine whether ocular motility restriction was present or not. Patients were asked if they felt satisfied with the treatment they received at each visit. The patients' questionnaire and the physicians' protocol was study specific and have not been validated.

Statistical analyses

All variables are expressed as median (10th and 90th percentile) or percentages, as appropriate. Statistical significance was set at the level of $p < 0.05$. Comparisons between two groups were

Fig. 3. CT scan of a patient with BOF in left orbit with limitation to adduct the left eye was observed 7 days after the injury. This patient was considered to have impingement of left medial rectus muscle.