CLINICAL STUDY

Missed orbital wall blow-out fracture as a cause of post-enucleation socket syndrome

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Abstract

Background **Post-enucleation socket syndrome (PESS: deep upper lid sulcus, ptosis or upper lid retraction, enophthalmos and lower lid laxity) is a well-recognised complication of a volume-deficient anophthalmic socket. A patient requiring enucleation following severe ocular trauma may have an underlying orbital wall blow-out fracture which if overlooked can cause severe volume deficit with poor cosmesis and limited prosthesis motility.**
Purpose **To establish the prevalence of an undiagnosed blow-out fracture in patients with PESS and a history of relevant trauma.**
Methods **Medical records and orbital computed tomography (CT) scans were reviewed for all patients presenting with PESS and a history of relevant trauma.**
Results **Undiagnosed blow-out fractures were found in 15 (33%) of 45 patients presenting between August 1993 and December 1996. These were significant enough to warrant surgical repair in 13 (29%) patients.**
Conclusions **We suggest that any patient presenting with PESS and a history of relevant trauma should be considered to have an orbital wall blow-out fracture until proven otherwise by CT scanning of the orbit. Similarly any patient requiring enucleation following severe ocular trauma should undergo CT scanning to rule out a coexisting blow-out fracture which could be repaired at the time of enucleation.**

Key words Blow-out fracture, Computed tomography, Post-enucleation socket syndrome, Trauma

Enucleation of an eye results in an orbital contents volume deficit of approximately 8 ml.[1] This can be restored by an orbital implant at the time of enucleation and the subsequent fitting of a prosthesis which is supported by the lower eyelid. Any persistent volume deficit results in a relative enophthalmos which may predispose to post-enucleation socket syndrome (PESS).

The characteristic features of PESS are ptosis, enophthalmos, a deep upper eyelid sulcus and lower eyelid laxity, as originally described by Tyers and Collin.[2] Patients can often present with upper lid retraction rather than a ptosis.[3]

Orbital volume deficit and PESS may be caused or exacerbated by an underlying orbital wall blow-out fracture. If this is overlooked the patient requiring enucleation after globe trauma may experience severe cosmetic deformities as well as prosthesis motility problems.

Our aim was to establish the prevalence of a missed orbital wall blow-out fracture in patients who had previously undergone an enucleation after sustaining globe trauma and who had subsequently presented with PESS.

Patients and methods

A retrospective study of patients presenting to the orbital and oculoplastics unit at Manchester Royal Eye Hospital with PESS and a history of relevant trauma was undertaken. Clinical notes and orbital computed tomography (CT) scans on patients presenting between August 1993 and December 1996 were studied. Clinical information studied included age, mode of original injury, clinical management prior to presentation with PESS and details of surgical correction. Radiological information recorded included the presence and location of orbital wall blow-out fracture(s), displacement of orbital soft tissues and an estimation of the resultant difference in volume between the affected orbit and the contralateral side.[4]

Results

Between August 1993 and December 1996, 45 patients with PESS and a history of relevant trauma underwent CT scanning of the orbits in order to rule out an underlying orbital wall blow-out fracture. Table 1 groups the patients

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Received: 19 May 1998
Accepted in revised form: 25 January 1999

Table 1. *Modes of injury in patients scanned to exclude an orbital wall blow-out fracture*

Mode of injury	No. scanned (% of total)	Fracture on CT scan (% of mode of injury group)	% of total fractures
Miscellaneous childhood trauma	11 (25%)	1 (9%)	7%
Road traffic accident	13 (29%)	7 (54%)	46%
Alleged assault	3 (7%)	1 (33%)	7%
Sport/leisure activity	8 (18%)	3 (37%)	20%
Gunshot injury	4 (9%)	2 (50%)	13%
Industrial accident	2 (4%)	0	0
Catapult injury	2 (4%)	1 (50%)	7%
Unknown	2 (4%)	0	0
Total	45	15	100%

according to the type of injury sustained and shows prevalence of blow-out fractures within each group. Miscellaneous childhood trauma accounted for 25% of the series but only 7% of all fractures. In contrast road traffic accident (RTA) patients accounted for a similar proportion (29%) of the series but 46% of all fractures seen. Fifteen patients (33% of all patients) had undiagnosed orbital wall blow-out fractures. Thirteen patients (29%) were considered to have significant fractures requiring surgical repair in order to restore a volume deficit.

The blow-out fracture volume was measured on CT in 10 of these patients (in 3 patients blow-out fractures of 'significant' size were recognised but not measured). The mean increase in volume of the blow-out orbit compared with the normal orbit was 2.03 cm^3 (SD 1.02 cm^3). All but one blow-out fracture had a volume increase of greater than 1.00 cm^3; the exception was an impure blow-out fracture with considerable posterior displacement of the lateral orbital margin resulting in underestimation of the fracture size on CT measurement. Two patients (4%) had small orbital floor fractures (volume less than 0.7 cm^3) which were felt not to contribute significantly to either the cosmetic deformity or implant motility and therefore did not undergo formal fracture repair.

Selected case reports

Case 1

A 63-year-old woman had sustained severe eye trauma 25 years previously during a RTA and underwent enucleation and an acrylic ball implant insertion at that time. She was referred for management of her severe cosmetic deformity. She had marked features of PESS and a tilted prosthesis, a migrated implant which was palpable through the lower lid, lagophthalmos and poor socket mobility (Fig. 1a).

A CT scan demonstrated a medial wall and an adjacent floor fracture. Fig.1b shows posterolateral and inferior migration of the orbital implant.

A supramid sheet was inserted subperiosteally to repair defects at the fracture sites. The procedure was combined with a scleral-wrapped hydroxyapatite implant exchange. The patient's overall cosmesis was much improved (Fig. 1c) and she was discharged after a 6 month review.

Case 2

A 20-year-old man sustained a ruptured globe after being struck by a stone fired from a catapult. He had a primary enucleation without an orbital implant and was referred to our clinic for a secondary hydroxyapatite implant.

On examination he had marked PESS (Fig. 2a). In view of the history of preceding trauma a CT scan was performed. This demonstrated large orbital wall blow-out fractures involving the anterior two-thirds of the floor and the middle third of the medial wall (Fig. 2b). The volume discrepancy between the orbits was 3.4 cm^3.

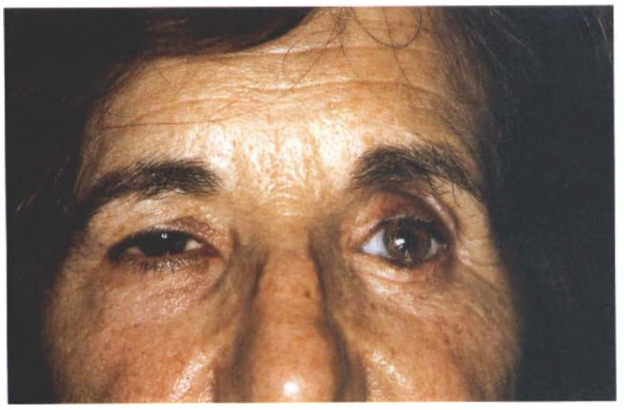
The patient subsequently underwent a repair of the fractures using a supramid sheet and this procedure was combined with insertion of a secondary hydroxyapatite implant. He has had a good cosmetic and functional result following this surgery (Fig. 2c).

Discussion

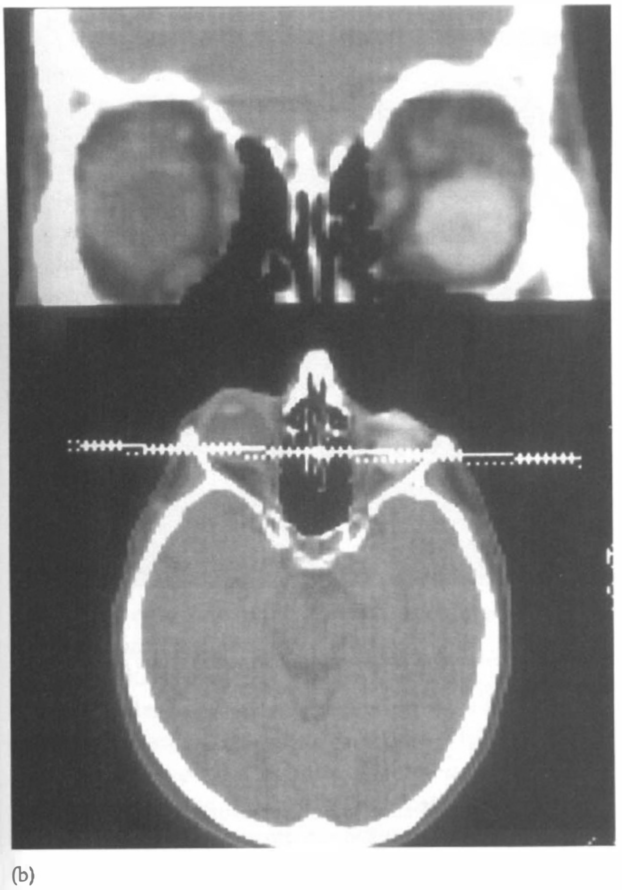
Removal of the globe results in a loss of intraorbital volume. It is likely that underestimation and inadequate replacement of orbital volume loss at the time of enucleation accounts for the majority of patients who develop PESS. Resolution of post-traumatic and post-operative oedema[6] can take many months and may further exacerbate a volume-deficient state.

The patients in our study had a previous history of globe trauma that was severe enough to require enucleation. The *major* cause of PESS in 29% of these patients was the presence of a previously undiagnosed orbital wall blow-out fracture which required surgical repair. A further 4% of patients were found to have an overlooked orbital wall blow-out fracture which did not appear to be contributing significantly to the patients' cosmetic or motility problems and therefore did not warrant specific repair. Nevertheless it was important to note the presence of small fractures in these patients for future reference in case problems relating to poor motility, implant migration or orbital infection develop at a later stage.

We consider that blow-out fractures (some very large) were missed in some of these patients because of the severity of the initial trauma. Seventeen patients (38% of the series and 59% of all fractures detected) were involved in RTAs or had received gunshot wounds. They may have required urgent medical attention for a



(a)



(b)

(c)

Fig. 1. *Case 1. (a) Clinical appearance at presentation: note the features of post-enucleation socket syndrome. (b) CT coronal reconstruction showing posterolateral and inferior displacement of the left orbital implant due to medial wall and floor blow-out fractures. (c) Appearance following blow-out fracture repair and exchange hydroxyapatite implant.*

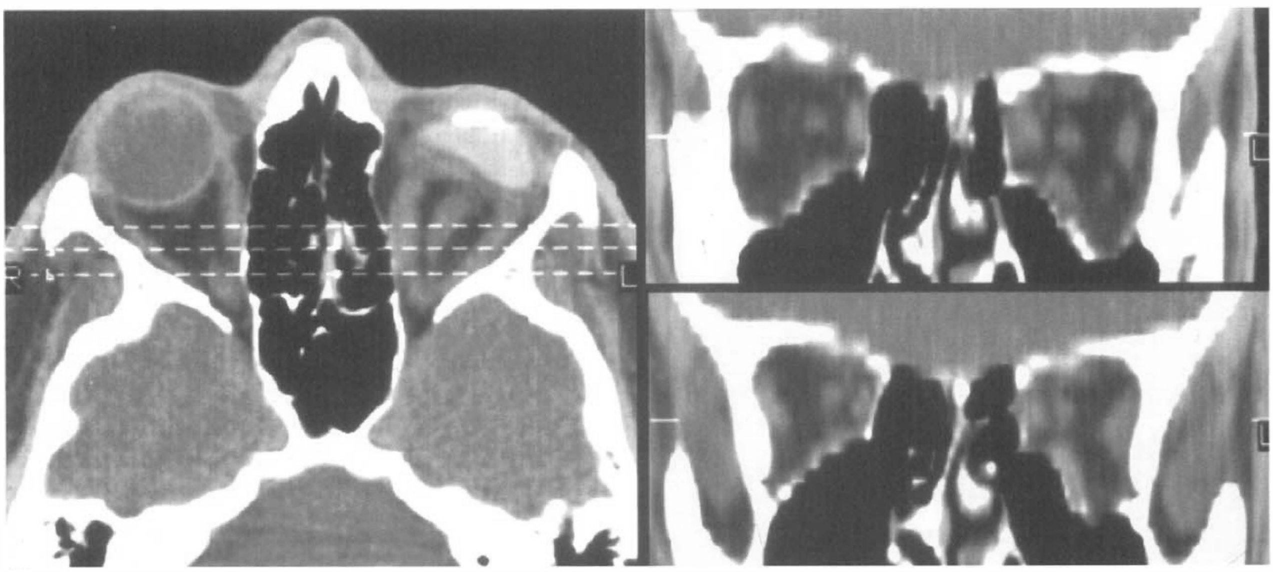
number of different injuries. In such a scenario the prime objective for the ophthalmologist is promptly to arrange enucleation of the severely traumatised globe to minimise the risk of sympathetic ophthalmia. Any underlying orbital injury may be overlooked because a severely disrupted globe can mask symptoms and signs that would otherwise alert the examining physician to the possibility of an orbital wall blow-out fracture. For instance, the patient will not necessarily experience diplopia due to absent or reduced vision in the traumatised eye. Ocular movements of a severely disrupted globe may be difficult to interpret and concurrent lid and facial trauma could mask subcutaneous emphysema and infraorbital hypoaesthesia.

Our unit became more alert to the possibility of undiagnosed blow-out fractures in this group of patients as a result of experiencing difficulties managing some patients referred to us with PESS. We now request an orbital CT scan on all patients presenting with PESS and a previous history of ocular or orbital trauma in order to rule out the possibility of an undiagnosed orbital wall blow-out fracture. Similarly all patients requiring enucleation or evisceration as a result of globe trauma undergo orbital CT scanning so that any significant fracture can be repaired at the same time.

High-resolution axial CT scanning coronal and sagittal planar and three-dimensional reconstructions allow the surgeon to plan the operative approach carefully.[7] Low radiation dose CT techniques have been

(a)

(c)



(b)

Fig. 2. *Case 2. (a) Clinical appearance at presentation. (b) CT coronal reconstruction showing a large left anterior floor fracture and a small posterior medial wall fracture. (c) Appearance following fracture repair and secondary hydroxyapatite implant insertion.*

shown to produce excellent image quality[8] enabling accurate estimation of fracture size and the degree of soft tissue prolapse into paranasal sinuses.

All the patients in this study have experienced the physical and psychological trauma associated with severe ocular injury and subsequent removal of an eye. Many of these patients have gone on to needlessly suffer years of poor cosmesis, poor prosthesis motility and additional surgical procedures as a result of an underlying orbital wall blow-out fracture having been overlooked. We suggest that any patient presenting with a volume-deficient socket or a migrated orbital implant and a preceding history of relevant trauma has an untreated orbital wall blow-out fracture until proven otherwise. These patients should undergo CT scanning to establish the integrity of the orbital skeleton before any surgical intervention is considered. Ideally patients who require enucleation as a result of severe blunt or penetrating ocular trauma should have a CT scan so that any coexisting blow-out fracture can be repaired at the time of enucleation, particularly if it is greater than 1.00 cm^3 in volume by CT measurement.

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