Orbital blowout fractures in sport

N. P. Jones FRCS FCOphth
University Department of Ophthalmology, Manchester Royal Eye Hospital, Manchester, UK

One-third of orbital blowout fractures are sustained during sport. Soccer is most commonly involved. Though visual acuity recovery is usually complete, permanent loss of binocular visual field is almost universal. Typically high-energy blows by opponent's finger, fist, elbow, knee or boot are responsible. Injuries to the eye itself may also be sustained and should be looked for. Ocular protection may be feasible in some sports, but the main preventive measure to be addressed is the reduction in aggressive play or deliberate injury.

Keywords: Blowout fracture, sports injury

The phenomenon of isolated orbital wall fracture was first recognized in the 19th century[1] but the term 'blowout' was attributed in 1957 by Converse and Smith[2]. That blunt injury sustained during sport could be a cause was recognized early; indeed it was a fracture caused by a hurling ball that fuelled speculation on the pathogenesis of such fractures (the 'buckling' *versus* the 'hydraulic' theories), and the cadaver studies of Smith and Regan[3] used a hurling ball to achieve their experimental fractures.

Pure blowout fracture is an uncommon injury. Two large surveys identified only one such injury from 3536 eye casualties[4] and seven from 5671[5]. It is clear that the majority of such injuries are sustained as a result of assault with considerable force. However, a significant group of such fractures are sustained during sport. This study aims to identify this group and to investigate common features of such injuries, sustained morbidity and methods of prevention.

Methods

The inpatient computerized diagnostic database and the orthoptic clinic attendance records were searched for patients seen at the Manchester Royal Eye Hospital, from 1987 to 1992, who had sustained orbital blowout fractures. Hospital records were reviewed. Patients who had received prior surgical treatment elsewhere were excluded from the study, as were those patients who had also sustained more widespread trauma including facial and zygomatic complex fractures. The study was limited to those with confirmed pure orbital blowout fractures. Particular attention was paid to blowout fractures sustained during sport: the sport involved; the mechanism of injury; the necessary treatment; and residual visual problem.

Address for correspondence: Dr Nicholas P. Jones FRCS FCOphth, Lecturer in Ophthalmology, Honorary Consultant Surgeon, University Department of Ophthalmology, Manchester Royal Eye Hospital, Oxford Road, Manchester M13 9WH, UK

0306-3674/94/040272-04

Results

During the retrospective study period a total of 62 pure orbital blowout fractures was identified in 62 patients. Various forms of assault accounted for 33 (53%) of these patients. Twenty-three fractures (37%) were sustained as a result of sporting activity. The aetiology of all fractures is shown in *Table 1*.

Of those fractures sustained at sport, *Table 2* shows the sport involved, the most common being soccer

Table 1. The cause of the blowout fractures

Cause	*No. of patients*
Assault	33(53)
Sport	23(37)
Falls	3(5)
Road-traffic accident	2(3)
Work	1(2)
Total	62(100)

Values in parentheses are percentages

Table 2. The sport involved in blowout fractures

Sport	*No. of patients*
Large ball field sports	
Soccer	7
Rugby	4
Total	11
Small ball sports	
Indoor cricket	3
Hockey	1
Squash	1
Fives	1
Total	6
Combat sports	
Karate	2
Thai boxing	1
Total	3
Swimming	2
Gymnastics	1
Overall total	23

Table 3. The object responsible for the blowout fracture

Object	*No. of patients*
Human body part	
Fist	4
Foot	4
Knee	3
Head	2
Finger	1
Elbow	1
Unknown	1
Total	16
Ball	
Indoor cricket ball	3
Football	1
Squash ball	1
Fives ball	1
Total	6
Hockey stick	1
Overall total	23

(seven fractures, 30%). The object actually responsible for the injury is shown in *Table 3*. Parts of opponent's bodies were responsible for 16 of the 23 injuries (70%). To divide completely the aetiology of eye injuries into 'assault' and 'sport' was not possible as several assaults were alleged on the sports field. Three soccer players were punched on the football field, one rugby player was deliberately injured by a finger, and a hockey player was assaulted with a hockey stick.

Blowout fracture was diagnosed clinically by the finding of classical signs: enophthalmos in eight patients (35%); restricted ocular movements in 16 (70%); diplopia in 14 (61%); infraorbital anaesthesia in four (17%); and periorbital crepitus in five (22%). The diagnosis was confirmed radiologically in all cases, usually by computed tomography (19 cases, 83%), but in some earlier cases by plain orbital radiography.

Seventeen of 23 fractures required surgery. Of these, only one fracture involved predominantly the medial orbital wall, the others involving predominantly or solely the orbital floor. Of these latter 16 cases, a silicone orbital floor implant was used in all but one case. In one patient a threatened implant extrusion required a second operative procedure.

In 15 patients, no associated ocular injuries were identified. In the remaining eight patients, four hyphaemas, four conjunctival injuries, three cases of iris damage, one secondary glaucoma, two cases of anterior uveitis and one of traumatic retinal oedema and haemorrhage, were identified.

After surgery (or where no surgery was performed, after settling of the ocular and orthoptic status) visual acuity was normal (6/6) or better in 19 cases (83%), and in only one case was significant (6/18) permanent visual acuity loss a direct result of blunt injury, due to retinal scarring. However, orthoptic examination revealed that although range of ocular movement improved consistently after surgery, permanent residual loss of the field of binocular vision was sustained in 22 of 23 cases. In 11 cases, 20% or more of binocular field was lost (maximum 60%), usually superiorly, but in four cases, inferiorly also. Examples of mild (*Figure 1*) and severe (*Figure 2*) loss of binocular field, drawn from these cases, are shown.

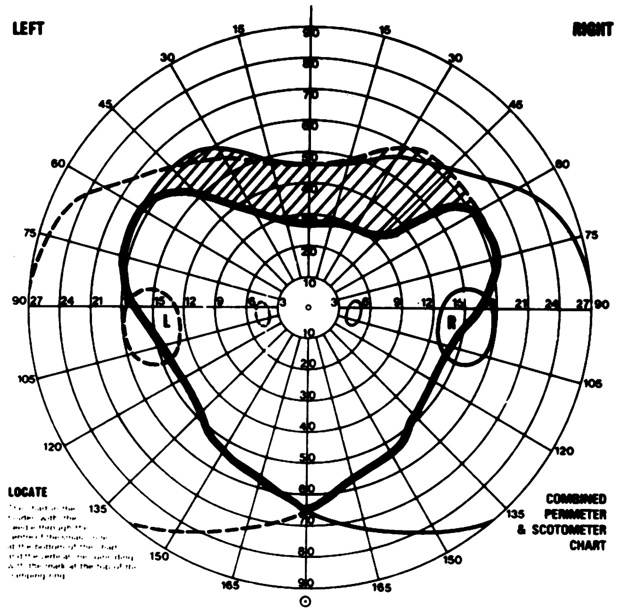

Figure 1. A binocular visual field map. The normal uniocular visual fields are shown, with the central overlap indicating the field of binocular vision. In this case, loss of about 15% of field area superiorly is indicated by hatching. This patient experiences double vision on looking up

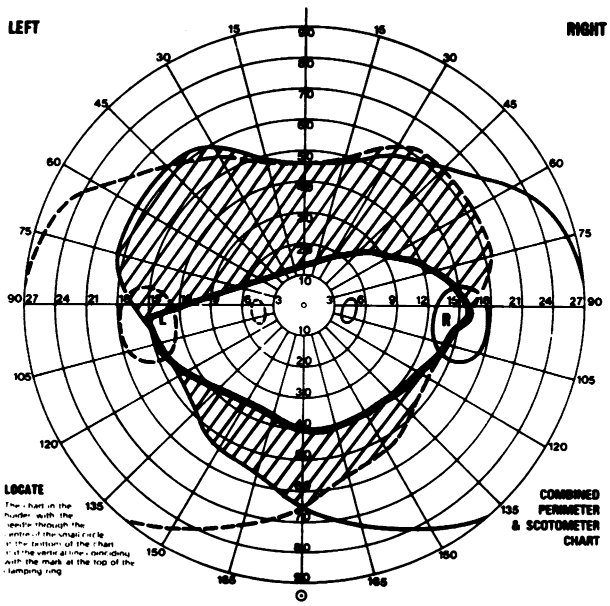

Figure 2. Severe restriction of binocular field (indicated by hatching), despite surgical repair of blowout fracture. Usable vision is only possible while looking directly ahead. Double vision is experienced on looking up or down

Discussion

The increasing importance of eye injuries in sport has already been well-documented[5,6]. Sport is now among the commonest causes of severe eye injury (in one study, the commonest, accounting for 42% of all eye injuries admitted to hospital)[6]. The dynamics and mechanics of blunt ophthalmic injury have been described. There are many manifestations of such injury, and orbital blowout fractures account only for a small proportion of these. In two previous studies performed at this institution[8,9] blowout fractures accounted for only 4% of sports-related eye injury, and 10% of hospital admissions after sports eye injury. Nevertheless they form a distinct subgroup with common features.

This study has confirmed that assault is the most important cause of pure orbital blowout fracture, but that a significant subset of such cases (37%) is sustained on the sports field. Typically, sports-related eye injuries are caused by a small, fast-flying projectile such as a squash ball, badminton shuttle-cock, or sometimes by a racquet or stick[9], only a minority being a result of a direct clash with an opponent. This study has demonstrated that such clashes are much more likely to lead to blowout fracture. This is probably related to the higher kinetic energy involved and such findings are in keeping with the predominance of assault in the aetiology of such fractures.

None of the sports listed in *Table 2* is a surprising inclusion. Every sport has its intrinsic risks. Football typically provides more eye injuries than any other sport in the UK[6,8] and this is a reflection not only of its popularity, but also of the potential for direct clashes, both accidental (such as the flying elbow when heading a ball) and deliberate (see below). That three injuries were sustained in indoor cricket might at first seem surprising. However, although the indoor ball is softer than the outdoor, the confined space and speed of flight combine to make injuries possible[10]. Protection should probably be worn by fielders in this game. Eye contact in the combat sports, especially kicks, can be devastating. Both swimming injuries in this study were caused by a passing knee, and the gymnast injured himself on his own knee during a mistimed tumble. The most serious result in this study was sustained as a result of a deliberate injury with a hockey stick. The problem of high sticking in this sport remains a subject for concern[11].

In any contact sport the line between enthusiastic play and aggressive behaviour is blurred. In this study, five 'sporting' injuries were clearly deliberate assaults. In three cases the player was punched (all on a football field). In one case the eye was deliberately 'gouged' by an opposing rugby player during a scrummage, a phenomenon that appears to be increasing in incidence. The potential for severe injury is clear. Eyes have been removed after such injuries. Sportsmen should be aware that the venue is no protection against the law in these cases. Successful prosecutions have led to custodial sentences in these circumstances[12].

Characteristically, measurements of morbidity after ocular insult are insensitive in the field of trauma. 'Blindness' or 'partial sight', as legally defined in the UK, do not record unilateral visual handicap, and fortunately the vast majority of mechanical eye trauma is unilateral. The loss of an eye through injury does not register upon such statistics. Permanent loss of visual acuity after sports injury is uncommon, yet permanent visual defects may be sustained which are less easy to quantify. Loss of focusing ability such that near visual acuity is permanently affected, is one example. Permanent loss of binocular visual field is another.

In this study, visual acuity was almost uniformly returned to normal after recovery. However, almost all patients had permanent loss of binocular visual field, with double vision when looking in certain directions, mostly superiorly. A minority were handicapped by such problems. The young sportsman, with a need for high-grade dynamic vision, is particularly affected by such defects.

It is accepted in ophthalmological circles that an orbital blowout fracture, despite a history of high-energy injury, may be associated with an uninjured eye, as is demonstrated in this series. The concept of the orbit as an energy-absorber which prevents direct ocular injury, is attractive. However, such a dissociation between ocular and orbital injuries is by no means guaranteed. In these circumstances it is essential to examine vision and the eye fully. It is particularly important that ocular examination by an ophthalmologist is requested in those blowout fractures that come to the attention of nonophthalmologists. The importance of ocular injury in maxillofacial trauma has been highlighted[13].

In summary, high-energy blows to the eye and orbit, particularly by boot, fist or elbow, may cause orbital blowout fracture. Sports physicians should be aware of this possibility and also of the need for prompt ophthalmological attention and possibly early surgery. The permanent morbidity of such fractures, though not usually expressed as loss of visual acuity, can be significant and handicapping, particularly when returning to play sport. Every effort should be made to minimize the frequency of deliberate injury on the sports field. In some sports (particularly racquet sports) ocular protection will prevent such injuries. Where ocular protection is not feasible, better control of dangerous play or deliberate assault is imperative.

References

1 Lang W. Traumatic enophthalmos with retention of perfect acuity of vision. *Trans Ophthalmol Soc UK* 1889; **9**: 41.
2 Converse JM, Smith B. Enophthalmos and diplopia in fractures of the orbital floor. *Br J Plastic Surg* 1957; **9**: 265.
3 Smith B, Regan W. Blowout fracture of the orbit: mechanism and correction of internal orbital fracture. *Am J Ophthalmol* 1957; **44**: 733.
4 Jones NP, Hayward JM, Khaw PT, Claoué CMP, Elkington AR. Function of an ophthalmic 'accident and emergency' department: results of a six month survey. *BMJ* 1986; **292**: 188–90.
5 MacEwen CJ. Eye injuries: a prospective survey of 5671 cases. *Br J Ophthalmol* 1989; **73**: 888–94.
6 MacEwen CJ. Sport associated eye injury: a casualty department survey. *Br J Ophthalmol* 1987; **71**: 701–5.

7 Jones NP. Eye injury in sport: incidence, biomechanics, clinical effects and prevention. *J R Coll Surg Edinb* 1993; **38**: 127–33.
8 Jones NP. Eye injuries in sport: an increasing problem. *Br J Sports Med* 1987; **21**: 168–70.
9 Jones NP. One year of severe eye injuries in sport. *Eye* 1988; **2**: 484–7.
10 Coroneo MT. An eye for cricket: ocular injuries of indoor cricketers. *Med J Aust* 1985; **142**: 469–71.
11 Elliott AJ, Jones D. Major ocular trauma: a disturbing trend in field hockey injuries. *BMJ* 1984; **289**: 21–2.
12 Grayson E. Sports medicine and the law. In: Payne SDW, ed. *Medicine, Sport and the Law*. Oxford, UK: Blackwell, 1990.
13 Holt JE, Holt R, Blodgett JM. Ocular injuries sustained during blunt facial trauma. *Ophthalmology* 1983; **90**: 14–18.