SCIENTIFIC REPORT

Optic nerve avulsion from door-handle trauma in children

I A Chaudhry, F A Shamsi, A Al-Sharif, E Elzaridi, W Al-Rashed

Br J Ophthalmol 2006;**90**:844–846. doi: 10.1136/bjo.2005.087544

Aim: To report severe visual loss caused by optic nerve avulsion (ONA) in children with door-handle trauma.

Methods: Clinical records at a tertiary eye care hospital, of 14 children who sustained severe visual loss as a result of door-handle injuries, were reviewed. The data were analysed for location, presenting symptoms and signs, diagnostic studies, intervention, and the cause of visual loss.

Results: There were 11 males and three females with an average age of 8 years and an average height of 125 cm. The place of trauma was home in 11 and school in three children. Presenting visual acuity (VA) was light perception (LP) in five patients and no light perception (NLP) in nine. All the 14 children had evidence of ONA and four patients had ruptured eye globes that required initial repair. The diagnosis of ONA was made clinically or by imaging studies and confirmed histopathologically in eyes that were enucleated. Average follow up was 28.8 months (range 4 months to 8 years). Final VA was LP in one patient and NLP in 13 patients, eight eyes required enucleation for painful blind eye or to achieve optimal cosmesis.

Conclusion: ONA was the common cause of visual loss in children who sustained ocular trauma caused by door-handles.

Eye injuries are a major and under-recognised cause of disabling ocular morbidity that especially affect the young.^{1–2} Optic nerve avulsion (ONA) is a rare presentation of ocular trauma. Traumatic ONA usually results in a serious visual loss. Many different causes of ONA have been reported. Some of the reported causes of ONA include road traffic accidents, sporting accidents, and falls.^{3–5} Ocular trauma caused by door-handles has only recently been reported.⁶ To the best of our knowledge no previous cases of traumatic ONA caused by door-handles have been reported in the ophthalmic literature. We report our experience with children who suffered severe visual loss from pointed door-handles, in whom the mechanism of profound visual loss was attributed to ONA.

METHODS

Medical records of all children with a history of ocular trauma caused by door-handle seen in a tertiary eye care hospital from March 2002 to March 2004 were reviewed. The clinical charts of these patients were reviewed in detail regarding place of trauma and the nature of the door-handles. Patient demographics including age, sex, mechanisms of injury, presenting and final Snellen visual acuity, surgical procedures, and outcomes were analysed. Information from medical records was obtained regarding the use of any diagnostic studies such as ultrasonography (US), computed tomography (CT), Doppler studies, visual evoked potential (VEP), and magnetic resonance imaging (MRI). A field survey of six of the door-handles that caused

trauma in some of the patients was conducted. Results from the histopathological specimens, where available, were also studied to correlate with the clinical diagnosis. Birmingham eye trauma terminology was used to classify eye injuries.

RESULTS

During the 24 month period, 14 ocular injuries resulting from door-handles, where the cause of severe visual loss was attributed to ONA, were identified. The mean age of these patients was 8 years (range 6–10 years). Eleven (78.6%) patients were males and three (21.4%) were females. Eight patients suffered right eye trauma and six had left sided injury. None of these patients had a previous history of ocular trauma or surgery. None of the 14 patients wore safety glasses or spectacles at the time of injury. Average height of these patients was 125 cm (range 114–134 cm). Eleven injuries occurred at home and three at school. The characteristics of these patients, diagnostic studies performed, surgical procedures undertaken, and final outcome are summarised in table 1. The presenting visual acuity (VA) was light perception (LP) in five and no light perception (NLP) in nine patients. Four patients had open globe injuries that required primary repair. In all 14 patients, the pointed door-handles had entered in the orbital compartment medial to the globe, causing ocular and periocular injuries. US of the eye and orbit was performed on all patients. CT of the orbits was performed in nine patients, VEP/visual evoked response (VER) in two patients, Doppler study, and MRI in one patient each. These diagnostic studies were carried out to evaluate the cause of visual loss and to determine the extent of ocular trauma in the patients. The mean follow up for these patients was 28.6 months (range 4 months to 8 years). The final VA of LP was maintained in only one patient with NLP in the rest of the 13 patients. The clinical diagnosis for the devastating vision loss in all the patients was attributed to traumatic ONA (figs 1–3). Four patients underwent primary repair of their open globes. Six patients required additional surgeries, which included conjunctival flap, recti muscle attachment, and conjunctival cyst excision. Eight patients required enucleation because of blind painful eye or to achieve the optimal cosmesis. The histopathological diagnosis of ONA was confirmed in all patients who underwent enucleation (fig 3).

DISCUSSION

Optic nerve avulsion is an uncommon presentation of ocular trauma. Motor vehicle and bicycle accidents are the most common cause of ONA followed by falls.^{1–5} Sporting injuries have also been associated with ONA, the commonest being basketball injuries.¹ In a study of 445 eyes of patients with blunt ocular trauma, only five eyes had an evidence of ONA.⁴ Most cases reported as ONA describe the eye in its normal position within the orbit with the extraocular muscle

Abbreviations: CT, computed tomography; LP, light perception; MRI, magnetic resonance imaging; NLP, no light perception; ON, optic nerve; ONA, optic nerve avulsion; US, ultrasonography; VA, visual acuity; VEP, visual evoked potential; VER, visual evoked response

Table 1 Characteristics, diagnostic studies, and surgical procedures performed in patients with optic nerve avulsion caused by door handle trauma

No	Age/sex/eye	Place of trauma	Visual acuity		Patient height (cm)	Diagnostic studies	Surgical procedures performed	Follow up
			Initial	Final				
1	6/M/L	Home	NLP	NLP	123	US, CT, VEP	1° repair, enuc	3 years
2	10/M/L	Home	NLP	NLP	126	US, CT, Doppler	Lid lac repair, enuc	16 months
3	8/F/R	School	LP	NLP	128	US, CT, MRI	Conj cyst excision	3 years
4	8/F/L	Home	LP	NLP	122	US	1° repair, enuc	11 months
5	6/M/L	Home	NLP	NLP	114	US, CT	Lid lac and fracture repair	5 months
6	10/M/R	Home	LP	NLP	NA	US, CT	Lid lac repair, enuc	8 years
7	7/M/R	School	NLP	NLP	128	US	Enuc	2 years
8	10/M/R	Home	LP	LP	126	US, CT	Lid lac and repair, enuc	2 years
9	8/F/R	Home	NLP	NLP	121	US	Lid and repair, enuc	3 years
10	7/M/R	School	NLP	NLP	124	US	Lid lac repair, conj flap	17 months
11	9/M/R	Home	NLP	NLP	134	US, CT	NA	4 months
12	6/M/R	Home	LP	NLP	125	US, VER	1° repair, enuc	5 months
13	7/M/L	Home	NLP	NLP	128	US, CT	Lid lac repair	6 months
14	7/M/L	Home	NLP	NLP	118	US	Lid lac and repair	8 months

R, right eye; L, left eye; VA, visual acuity; LP, light perception; NLP, no light perception; US, ultrasonography; CT, computed tomography; MRI, magnetic resonance imaging; VEP, visual evoked potential; VER, visual evoked response; 1° = primary, enuc, enucleation; NA, not available.

attached.⁷ The patient may have immediate total or partial loss of vision in the affected eye.

The diagnosis of ONA is usually apparent if the media is clear (fig 1). The fundus examination in such cases usually shows an excavation in the optic disc area.⁴ The diagnosis can only be suspected and not confirmed if disc area is obscured by vitreous haemorrhage. It is essential to confirm the diagnosis so that the patient may not be subjected to unnecessary treatment such as optic nerve decompression or high dose corticosteroids.⁴ Reports of US in the diagnosis of ONA have shown encouraging results in cases where the optic nerve head is obscured by overlying vitreous haemorrhage.⁴⁻⁸ On US, a posterior ocular wall defect in the region of the optic nerve (ON) head characterised by hypochoic defect

may be apparent.⁸ A-scan may show a marked widening of the ON suggesting haemorrhage and oedema within the nerve sheath in addition to ONA.³ In some instances careful examination of thin sections of CT scan may also be helpful in delineating the posterior scleral wall defect corresponding to the avulsed ON (fig 2). Histopathological examination of the enucleated eye may reveal absence of ON from the lamina cribrosa (fig 3). These findings have not been clearly elucidated previously.

Several different mechanisms have been proposed to explain how the ON is avulsed from the eye. It has been proposed that a severe, forced rotation of the globe causes the ON to avulse from the weaker posterior sclera.⁹ This notion is supported by observations in our histopathology findings of the cross section of the enucleated eye revealing absence of ON fibres from the lamina cribrosa (fig 3). Other proposed mechanisms include the disruption at the weaker lamina cribrosa by the sudden elevation of intraocular pressure caused by compression of the globe or by sudden forward

Figure 1 Fundus photograph of a 7 year old male with no light perception vision and vitreous haemorrhage overlying optic nerve head.

Figure 2 Axial CT scan of the eye globe of a patient with optic nerve avulsion and no light perception vision, showing disruption in the area of lamina cribrosa.

Figure 3 Histopathology of the cross section of the enucleated globe at the lamina cribrosa revealing the absence of optic nerve fibres and associated vitreous haemorrhage in a patient with history of optic nerve avulsion and loss of vision (haematoxylin and eosin, ×10).

propulsion of the globe as a result of increased intraorbital pressure.⁵⁻⁹

In all of our patients the pointed door-handles had entered in the orbital compartment. The mechanism of ONA injury caused by a pointed door-handle entering the orbit, medial to the globe, may include creation of a wedge effect in the orbit.³⁻¹⁰ As the door-handle pushes deeper, the wedge effect pushes the eye against the angled lateral wall of the orbit, forcing the eye anteriorly.⁷ With increasing force, the tensile strength of the ON is exceeded causing ONA. The potential complications that may accompany ONA include chiasmal injury to the fellow eye with severe visual loss.¹⁰ There have been sporadic reports of chiasmal injuries and associated temporal field loss in the contralateral eye.¹¹ To the best of our knowledge no cases of traumatic ONA caused by door-handles have been reported in the medical literature.

Our results and the findings of most studies that a higher frequency of childhood ocular trauma takes place in homes underscores the need for primary prevention programmes targeting parents and the home environment.¹ Adult supervision therefore is an important factor in the prevention of accidents in childhood years.

Authors' affiliations

I A Chaudhry, Oculoplastic and Orbit Division, King Khaled Eye Specialist Hospital, Riyadh, Kingdom of Saudi Arabia

F A Shamsi, Research Department, King Khaled Eye Specialist Hospital, Riyadh, Kingdom of Saudi Arabia

A Al-Sharif, Department of Ophthalmology, King Saud University, Riyadh, Kingdom of Saudi Arabia

E Elzaridi, Royal Victoria Infirmary, Queen Victoria Road, Newcastle upon Tyne NE1 4LP, UK

W Al-Rashed, Anterior Segment and Oculoplastic and Orbit Division, King Khaled Eye Specialist Hospital, Riyadh, Kingdom of Saudi Arabia

Correspondence to: Imtiaz A Chaudhry, MD, PhD, FACS, Oculoplastic and Orbit Division, King Khaled Eye Specialist Hospital, PO Box 7191, Riyadh 11462, Kingdom of Saudi Arabia; orbitdr_kkesh@yahoo.com

Accepted for publication 2 March 2006

REFERENCES

- 1 **United States Eye Injury Registry**. *Eye trauma epidemiology and prevention*. 1 August 2001. Available at <http://www.USEIR.org> on 30 March, 2005.
- 2 **Serrano JC**, Chalela P, Arias JD. Epidemiology of childhood ocular trauma in a north eastern Columbian region. *Arch Ophthalmol* 2003;**121**:1439-45.
- 3 **Sawhney R**, Kochhar S, Gupta R, et al. Traumatic optic nerve avulsion: role of ultrasonography. *Eye* 2003;**17**:667-70.
- 4 **Atmaca LS**, Yilmaz M. Changes in the fundus caused by blunt ocular trauma. *Ann Ophthalmol* 1993;**25**:447-52.
- 5 **Anand S**, Harvey R, Sandramouli S. Accidental self-inflicted optic nerve head avulsion. *Eye* 2003;**17**:646-8.
- 6 **Chaudhry IA**, Al-Sharif AM, Shamsi FA, et al. Severe ocular injuries from pointed door-handles in children. *Ophthalmology* 2005;**112**:1834-7.
- 7 **Morris WR**, Osborn D, Fleming JC. Traumatic evulsion of the globe. *Ophthalm Plast Reconstr Surg* 2002;**18**:261-7.
- 8 **Talwar D**, Kumar A, Velma L, et al. Ultrasonography in optic nerve head avulsion. *Acta Ophthalmol* 1991;**69**:121-3.
- 9 **Pillai S**, Mahmood MA, Limaye SR. Complete evulsion of the globe and optic nerve. *Br J Ophthalmol* 1987;**71**:69-77.
- 10 **Arkin MS**, Rubin PA, Bilyk JR, et al. Anterior chiasmal optic nerve avulsion. *Am J Neurol Res* 1996;**17**:1777-18.
- 11 **Kraus HR**, Yee RD, Foos RY. Autoenucleation. *Surv Ophthalmol* 1984;**29**:179-87.

bmjupdates+

bmjupdates+ is a unique and free alerting service, designed to keep you up to date with the medical literature that is truly important to your practice.

bmjupdates+ will alert you to important new research and will provide you with the best new evidence concerning important advances in health care, tailored to your medical interests and time demands.

Where does the information come from?

bmjupdates+ applies an expert critical appraisal filter to over 100 top medical journals. A panel of over 2000 physicians find the few 'must read' studies for each area of clinical interest.

Sign up to receive your tailored email alerts, searching access and more...

www.bmjupdates.com