LETTERS TO THE EDITOR

Traumatic ocular haemorrhage related to bungee jumping

EDITOR,—I read with interest the report by David *et al.*¹ I have been following a similar case of a patient who presented with sudden loss of vision immediately after bungee jumping.

A 26-year-old, healthy white female engaged in bungee jumping at the local county fair. Immediately afterwards, she experienced blurred vision, more so in the right eye, as well as a spontaneous nose bleed. Three days later, she presented to the retina service with a visual acuity of 20/400 in her right eye and 20/20-2 in her left eye. Her pupil response was normal.

On external examination, a monocular haematoma of the right eye could be seen, as well as a small subconjunctival haemorrhage in the left eye. Slit-lamp examination was unremarkable. Fundus examination showed an abnormal foveal reflex with oedema in both eyes, and small retinal haemorrhages in the right eye (Fig 1). Visual field examination showed a slight depression of her central sensitivity in both eyes, more so in the right eye. Amsler grid testing demonstrated a small area of central blurring, more so in the right than in the left eye. Fluorescein angiography showed a trace oedema in the late phase of the angiogram in the right eye. She had not taken any aspirin containing medications; she was taking oral contraceptives; there was no history of spontaneous nose bleeds or easy bruising before the ocular injury.

On return visits, there was a gradual improvement of vision, although 7 months from the initial trauma, the acuity had not improved to any better than 20/70. The macular changes had regressed and repeat fluorescein angiography showed only mild retinal pigment epithelium changes in the fovea.

The most likely explanation for her ocular findings is that the patient experienced a sudden increase in venous pressure during the bungee jump. The first part of the bungee jump consisted of a free fall, during which the patient dived down with her head in the lowest position. During this episode, there is an acceleration which creates a tendency of the blood to move from the head towards the feet. At the end of the free fall, there is a sudden deceleration which is caused by the stretching of the bungee cord. The reverse of direction of acceleration will create pooling of blood towards the head, causing a rapid rise in intravenous pressure. When the bungee cord is stretched maximally, it recoils

and causes an acceleration back towards the point of origin from where the patient jumped. This leads to an additional increase in movement of blood towards the head and eye, creating a further increase in venous pressure. The axial accelerating forces are furthermore affected by centrifugal forces created by the whiplash-like activity of the bungee cord at the time of maximal stretch.

Accelerating forces along the axial length of the body can be expressed as 'g' forces; 1 g is the force normally exerted by gravity. If the acceleration is towards the feet, then the g force is positive; accelerating towards the head is a negative g force. Each increase in negative g force is accompanied by an increase in venous pressure above the level of the heart.

Under testing conditions, conjunctival and retinal haemorrhages can be produced in a rapid deceleration with high g forces for a short duration. Retinal haemorrhages are produced by increasing the intravenous pressure to 100 mm Hg or more, which is achieved at approximately a minus 3 g force.²

A similar mechanism of sudden rise of venous pressure that leads to ocular haemorrhages can be seen in Purtscher's retinopathy and Valsalva retinopathy.^{3,4} Our patient had no evidence of spontaneous haemorrhages before the injury, and prothrombin time and partial thromboplastin time levels were normal, as was her bleeding time.

This underscores that bungee jumpers should be aware of the risk of loss of vision.

E VAN RENS
Retina Service,
Carle Clinic Association,
Urbana, IL 61801, USA

- 1 David DB, Meart T, Quinlan MP. Ocular complications associated with bungee jumping. *Br J Ophthalmol* 1994; 78: 234-5.
- 2 Byrnes V. Elevated intravascular pressure as an etiologic mechanism in the production of eye injuries. *Trans Am Ophthalmol Soc* 1959; 57: 473-538.
- 3 Duane TD. Valsalva hemorrhagic retinopathy. *Am J Ophthalmol* 1973; 75: 637-42.
- 4 Pruett RC, Carvalho ACA, Trempe CL. Microhemorrhagic maculopathy. *Arch Ophthalmol* 1981; 99: 425-32.

Reply

EDITOR,—Thrillseekers throughout the world are queuing up for the opportunity to bungee jump. Whereas previously this feat could only be performed in New Zealand it is now possible to do so at most local county fairs and charity fund raising events. This has allowed for greater access and perhaps less control on the operators.

Unfortunately, these adventurers may be trading a few seconds of sheer exhilaration for a lifetime of visual disability. There have been a few cases of retinopathy secondary to bungee jumping reported in the literature. In the case previously reported by David and colleagues the patient's visual acuity recovered to 6/6 in each eye.¹ Humphrey visual field analysis performed 6 months after the jump has, however, demonstrated a paracentral scotoma. In the case reported by Habib and Malik the patient's visual acuities improved from 6/60 to 6/12 right and from 6/9 to 6/5 left (12 weeks after the jump).² The patients reported by Jain and Talbot,³ and by Chan⁴ also appear not to have suffered any long term sequelae.

The report from van Rens adds another case to the literature. The patient, however, has not completely recovered the vision in the affected eye. The patient's visual acuity had been tested not long before the jump and was recorded as

'normal' (personal communication). Interestingly, in the previously reported cases¹⁻³ the patients all had full body harnesses¹⁻³ — the patient described by van Rens was only anchored at the ankles. The compression of the chest by the harness may not be as significant as the rate of deceleration induced by the tensile strength of the bungee cord. The British Elastic Ropes Sports Association (BERSA) is a voluntary association of bungee jumping operators who promote safety and education. According to BERSA (personal communication) there are two different types of cord in use. There are latex cords which are specifically designed for bungee jumping and stretch to four times their length thus giving a gradual deceleration and there are shock cords which account for a more abrupt deceleration. They emphasise the importance of matching the jumper's weight to the elasticity of the bungee rope.

At present, guidelines are set by the health and safety executive, but no standards exist. It is important that the public is aware of the potential hazard.

DON B DAVID
Birmingham and Midland Eye Hospital,
Church Street, Birmingham B3 2NS
M P QUINLAN
Victoria Eye Hospital,
Eign Street, Hereford

- 1 David DB, Mears T, Quinlan MP. Ocular complications associated with bungee jumping. *Br J Ophthalmol* 1994; 78: 234-5.
- 2 Habib NE, Malik TY. Visual loss from bungee jumping. *Lancet* 1994; 343: 487.
- 3 Jain BK, Talbot EM. Bungee jumping and intraocular haemorrhage. *Br J Ophthalmol* 1994; 78: 236-7.
- 4 Chan J. Ophthalmic complications after bungee jumping. *Br J Ophthalmol* 1994; 78: 239.

Infectious endophthalmitis after cataract surgery

EDITOR,—In the paper on infectious endophthalmitis after cataract surgery by Hughes and Hill,¹ the authors discuss the role of povidone iodine solution in preventing endophthalmitis. We question two statements: (1) 'the solution must remain in contact with the eye for several minutes', and (2) 'the ocular surface should be irrigated with saline before surgery as it has been suggested that endothelial toxicity may occur if significant amounts of povidone iodine enter the eye'. No references or evidence are given for these statements.

Povidone iodine solution is a potent antimicrobial agent. It kills most bacteria within 30 seconds^{2,3} and thus the antiseptic need not remain in contact with the eye for several minutes.

Our experience is at variance with Hughes and Hill's recommendation to irrigate the eye with saline to remove the instilled povidone iodine because of fear of the solution entering the eye and causing endothelial toxicity. Firstly, we do not recommend irrigation of the eye with saline as part of the preoperative preparation (unless there is mucus or debris on the conjunctiva or cornea) because we found in our study that irrigation actually led to an increase in the number and species of bacteria on the conjunctiva.⁴

Secondly, as for the likelihood of causing endothelial toxicity if the instilled povidone iodine solution enters the eye, we feel this possibility is distinctly improbable. We invariably find that the solution instilled at the time of preoperative preparation disappears from the surface of the eye in a matter of a few minutes — certainly long before an incision is made into the eye. We further point out that

Figure 1 Fundus photograph right eye. Foveal oedema and intraretinal haemorrhage.