Penetrating injury of the eye

Penetrating injury of the eye¹ represents a major threat to vision in the workplace,² ³ home,² ⁴ school and playground, and on the battlefield,² ⁵ and in sport.

It represents not only a cause of severe visual loss but also a profound emotional trauma to patients and their families. Treatment is time consuming and expensive but despite this there is often a grave prognosis.⁴ ⁵ ⁶

Esmæli et al.,⁷ in a retrospective analysis of 176 cases of ruptured globe, found that predictors of a good (6/18 or better) visual outcome were a presenting acuity after injury of 6/60 or better, wound location anterior to the pars plana, a wound length of 10 mm or less, and a sharp mechanism of injury.

They concluded from their data that eyes with wounds longer than 20 mm, which extend posterior to the equator, will lead to poor final vision and subsequent enucleation in the overwhelming majority of cases, and that primary enucleation should be considered in eyes with such surgical findings.

However, in eyes with hand movement or better vision, short wounds (less than 10 mm) in the cornea or anterior sclera have a relatively good result. For these eyes careful initial wound repair and secondary vitrectomy should be performed. These findings should be borne in mind in discussions with patients and their families.

A study from Australia estimates the incidence of penetrating eye injury to be 3.6 per 100 000 of the population,⁸ and Desai et al., in this journal in 1996,⁹ reported that the majority of hospital admissions for ocular trauma are in young male patients involved in accidents in the home.

In the military setting penetrating eye injury appears to be increasing. In the Crimean war the overall incidence of eye injury was reported as only 0.65% as a percentage of all injuries,¹⁰ whereas in more recent conflicts—for example, the Arab-Israeli wars of 1967, 1973, 1982¹¹ ¹² and the Gulf War of 1991,¹³ ¹⁴ show an incidence of 6.7–9.1%.

Unlike in peacetime the ocular injuries of war are bilateral in 15–25% of cases.¹³ ¹⁴

This increasing incidence is probably due to the greater use of fragmentation weapons by the modern military, which has provided a strong stimulus for the development of high quality ocular protection. Cotter and La Piana¹⁵ analysed the data from the Vietnam war and, using theoretical analysis, found that had the standard current US Army 2 mm thick defence goggle been worn, 52% of eye injuries would have been prevented. Projecting this figure to the Vietnam War overall, 5000 eye injuries from US and allied forces would have been prevented!¹⁶

In this issue of the BJO Uchio et al. (p 1106) present a computer model of the physical and mechanical conditions necessitating penetration of the globe using a system of finite element analysis.

The biophysics of missile injury to tissue is complex and difficult to study.¹⁷ In general terms the injury to the tissue depends upon the kinetic energy of the missile, its shape and density, the angle and pattern of its flight, and the tissue characteristics of the “target”.

A penetrating injury of the globe is even more complex to study¹⁸ ⁵⁰ as the initial energy of the missile strike produces a “shock wave” which rebounds from the ocular coats and the orbital wall.

Uchio et al., using computer modelling software developed for the investigation of the physical behaviour of cars in simulated vehicle accidents, have explored a simulation of penetrating injury of the eye. This is a significant advance in our understanding of the biomechanics of ocular injury. Ocular protection and consequent prevention of eye injury represent a major breakthrough in trauma care. The increased utilisation of protective eyewear in the workplace has produced a decrease in eye injuries;¹⁹ however, use of protective eyewear is far from universal.

While part of the reason for this is undoubtedly because of poor health education we have to question whether the worker can adequately see to perform his task through a dusty and scratched protective lens and whether the infantryman can adequately sight his weapon with the prismatic aberration induced by his ballistic eye protection.

To provide protection is one matter but to ensure a high compliance of wear is quite another. Research and development continues in the field of industrial, military, and sports eye protection. This, combined with a better understanding of the biomechanics of penetrating eye injury, meticulous primary microsurgical repair, and secondary closed intracocular microsurgery, should produce a reduction in visual loss secondary to penetrating eye injury.

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